## Local search and trajectory metaheuristics for the flexible job shop scheduling problem with sequencing flexibility and position-based learning effect\*

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#### Abstract

This paper considers the flexible job shop scheduling problem with sequencing flexibility, a production environment with a wide range of relevant practical applications, especially in today's on-demand printing industry. In order to approximate the problem of real-world applications, we consider the influence of a position-based learning effect on the processing time of the operations. In the present work, we are concerned with the development of effective and efficient methods for its solution. For this purpose, a local search method and four trajectory metaheuristics are considered. In the local search, we show that the classical strategy of reallocating only operations that are part of the critical path may miss better quality neighbors, as opposed to what happens in the case where there is no learning effect. Consequently, we analyze an alternative type of neighborhood reduction that eliminates only neighbors that are not better than the current solution. In addition, we propose a neighborhood reduction and experimentally verify that it significantly reduces the size of the neighborhood, thereby increasing efficiency, with minimal loss of effectiveness. Extensive numerical experiments are performed. Statistical tests confirm that tabu search based on the reduced neighborhood, when applied to large-sized instances, outperforms the other three metaheuristics, namely iterated local search, greedy randomized adaptive search, and simulated annealing. Experiments on classical instances without sequencing flexibility show that the introduced methods also stand out in relation to methods from the literature. All methods, instances, and solutions are freely available.

**Keywords:** Scheduling, flexible job shop, routing flexibility, sequencing flexibility, positionbased learning effect, trajectory metaheuristics.

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## 1 Introduction

The flexible job shop (FJS) with sequencing flexibility is a production environment with a wide range of relevant practical applications, especially in the nowadays on-demand printing industry [38, 39]. Today, companies in the print-on-demand business must deal with customized production and prioritize on-time delivery in an effort to meet their customers' needs. In this context, production activities are organized in flexible workshops to better manage the execution of the wide range of tasks demanded. Other businesses that fit into this production environment include the glass industry [1], the mold industry [22], the scheduling of aircraft support operations in flight decks [49], the scheduling of repairing orders in automobile collision repair shops [2], and the construction of production programs for steelmaking [19]. It is therefore important that the solving methods are prepared to cope with the most diverse characteristics of the actual problems encountered in this production environment. One such factor is the learning effect, i.e. how the processing time of an operation varies with the number of times it is executed. Naturally, using processing times that are not entirely consistent with reality can lead to inaccurate schedules and result in significant economic losses.

The FJS scheduling problem is an extension of the classical job shop (JS) scheduling problem in which each operation can be processed by one within a set of machines instead of a single machine. This characteristic is known as routing flexibility. Two additional features are considered in the present work: sequencing flexibility and learning effect. In the FJS without sequencing flexibility, there exists the concept of a task, which consists of a set of operations that must respect a sequential order of execution (first the first operation, then the second, then the third, etc). The sequencing flexibility consists in considering that the precedences between the operations of a same task are given by an arbitrary directed acyclic graph (DAG). In a classical scheduling problem, given an operation and a machine that can process this operation, a fixed processing time is given that corresponds to the time demanded by the machine to process the operation. The learning effect corresponds to the real-life ingredient that consists in the fact that a person learns through the execution of a repetitive task and, the more times they execute it, the faster they do it. In this work we consider a learning function that depends on the position that an operation occupies within the list of operations executed by a machine, i.e. a position-based learning effect function.

A recent literature review on the FJS scheduling problem was done in [16], while a recent review of the FJS with sequencing flexibility was included in [4]. For applications in real-life problems see [1, 2, 8, 19, 22, 38, 39, 49] and for development of methods for the FJS with sequencing flexibility and a variety of additional features see [9, 13, 23, 31, 32, 33, 45].

The impact on a worker's qualification, by repeated processing of an operation, and the resulting reduction in the operation's processing time was investigated in [18] in 1957. Since the publications of the pioneer works [10, 14, 27] that introduced the concept of learning effect in scheduling problems near two decades ago, a large number of papers has been published devoted to this subject. Surveys and classifications can be found in [6, 11, 29, 42]. However, few papers, which are reviewed below, address the FJS scheduling problem with learning effect and, to the best of our knowledge, none of them consider sequencing flexibility.

In [44] the FJS scheduling problem with sequence-dependent setup times as well as positiondependent learning and time-dependent deterioration effects is considered. The authors propose a hybrid metaheuristic that combines the genetic algorithm and variable neighborhood search for the purpose of minimizing the makespan. The same problem is considered in [5], where the problem is modeled as a bilevel optimization problem in which both levels have the same objective, namely, minimizing the makespan. The proposed method, called evolutionary bilevel optimization, constructs feasible solutions in a two-stage hierarchical approach that assigns operations to machines in the first stage and schedules operations in the second stage. In [47] a dual resource FJS is considered in which a machine and a worker are required to process an operation. It is also assumed that there is flexibility in the choice of both, and therefore, for each operation there is a set of machines and a set of workers capable of processing it. The problem is described using a mathematical model and a hybrid method that combines genetic algorithms and variable neighborhood search is developed. In [48] an FJS scheduling problem with operation processing time deterioration effect is considered with the objective of minimizing a function that combines makespan and energy consumption. The proposed methodology hybridizes pigeon-inspired optimization and simulated annealing. In [50], the FJS scheduling problem with time-dependent learning effect is considered. The problem is multiobjective and the goal is to minimize the makespan, total carbon emissions, and total workers' cost. A memetic algorithm, based on NSGA-II, associated with a variable neighborhood search is proposed. Four different neighborhoods are proposed and special attention is given to the development of constructive heuristics to develop the initial population. In [43] a dual resource (machine and worker) FJS with position-dependent learning effect is considered. Additionally, a transportation time between machines is also taken into account. The goal is to minimize makespan, energy consumption, and noise. Therefore, the problem is multi-objective. All of these ingredients come from a real-life sand casting problem. To tackle the problem, a discrete multi-objective imperial competition algorithm is developed in which a local search based on simulated annealing is used. In [36], a multi-objective FJS scheduling problem with position-dependent learning effect, in which makespan and total carbon emissions are minimized. is considered. The problem is modeled as a mixed integer linear multiobjective optimization problem and an improved multiobjective sparrow search algorithm is developed.

The problem considered in the present work was recently considered in [4], where integer linear programming and constraint programming models were introduced and compared. To improve the performance of exact methods applied to small-sized instances of the problem, constructive heuristics were also developed. In the present work we continue that work by developing local search strategies and metaheuristics that can compute good quality solutions to large-sized instances. (It should be noted that the problem is NP-hard since it contains the JS scheduling problem, knowingly NP-hard [24], as a particular case). In [41] it was introduced, for the FJS scheduling problem, a neighborhood reduction that eliminates only neighbors that do not improve the current solution. The reduction is based on the fact that, given a feasible solution, removing and relocating an operation that is not in the "critical path" has no chance of leading to a better solution. This idea was extended to the FJS scheduling problem with sequencing flexibility in [38, 39]. In the present paper, we begin by showing that the fundamental principle on which this neighborhood reduction is based does not hold when we consider learning effect. Consequently, a new neighborhood reduction is introduced in the present work. In addition, we also introduce a neighborhood cutoff that can leave better quality neighbors behind. However, numerical experiments will show that if on the one hand the neighborhood cutoff is about 90%, the solution found gets worse by about 1% on average. Based on the introduced local search, we then implement four trajectory metaheuristics. With them, we manage to find good quality solutions for large-sized instances and to find solutions very close to the optimal solutions in small-sized instances with known optimal solution.

The rest of this paper is organized as follows. In Section 2 we elaborate on how a feasible solution of the problem can be represented by a DAG. This representation allows us to introduce in a simple way the concept of neighborhood and, in the sequel, a local search. Still in Section 2, we analyze different possibilities to reduce the number of neighbors of a current solution to be inspected. In Section 3 we describe the considered metaheuristics, namely, iterated local search, greedy randomized adaptive search procedure, tabu search, and simulated annealing. Section 4 is devoted to extensive numerical experiments. Conclusions and lines of future work are stated in the final section.

## 2 Local search

The data of an instance of the FJS with sequencing flexibility and position-based learning effect consists of (a) a set of operations  $\mathcal{O}$  and a set of machines  $\mathcal{F}$ ; (b) for each operation  $i \in \mathcal{O}$ , a subset  $\mathcal{F}_i \subseteq \mathcal{F}$  containing the machines that can process i; (c) for each operation-machine pair (i,k) with  $i \in \mathcal{O}$  and  $k \in \mathcal{F}_i$ , a standard processing time  $p_{ik}$ ; and (d) a set of arcs  $\widehat{A} \subseteq \mathcal{O} \times \mathcal{O}$ representing the precedence relations between the operations. The learning effect is given by a function  $\psi_{\alpha}(p,r)$  which, given a standard processing time p and a position r, returns the actual processing time of an operation with standard processing time p when processed at the r-th position of a machine. The parameter  $\alpha > 0$  represents the learning effect rate. In the current work, we consider  $\psi_{\alpha}(p,r) = \lfloor 100 p/r^{\alpha} + 1/2 \rfloor$ . A simple example of an instance is shown in Figure 1.

A feasible solution to an instance of the FJS with sequencing flexibility and position-based learning effect can be represented by a DAG G = (V, A) as depicted in Figure 2a. This graph is sometimes referred to as a solution graph in the literature. The vertices of G, represented by the set V, correspond to the operations plus the dummy vertices s and t, i.e.  $V = \mathcal{O} \cup \{s, t\}$ . The arcs, represented by the set A, correspond to the arcs in A representing the precedence relationships between operations (in black in the picture), arcs going from s to operations that have no predecessors and arcs going to t from operations that do not precede any other operation (in purple in the picture). Arcs that start from s and arcs that reach t are named dummy arcs. Furthermore, dashed arcs represent the assignment of operations to machines and the order in which the operations are processed by each machine. These arcs are named machine arcs. Each node  $i \in V \setminus \{s, t\} = \mathcal{O}$ , that is, each operation, has a value  $w_i$  associated with it that represents its actual processing time, which is calculated with the learning function using the operation's standard processing time and the position that the operation occupies in the machine to which it was assigned. Nodes s and t are associated with the value zero. The longest path between nodes s and t is called critical path (highlighted in yellow in the figure), and its length corresponds to the makespan of the represented solution.

Given a feasible solution and a DAG G = (V, A) representing it, a new feasible solution can be constructed by removing an operation from the machine to which it was assigned and

			Mac	hines
$(1) \longrightarrow (2) \longrightarrow (3)$			1	2
$\bigcirc$ $\bigcirc$ $\bigcirc$	ß	1	1	1
	ion	2	1	1
	perations	3	1	1
$(4) \longrightarrow (5)$	pei	4	10	10
$\bigcirc$ $\bigcirc$	$ \circ $	5	1	1

Figure 1: On the left, representation of the operations' precedence constraints by a DAG  $D = (\mathcal{O}, \widehat{A})$ , where  $\mathcal{O} = \{1, 2, ..., 5\}$  represents the set of operations and  $\widehat{A} = \{(1, 2), (2, 3), (4, 5)\}$  is the set of arcs that represents the precedence constraints. In this simple example, precedence constraints are given by a linear order, i.e. there is no sequencing flexibility. This instance has two machines and each of the five operations can be processed in any of the two machines, i.e.  $\mathcal{F} = \{1, 2\}$  and  $\mathcal{F}_i = \mathcal{F}$  for all  $i \in \mathcal{O}$ . This means that there is full routing flexibility. The table on the right shows the standard processing times  $p_{ik}$  of the five operations on each of the two machines.

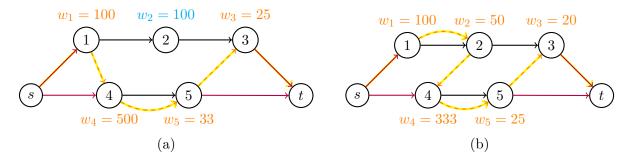


Figure 2: In this figure we consider the instance in Figure 1 with learning rate  $\alpha = 1$ . The digraph on the left (Figure 2a) represents a feasible solution in which machine 1 (associated with the cyan color) processes operation 2 only, while machine 2 (associated with the orange color) processes operations 1, 4, 5, and 3 in that order. The colored numbers represent the actual processing time of the operations, with the influence of the learning effect. The critical path, which length corresponds to the makespan, is given by the path s, 1, 4, 5, 3, t (highlighted in yellow in the picture). The digraph on the right (Figure 2b) represents the feasible solution obtained by reallocating operation 2, that was not in the critical path, from machine 1 to machine 2 between operations 1 and 4. The constructed feasible solution, with critical path given by s, 1, 2, 4, 5, 3, t, has a makespan smaller than the original one (528 versus 658).

reinserting it in the same machine but in another position or in another machine. When an operation is removed, the machine arcs adjacent to it must be removed and a new arc going from the operation before the removed one to the one after the removed one (if both exist) must be created. When the operation is reinserted, a similar reverse operation must also be done. When reinserting the operation, it is important to verify that a cycle is not produced in the digraph. Only reinsertions that do not create cycles build a digraph that corresponds to a feasible solution. When there is no learning effect, it is known [41] that there are chances to build a better feasible solution by removing and relocating operations that are part of the critical path only. If an operation is not part of the critical path, its removal and reinsertion cannot decrease the length of the critical path. It can increase it or create another even longer path. This is false when considering learning effect. An example is shown in Figure 2b.

Given a feasible solution, we can define its neighborhood as the set of all feasible solutions that can be obtained by removing and reinserting a single operation. When there is no learning effect, just the removal and reinsertion of operations from the critical path may lead to better neighbors, i.e. neighbors with lower makespan. This fact is widely used to generate just promising neighbors. The observation in the previous paragraph shows that this reduction cannot be used in the problem we are considering in the present work. This leads us to analyze whether every removal and reinsertion that does not generate cycles has the potential to generate a neighbor with lower makespan or whether any neighborhood reduction is possible. The main point is to note that when an operation is removed from a machine, the operations that were scheduled to be processed later on that machine have their position decreased by one unit and, consequently, their actual processing time increased. Similarly, in the machine where the operation is inserted, the operations scheduled to be processed after the inserted operation have their position increased by one and, therefore, their processing time is decreased. These modifications may change the makespan whether improving or worsening.

Consider a feasible solution represented by a DAG G = (V, A). Let  $\mathcal{P}$  be a critical path in G, with length  $C_{\max}$ . Let  $i \in \mathcal{O}$  be an arbitrary operation. We name  $f_i$  the machine to which i is assigned. Let  $k \in \mathcal{F}$  be an arbitrary machine. We name  $Q_k = i_1, \ldots, i_{|Q_k|}$  the ordered list of operations assigned to machine k. If an operation i is assigned to machine  $f_i$  and it is in the  $\gamma$ -th position of  $Q_{f_i}$ , then its actual processing time is given by  $w_i = \psi_{\alpha}(p_{i,f_i}, \gamma)$ . We intend to compute all neighbors of the solution represented by G, f, Q, and w. The neighbors will be constructed, for all  $v \in \mathcal{O}$ , by removing v and reinserting v at every possible place that does not generate a cycle. We want to determine if there are insertions that can be ignored because we know a priori that they will not lead to a makespan reduction.

Let  $v \in \mathcal{O}$  be an arbitrary operation. The computation of the neighbors of the current solution (associated with the remotion and reinsertion of v) begins by computing a digraph  $G_v^- = (V^-, A^-)$  in which the operation v is removed. Such a graph is sometimes referred to as a reduced graph in the literature. The quantities  $f^-$ ,  $Q^-$ , and  $w^-$  associated with  $G_v^-$  are also calculated. This digraph with its associated information is an intermediate structure necessary for the computation of the neighbors and, since the operation v is not assigned to any machine, it does not represent a feasible solution. This task is described in Algorithm 1. In line 2, the assignment of operations to machines is copied for all operations other than v. In line 3, the lists of operations of all machines other than  $f_v$  are copied, and, in the list of machine  $f_v$ , operation vis eliminated. In line 4, the actual processing times of most of the operations are copied, except for the operations succeeding v in the list  $Q_{f_v}$ . The actual processing times of these operations, whose position within the machine was reduced by one, need to be recalculated. The value of  $w_n$  is set to zero. In line 5, machine arcs adjacent to v are removed (if they exist) and a new machine arc between its predecessor and successor is inserted, unless v is the first or last element in  $Q_{f_v}$ . In lines 6 and 7, the set  $\mathcal{R}_v^{\leftarrow}$  of vertices that reaches v and the set of vertices  $\mathcal{R}_v^{\rightarrow}$  that are reached from v in  $G_v^-$  are calculated, which will be useful for detecting cycles in future possible

reinsertions of v. In line 8, the longest path  $\mathcal{P}^-$  in the digraph  $G_v^-$  is calculated, which will be useful to determine whether a reinsertion has chances to decrease the makespan or not. We call  $\xi$  the length of  $\mathcal{P}^-$ . (We do not call it  $C_{\max}^-$  because as  $G_v^-$  does not represent a feasible solution, then the length of the path  $\mathcal{P}^-$  does not represent a makespan.) Along with the computation of  $\mathcal{P}^-$ , the algorithm also computes, for each machine k, the smallest position  $\tau_k$  such that, for all  $\gamma > \tau_k$ , the  $\gamma$ -th operation processed by machine k is not in  $\mathcal{P}^-$ . (If machine k does not process any operation in  $\mathcal{P}^-$ , then  $\tau_k = 0$ .) The tasks in lines 6, 7, and 8 use auxiliary wellknown algorithms for topological sorting, depth-first search, and an adaptation [15, §22.2] of the Bellman-Ford algorithm described in Algorithms 2, 3, and 4, respectively, for completeness.

Let G be the digraph, with associated quantities f, Q, and w, representing the current feasible solution. Let  $\mathcal{P}$  be the critical path in G, with length  $C_{\max}$ . Let v be the operation we removed and wish to reinsert. Let  $G_v^-$  be the digraph with v removed and let  $f^-$ ,  $Q^-$ , and  $w^-$  be the quantities associated with  $G_v^-$ . Let  $\mathcal{P}^-$  be the critical path in  $G_v^-$ , with length  $\xi$ , and, for each machine k, let  $\tau_k$  be the smallest position in  $Q_k$  such that every operation in a position after  $\tau_k$  is not in  $\mathcal{P}^-$ . Let  $\kappa$  be a machine and  $\gamma$  be a position in the list  $Q_\kappa^-$  such that inserting v at position  $\gamma$  of  $Q_\kappa^-$  does not generate a cycle. Does such an insertion have a chance of generating a new digraph whose associated feasible solution has a makespan smaller than  $C_{\max}$ ? If  $\xi \ge C_{\max}$  and  $\gamma > \tau_k$ , then the answer is "no". This is because the path  $\mathcal{P}^$ with length  $\xi$  not smaller than  $C_{\max}$  already exists and the insertion of v in machine  $\kappa$ , at a position  $\gamma$  later than  $\tau_k$ , will not modify the actual processing time of any operation in  $\mathcal{P}^-$ . If  $\xi < C_{\max}$  but  $\gamma \le \tau_k$ , then chances exist.

It should be noted that, strictly speaking, the fact of v being in  $\mathcal{P}$  or not is not related to the answer to the question above. But already anticipating something that will come later, as the neighborhood reduction driven by the answer to the question may be quite small, we will consider in the experiments, heuristically,  $v \in \mathcal{P}$  as equivalent or strongly correlated to  $\xi < C_{\text{max}}$ . That is, we will consider that removing an operation from the critical path will most likely imply that  $\xi < C_{\text{max}}$ . This is very plausible for moderate values of the learning factor  $\alpha$ , with which a possible reduction of one in the machine position of some critical path operations does not cancel out the benefit of removing an operation from the critical path.

The task of reinserting v in  $G_v^-$  at position  $\gamma$  of machine  $\kappa$  generates a DAG that we name  $G_v^+$ . This task is similar to the removing task. The construction of  $G_v^+$ , its associated quantities  $f^+$ ,  $Q^+$ , and  $w^+$ , and its critical path  $\mathcal{P}^+$  with length  $C_{\max}^+$  is described in Algorithm 5. Algorithm 6 implements a best neighbor local search with the neighborhood reduction already discussed. It corresponds to a classical local search with a best neighbor strategy. The only relevant detail that remains to be explained is how to determine whether an insertion generates a cycle or not. A cycle will only be created in  $G_v^+$  if v is inserted in a position that leaves some  $u \in \mathcal{R}_v^+$  to be processed after v in machine  $\kappa$  or some  $u \in \mathcal{R}_v^{\rightarrow}$  to be processed before v in machine  $\kappa$ . The limits  $\underline{\gamma}$  and  $\overline{\gamma}$  such that  $\underline{\gamma} + 1 \leq \gamma \leq \overline{\gamma}$  avoids cycles are calculates in lines 7 and 8. A possible reduction of this interval is computed in lines 9 and 10, eliminating the possibility of making insertions after  $\tau_{\kappa}$  if  $\xi \geq C_{\max}$ , as already discussed. **Algorithm 1:** Computes  $G_v^- = (V_v^-, A_v^-)$ ,  $f^-, Q^-$ , and  $w^-$  by removing operation v from the solution graph G = (V, A). Then, in  $G_v^-$ , it computes the set  $\mathcal{R}_v^{\leftarrow}$  of vertices that reaches v and the set of vertices  $\mathcal{R}_v^{\rightarrow}$  that are reached from v, the largest path  $\mathcal{P}^-$  from s to t and its length  $\xi$ , and the position  $\tau_k$  of the last critical operation in each machine  $k \in \mathcal{F}$ .

**Input:**  $\mathcal{O}, \mathcal{F}, p, v, f, Q, w, G = (V, A)$ **Output:**  $f^-$ ,  $Q^-$ ,  $w^-$ ,  $G_v^- = (V_v^-, A_v^-)$ ,  $\mathcal{P}^-$ ,  $\xi$ ,  $\mathcal{R}_v^{\leftarrow}$ ,  $\mathcal{R}_v^{\rightarrow}$ ,  $\tau$ 1 function RemoveOp( $\mathcal{O}, p, v, f, Q, w, G, f^-, Q^-, w^-, G_v^-, \mathcal{P}^-, \xi, \mathcal{R}_v^{\leftarrow}, \mathcal{R}_v^{\rightarrow}, \tau$ ) Define  $f_i^- := f_i$  for all  $i \in \mathcal{O} \setminus \{v\}$ .  $\mathbf{2}$ Let  $Q_{f_v}$  be given by the sequence  $i_1, \ldots, i_{\gamma-1}, i_\gamma, i_{\gamma+1}, \ldots, i_{|Q_{f_v}|}$  with  $i_\gamma = v$ . Define 3  $Q_k^- := Q_k$  for all  $k \in \mathcal{F} \setminus \{f_v\}$  and  $Q_{f_v}^- := i_1, \dots, i_{\gamma-1}, i_{\gamma+1}, \dots, i_{|Q_{f_v}|}$ . Define  $w_i^- := w_i$  for all  $i \in \mathcal{O} \setminus \{v, i_{\gamma+1}, \dots, i_{|Q_{f_v}|}\}, w_v^- := 0$ , and  $\mathbf{4}$  $w_{i_{\ell}}^{-} := \psi_{\alpha}(p_{i_{\ell}, f_{i_{\ell}}}, \ell - 1) \text{ for } \ell = \gamma + 1, \dots, |Q_{f_{\nu}}|.$ Define the graph  $G_v^- = (V_v^-, A_v^-)$  with  $V_v^- := V$  and  $\mathbf{5}$  $A_v^- := (A \setminus \{(i_{\gamma-1}, v), (v, i_{\gamma+1})\}) \cup \{(i_{\gamma-1}, i_{\gamma+1})\}.$ Initialize  $\mathcal{V} \leftarrow \emptyset$ ,  $\mathcal{U}$  as an empty list, and  $\mathcal{R}_v^{\leftarrow} \leftarrow \{v\}$ , and compute in  $\mathcal{U}$  and  $\mathcal{R}_v^{\leftarrow}$  a 6 topological sort of the vertices in  $V_v^-$  and the set of vertices  $i \in V_v^-$  such that a  $\mathcal{R}_v^{\leftarrow}$ ). Initialize  $\mathcal{R}_v^{\rightarrow} \leftarrow \emptyset$  and compute in  $\mathcal{R}_v^{\rightarrow}$  the set of vertices  $i \in V_v^-$  such that a path  $\mathbf{7}$ from v to i exists, by calling DFS $(G_v^-, v, \mathcal{R}_v^{\rightarrow})$ . Compute the largest path  $\mathcal{P}^-$  from s to t, its length  $\xi$ , and determine the 8 position  $\tau_k$  of the last critical operation at each machine k for all  $k \in \mathcal{F}$  by calling CriticalPath( $\mathcal{F}, f^-, w^-, Q^-, G_v^- = (V_v^-, A_v^-), \mathcal{U}, \mathcal{P}^-, \xi, \tau$ ).

**Algorithm 2:** Computes a topological sort  $\mathcal{U}$  of the vertices of G = (V, A). In addition, if v and  $\mathcal{R}_v^{\leftarrow}$  are present as an input parameter, computes the set  $\mathcal{R}_v^{\leftarrow}$  of vertices that reaches v in G = (V, A).

 $\begin{array}{c|c} \textbf{Input: } G = (V, \overline{A}), \mathcal{U}, i, \mathcal{V}, v, \mathcal{R}_v^{\leftarrow} \\ \textbf{Output: } \mathcal{U}, \mathcal{V}, \mathcal{R}_v^{\leftarrow} \\ \textbf{1 function TopologicalSort} + (G, \mathcal{U}, i, \mathcal{V}, v, \mathcal{R}_v^{\leftarrow}) \\ \textbf{2} & \quad \text{Set } \mathcal{V} \leftarrow \mathcal{V} \cup \{i\}. \\ \textbf{3} & \quad \textbf{for } j \text{ such that } (i, j) \in A \text{ do} \\ \textbf{4} & \quad \begin{array}{c} \textbf{if } j \notin \mathcal{V} \text{ then} \\ & \quad \begin{array}{c} & \quad \end{array} \\ \textbf{5} & \quad \begin{array}{c} \text{I fopologicalSort} + (G, \mathcal{U}, j, \mathcal{V}, v, \mathcal{R}_v^{\leftarrow}) \\ \textbf{6} & \quad \end{array} \\ \textbf{6} & \quad \begin{array}{c} \text{if } i \notin \mathcal{R}_v^{\leftarrow} \text{ and } j \in \mathcal{R}_v^{\leftarrow} \text{ then} \\ & \quad \end{array} \\ \textbf{7} & \quad \begin{array}{c} \text{set } \mathcal{R}_v^{\leftarrow} \leftarrow \mathcal{R}_v^{\leftarrow} \cup \{i\}. \end{array} \end{array}$ 

**8** Insert *i* at the beginning of  $\mathcal{U}$ .

Al	gorithm 3: Computes the set of vertices $\mathcal{R}_v^{-\gamma}$ as the set
rea	ached by $v$ in $G = (V, A)$ .
Ι	<b>input:</b> $G = (V, A), v, \mathcal{R}_v^{\rightarrow}$
(	Dutput: $\mathcal{R}_v^{ ightarrow}$
1 f	$\mathbf{function} \ \mathrm{DFS}(G, v,  \mathcal{R}_v^{\rightarrow})$
<b>2</b>	Set $\mathcal{R}_v^{\rightarrow} \leftarrow \mathcal{R}_v^{\rightarrow} \cup \{v\}.$
3	for $j$ such that $(v, j) \in A$ do
4	$   \mathbf{if} \ j \notin \mathcal{R}_v^{\rightarrow} \ \mathbf{then}$
5	$  DFS(G, j, \mathcal{R}_v^{\rightarrow})$

of vertices  $\mathcal{D}^{\rightarrow}$  as the Algorithm 2. Computed the get set of vertices that can be

Algorithm 4: Computes a critical path  $\mathcal{P}$  and its length  $\xi$  for a given graph G = (V, A). In addition, if  $\tau$  is present as an input parameter, determines the last critical operation in each machine.

**Input:**  $\mathcal{F}$ , f, w, Q, G = (V, A),  $\tau$ **Output:**  $\mathcal{U}, \mathcal{P}, \xi, \tau$ 1 function CriticalPath( $\mathcal{F}, f, w, Q, G, \mathcal{U}, \mathcal{P}, \xi, \tau$ ) Initialize  $d_i \leftarrow -\infty$  for all  $i \in V \setminus \{s\}$  and define  $d_s := 0$  and  $\pi_s := 0$ .  $\mathbf{2}$ Initialize  $\mathcal{V} \leftarrow \emptyset$  and  $\mathcal{U}$  as an empty list and compute in  $\mathcal{U}$  a topological sort of the 3 vertices in V, by calling TopologicalSort+ $(G, \mathcal{U}, s, \mathcal{V})$ . for  $\ell = 1, \ldots, |V|$  do  $\mathbf{4}$ Let i be the  $\ell$ -th operation in the topological order given by  $\mathcal{U}$ .  $\mathbf{5}$ 6 for j such that  $(i, j) \in A$  do if  $d_j < d_i + w_i$  then 7  $\begin{bmatrix} d_j \leftarrow d_i + w_i \text{ and } \pi_j \leftarrow i. \end{bmatrix}$ 8 9  $\xi := d_t$ Initialize  $i \leftarrow \pi_t$ ,  $\mathcal{P} \leftarrow \emptyset$ , and  $\tau_k \leftarrow 0$  for all  $k \in \mathcal{F}$ . 10 do  $\mathbf{11}$ if  $\tau_{f_i} = 0$  then 12Let  $Q_{f_i}$  be given by the sequence  $i_1, \ldots, i_{\ell-1}, i, i_{\ell+1}, \ldots, i_{|Q_{f_i}|}$ . Define  $\tau_{f_i} := \ell$ . 13  $\mathcal{P} \leftarrow \mathcal{P} \cup \{i\}$  and  $i \leftarrow \pi_i$ . 14 while  $i \neq s$  $\mathbf{15}$ 

#### 3 **Metaheuristics**

It is known that the direct application of a local search as the one introduced in the previous section suffers from premature convergence to local solutions. Therefore, it is natural to think of using it in connection with metaheuristics. In particular, trajectory metaheuristics are a natural choice since they make direct use of local search strategies. In this paper we consider the well-known metaheuristics iterated local search (ILS), greedy randomized adaptive search **Algorithm 5:** Computes  $G_v^+ = (V_v^+, A_v^+)$ ,  $f^+$ ,  $Q^+$ , and  $w^+$  by inserting operation v at position  $\gamma$  of machine  $\kappa$  in the reduced graph  $G_v^-$ . Then, in  $G_v^+$ , it computes the largest path  $\mathcal{P}^+$  from s to t and its length  $C_{\max}^+$ .

Input:  $\mathcal{O}, \mathcal{F}, p, v, \gamma, \kappa, f^-, Q^-, w^-, G_v^- = (V_v^-, A_v^-)$ Output:  $f^+, Q^+, w^+, G_v^+ = (V_v^+, A_v^+), \mathcal{P}^+, C_{\max}^+$ 1 function InsertOp( $\mathcal{O}, p, v, \gamma, \kappa, f^-, Q^-, w^-, G_v^-, f^+, Q^+, w^+, G_v^+, \mathcal{P}^+, C_{\max}^+)$ 2 Define  $f_i^+ := f_i^-$  for all  $i \in \mathcal{O} \setminus \{v\}$  and  $f_v^+ := \kappa$ . Let  $Q_{\kappa}^{-}$  be given by the sequence  $i_1, i_2, \ldots, i_{|Q_{\kappa}^{-}|}$ . 3 Define  $Q_k^+ := Q_k^-$  for all  $k \in \mathcal{F} \setminus \{\kappa\}$  and  $Q_k^+ := i_1, \ldots, i_{\gamma-1}, v, i_\gamma, \ldots, i_{|Q_k^-|}$ . 4 Define  $w_i^+ := w_i^-$  for all  $i \in \mathcal{O} \setminus \{v, i_\gamma, \dots, i_{|Q_\kappa|}\}$ , and  $w_{i_\ell}^+ := \psi(p_{i_\ell,\kappa}, \ell)$  for  $\mathbf{5}$  $\ell = \gamma, \dots, |Q_{\kappa}^+|.$ Define the graph  $G_v^+ = (V_v^+, A_v^+)$  with  $V_v^+ := V_v^-$  and 6  $A_v^+ := (A_v^- \setminus \{(i_{\gamma-1}, i_{\gamma}))\} \cup \{(i_{\gamma-1}, v), (v, i_{\gamma})\}.$ Initialize  $\mathcal{V} \leftarrow \emptyset$  and  $\mathcal{U}$  as an empty list and compute in  $\mathcal{U}$  a topological sort of the 7 vertices in  $V_v^+$ , by calling TopologicalSort+ $(G_v^+, \mathcal{U}, s, \mathcal{V})$ . Compute the critical path  $\mathcal{P}^+$  from s to t and its length  $C_{\max}$  by calling 8 CriticalPath( $\mathcal{F}, f^+, w^+, Q^+, G_v^+ = (V_v^+, A_v^+), \mathcal{U}, \mathcal{P}^+, C_{\max}^+$ ).

procedure (GRASP), tabu search (TS), and simulating annealing (SA). The basic components of each of them are presented below.

## 3.1 Iterated local search

The ILS [37] strategy consists of iteratively running a local search until it converges to a local solution and perturbing the solution found to be used as the initial solution for the next run of the local search. For the first run of the local search, it uses as initial solution the best among the solutions constructed by the constructive heuristics ECT and EST introduced in [4]. The perturbation consists of a sequence of  $\ell^p$  modifications, where  $\ell^p$  is a random number between  $\ell_{\min}^p$  and  $\ell_{\max}^p$ . ( $\ell_{\min}^p$  and  $\ell_{\max}^p$  are the only two parameters of the ILS.) Each modification consists of removing a random operation and relocating it to a random place so that the solution thus constructed is feasible. Algorithms 7 and 8 describe the ILS completely. They make use of Algorithm 6 for the local search and Algorithms 1 and 5 for removing and reinserting an operation, respectively. The random choices at line 12 of Algorithm 7 and lines 2, 4, and 7 of Algorithm 8 follow a discrete uniform distribution within the prescribed range. The same applies to all the methods described below, which make random choices following discrete or continuous (depending on the situation) uniform distributions within prescribed ranges.

## 3.2 Greedy randomized adaptive procedure

The GRASP [21] consists of iteratively generating an initial solution and running a local search starting from the initial solution just generated. The initial solutions are generated as the best among the solutions generated by randomized versions of the constructive heuristics ECT and Algorithm 6: Best neighbor local search with reduced neighborhood.

**Input:**  $\mathcal{O}, \mathcal{F}, p, G = (V, A), f, w, Q, \mathcal{P}, C_{\max}$ **Output:**  $G^{\star} = (V^{\star}, A^{\star}), f^{\star}, w^{\star}, Q^{\star}, \mathcal{P}^{\star}, C_{\max}^{\star}$ function LocalSearch( $\mathcal{O}, \mathcal{F}, p, G, f, w, Q, \mathcal{P}, C_{\max}, G^{\star}, f^{\star}, w^{\star}, Q^{\star}, \mathcal{P}^{\star}, C_{\max}^{\star}$ ) 1 2  $\mathbf{do}$  $C^{\mathrm{bn}}_{\mathrm{max}} \leftarrow +\infty$ 3 for  $v \in \mathcal{O}$  do  $\mathbf{4}$ RemoveOp( $\mathcal{O}, p, v, f, Q, w, G, f^-, Q^-, w^-, G_v^-, \mathcal{P}^-, \xi, \mathcal{R}_v^{\leftarrow}, \mathcal{R}_v^{\rightarrow}, \tau$ ) 5 for  $k \in \mathcal{F}_v$  do 6 Let  $\underline{\gamma}$  be the position of the last operation in  $Q_k^- = i_1, \ldots, i_{|Q_k^-|}$  such that  $\mathbf{7}$  $i_{\underline{\gamma}} \in \mathcal{R}_v^{\leftarrow}$  and let  $\underline{\gamma} = 0$  if  $i_{\ell} \notin \mathcal{R}_v^{\leftarrow}$  for  $\ell = 1, \dots, |Q_k^-|$ . Let  $\bar{\gamma}$  be the position of the first operation in  $Q_k^- = i_1, \ldots, i_{|Q_k^-|}$  such that 8  $i_{\bar{\gamma}} \in \mathcal{R}_v^{\to}$  and let  $\bar{\gamma} = |Q_k^-| + 1$  if  $i_\ell \notin \mathcal{R}_v^{\to}$  for  $\ell = 1, \dots, |Q_k^-|$ . if  $\xi \geq C_{\max}$  then 9  $\bar{\gamma} \leftarrow \min\{\bar{\gamma}, \tau_k\}$ , where  $\tau_k$  is such that there is no critical operation 10 after  $\tau_k$  in  $Q_k^-$  ( $\tau_k = 0$  if there is no critical operation in  $Q_k^-$ ). for  $\gamma = \gamma + 1, \ldots, \bar{\gamma}$  do 11 InsertOp( $\mathcal{O}, p, v, \gamma, k, f^-, Q^-, w^-, G_v^-, f^+, Q^+, w^+, G_v^+, \mathcal{P}^+, C_{\max}^+$ )  $\mathbf{12}$  $\begin{array}{l} \mathbf{if} \ C^+_{\max} < C^{\mathrm{bn}}_{\max} \ \mathbf{then} \\ | \ \ G^{\mathrm{bn}}, f^{\mathrm{bn}}, w^{\mathrm{bn}}, Q^{\mathrm{bn}}, \mathcal{P}^{\mathrm{bn}}, C^{\mathrm{bn}}_{\max} \leftarrow G^+_v, f^+, w^+, Q^+, \mathcal{P}^+, C^+_{\max} \end{array}$ 13 14  $\delta \leftarrow C_{\max} - C_{\max}^{\operatorname{bn}}$ 15if  $\delta > 0$  then 16 $G, f, w, Q, \mathcal{P}, C_{\max} \leftarrow G^{\operatorname{bn}}, f^{\operatorname{bn}}, w^{\operatorname{bn}}, Q^{\operatorname{bn}}, \mathcal{P}^{\operatorname{bn}}, C_{\max}^{\operatorname{bn}}$  $\mathbf{17}$ while  $\delta > 0$ 18  $G^{\star}, f^{\star}, w^{\star}, Q^{\star}, \mathcal{P}^{\star}, C_{\max}^{\star} \leftarrow G, f, w, Q, \mathcal{P}, C_{\max}$ 19

EST introduced in [4].

The two constructive heuristics introduced in [4] are based on the earliest starting time (EST) rule [8] and the earliest completion time (ECT) rule [35]. The heuristics schedule one operation at a time. In the EST-based constructive heuristic, the instant  $r_{\min}$  which is the earliest instant at which an unscheduled operation could be initiated is computed first. All operation/machine pairs that could start at that instant are considered and the pair with the shortest processing time is selected. Since they all would start at instant  $r_{\min}$ , selecting the pair with the shortest processing time is the same as selecting the pair that ends earliest. This idea is taken to the extreme in the constructive heuristic based on the ECT rule: without limiting the choice to the operation/machine pairs that could start as soon as possible, the operation/machine pair that will finish earliest is chosen, even if the processing of the operation does not start as soon as possible.

In the EST-based constructive heuristic, the randomization is done as follows. First, the

Algorithm 7: Iterated local search.

**Input:**  $\mathcal{O}, \mathcal{F}, p, \widehat{A}, \ell_{\min}^p, \ell_{\max}^p$ **Output:**  $f^{\star}, w^{\star}, Q^{\star}, G^{\star}, C^{\star}_{\max}$ 1 function ILS( $\mathcal{O}, \mathcal{F}, p, \widehat{A}, \ell_{\min}^{p}, \ell_{\max}^{p}, f^{\star}, w^{\star}, Q^{\star}, G^{\star}, C_{\max}^{\star})$  $ECT(\mathcal{O}, \mathcal{F}, p, \widehat{A}, f^1, w^1, Q^1, G^1, \mathcal{U}^1, \mathcal{P}^1, C^1_{\max}, \tau^1)$  $\mathbf{2}$  $\mathrm{EST}(\mathcal{O}, \mathcal{F}, p, \widehat{A}, f^2, w^2, Q^2, G^2, \mathcal{U}^2, \mathcal{P}^2, C^2_{\mathrm{max}}, \tau^2)$ 3  $\begin{array}{l} \mathbf{if} \ C_{\max}^1 < C_{\max}^2 \ \mathbf{then} \\ \mid \ f^\star \leftarrow f^1, \ w^\star \leftarrow w^1, \ Q^\star \leftarrow Q^1, \ G^\star \leftarrow G^1 \ \mathrm{and} \ C_{\max}^\star \leftarrow C_{\max}^1 \end{array}$ 4  $\mathbf{5}$ else 6  $f^{\star} \leftarrow f^2, w^{\star} \leftarrow w^2, Q^{\star} \leftarrow Q^2, G^{\star} \leftarrow G^2 \text{ and } C^{\star}_{\max} \leftarrow C^2_{\max}$  $\mathbf{7}$ while the stopping criterion is not satisfied do 8 LocalSearch( $\mathcal{O}, \mathcal{F}, p, G, f, w, Q, \mathcal{P}, C_{\max}, G', f', w', Q', \mathcal{P}', C'_{\max}$ ) 9 if  $C'_{\max} < C^{\star}_{\max}$  then 10 $\int f^{\star} \leftarrow f', w^{\star} \leftarrow w', Q^{\star} \leftarrow Q', G^{\star} \leftarrow G' \text{ and } C^{\star}_{\max} \leftarrow C'_{\max}$ 11 Set  $\ell^p$  a random number between  $\ell^p_{\min}$  and  $\ell^p_{\max}$ . 12for  $i = 1, \ldots, \ell^p$  do 13 Perturb( $\mathcal{O}, \mathcal{F}, p, f', w', Q', G', f, w, Q, G, \mathcal{P}, C_{\max}$ )  $\mathbf{14}$ 

Algorithm 8: Perturbs a solution.

**Input:**  $\mathcal{O}, \mathcal{F}, p, f, w, Q, G = (V, A)$ **Output:**  $f', w', Q', G' = (V', A'), \mathcal{P}', C'_{max}$ 1 function Perturb( $\mathcal{O}, \mathcal{F}, p, f, w, Q, G, f', w', Q', G', \mathcal{P}', C'_{\max}$ ) Let  $v \in V \setminus \{s, t\}$  be a random operation. 2 RemoveOp( $\mathcal{O}, p, v, f, Q, w, G, f^-, Q^-, w^-, G_v^-, \mathcal{P}^-, \xi, \mathcal{R}_v^{\leftarrow}, \mathcal{R}_v^{\rightarrow}, \tau$ ) 3 Let  $k \in \mathcal{F}_v$  be a random machine and let  $Q_k^- = i_1, \ldots, i_{|Q_k^-|}$ . 4 Let  $\gamma$  be the position of the last operation in  $Q_k^-$  such that  $i_{\gamma} \in \mathcal{R}_v^{\leftarrow}$  and let  $\gamma = 0$  if  $\mathbf{5}$  $i_{\ell} \notin \mathcal{R}_{v}^{\leftarrow}$  for  $\ell = 1, \ldots, |Q_{k}^{-}|$ . Let  $\bar{\gamma}$  be the position of the first operation in  $Q_k^-$  such that  $i_{\bar{\gamma}} \in \bar{R}_v^{\to}$  and let 6  $\bar{\gamma} = |Q_k^-| + 1$  if  $i_\ell \notin \mathcal{R}_v^{\to}$  for  $\ell = 1, \dots, |Q_k^-|$ . Let  $\gamma \in \{\gamma + 1, \dots, \bar{\gamma}\}$  be a random feasible position. 7 InsertOp( $\mathcal{O}, p, v, \gamma, k, f^-, Q^-, w^-, G_v^-, f', Q', w', G', \mathcal{P}', C'_{\max}$ ) 8

earliest time  $r_{\min}$  at which an unscheduled operation can be initiated is calculated. Then we calculate the shortest and the longest processing times a and b associated with the operation/machine pairs that can start at  $r_{\min}$ . Given  $\alpha \in (0, 1]$ , a random pair is chosen from those whose processing time is between a and  $a + \alpha(b - a)$ . In the ECT-based constructive heuristic, the randomization consists of, from among the unscheduled operations, calculating the lowest and highest completion instants a and b and drawing an operation/machine pair from among those that would terminate between a and  $a + \alpha(b - a)$ . It is worth noting that the calculation

of the effective processing time always takes into consideration the learning effect. The only parameter of the method is  $\alpha$ . The GRASP strategy is described in Algorithm 9 and the randomized versions of the constructive heuristics based on the EST and ECT dispatching rules are described in Algorithms 10 and 11, respectively. Algorithm 9 uses Algorithm 6 to perform the local search and Algorithms 10 and 11 use Algorithm 4 for the calculation of the critical path associated with the initial solution, which is a necessary input for the local search. For more details on the deterministic versions of the constructive heuristics based on the EST and ECT dispatching rules see [4, Algorithms 1 and 4].

Algorithm 9: Greedy randomized adaptive procedure. **Input:**  $\mathcal{O}, \mathcal{F}, p, \widehat{A}, \alpha$ **Output:**  $f^{\star}, w^{\star}, Q^{\star}, G^{\star}, C^{\star}_{\max}$ 1 function GRASP( $\mathcal{O}, \mathcal{F}, p, \overline{\hat{A}}, \alpha, f^{\star}, w^{\star}, Q^{\star}, G^{\star}, C_{\max}^{\star}$ ) Initialize  $C^{\star}_{\max} \leftarrow +\infty$ 2 while the stopping criterion is not satisfied do 3 RandomizedECT( $\mathcal{O}, \mathcal{F}, p, \hat{A}, \alpha, f^1, w^1, Q^1, G^1, \mathcal{P}^1, C^1_{\max}$ )  $\mathbf{4}$ RandomizedEST( $\mathcal{O}, \mathcal{F}, p, \hat{A}, \alpha, f^2, w^2, Q^2, G^2, \mathcal{P}^2, C_{\max}^2$ ) 5  $\begin{array}{l} \mathbf{if} \ C_{\max}^1 < C_{\max}^2 \ \mathbf{then} \\ | \ f \leftarrow f^1, \ w \leftarrow w^1, \ Q \leftarrow Q^1, \ \mathcal{P} \leftarrow \mathcal{P}^1, \ G \leftarrow G^1, \ \mathrm{and} \ C_{\max} \leftarrow C_{\max}^1 \end{array} \\ \end{array}$ 6 7 else 8  $f \leftarrow f^2, w \leftarrow w^2, Q \leftarrow Q^2, \mathcal{P} \leftarrow \mathcal{P}^2, G \leftarrow G^2, \text{ and } C_{\max} \leftarrow C^2_{\max}$ 9 LocalSearch( $\mathcal{O}, \mathcal{F}, p, G, f, w, Q, \mathcal{P}, C_{\max}, G', f', w', Q', \mathcal{P}', C'_{\max}$ ) 10 if  $C'_{\max} < C^{\star}_{\max}$  then 11  $f^{\star} \leftarrow f', w^{\star} \leftarrow w', Q^{\star} \leftarrow Q', G^{\star} \leftarrow G' \text{ and } C^{\star}_{\max} \leftarrow C'_{\max}$ 12

### 3.3 Tabu search

The TS [25, 26] considered consists basically of a local search with a modification in the acceptance criteria of a neighbor as a new solution. The acceptance depends on a list of tabu moves. The size  $t_{\text{max}}$  of this list is the only parameter of the method. In a given iteration, the best neighbor is computed, disregarding neighbors constructed with a tabu move unless they correspond to the best solution already constructed. The way of constructing the neighborhood follows exactly the same scheme as the local search described in Algorithm 6. The move that transforms the solution of the current iteration into the solution of the next iteration consists in relocating a certain operation v at the  $\gamma$  position of a machine  $k \in \mathcal{F}_v$ . We keep in the tabu list the operation/machine pair (v, k). The complete method is described in Algorithm 12.

### 3.4 Simulated annealing

In the SA [34], as in the other metaheuristics, the initial solution is given by the best solution among those provided by the constructive heuristics based on the EST and ECT dispatch rules. **Algorithm 10:** Computes a feasible solution using a randomization of the earliest starting time (EST) rule.

**Input:**  $\mathcal{O}, \mathcal{F}, p, \widehat{A}, \alpha$ **Output:**  $f, w, Q, G, \mathcal{P}, C_{\max}$ 1 function RandomizedEST( $\mathcal{O}, \mathcal{F}, p, \hat{A}, \alpha, f, w, Q, G, \mathcal{P}, C_{\max}$ ) Set  $A \leftarrow \widehat{A} \cup \{(s,j) \mid (\cdot,j) \notin \widehat{A}\} \cup \{(i,t) \mid (i,\cdot) \notin \widehat{A}\}$  and define  $V := \mathcal{O} \cup \{s,t\}$  and 2 G = (V, A).Set  $r_v^{op} \leftarrow +\infty$  and define  $r_s^{op} := 0$ ,  $w_s := w_t := 0$ , and  $c_s := 0$ . Set  $r_k^{\max} \leftarrow 0$  and  $g_k \leftarrow 1$  for all  $k \in \mathcal{F}$ . 3  $\mathbf{4}$ Initialize  $\Pi \leftarrow V \setminus \{s, t\}$  as the set of non-scheduled operations, and  $Q_k$  as an empty 5 list for all  $k \in \mathcal{F}$ . while  $\Pi \neq \emptyset$  do 6  $\mathbf{7}$ for  $v \in \Pi$  do  $\begin{array}{l} \mathbf{if} \ \Pi \cap \{i \mid (i,v) \in A\} = \emptyset \ \mathbf{then} \\ \mid \ r_v^{\mathrm{op}} \leftarrow \max\{c_i \mid i \in V \setminus \Pi \ \mathrm{such} \ \mathrm{that} \ (i,v) \in A\} \end{array}$ 8 9 Set  $r_{\min} = \min_{v \in \Pi, k \in \mathcal{F}_v} \{\max(r_v^{\text{op}}, r_k^{\max})\}$  and let E be the set of pairs (v, k) with 10  $v \in \Pi$  and  $k \in \mathcal{F}_v$  such that  $\max(r_v^{\text{op}}, r_k^{\text{mac}}) = r_{\min}$ . Compute  $\underline{\psi} \leftarrow \min_{(v,k)\in E} \{\psi(p_{v,k}, g_k)\}$  and  $\overline{\psi} \leftarrow \max_{(v,k)\in E} \{\psi(p_{v,k}, g_k)\}$ , set 11  $\mathcal{L} \leftarrow \{(v,k) \in E \mid \psi(p_{v,k},g_k) \leq \underline{\psi} + \alpha(\overline{\psi} - \underline{\psi})\}$  and choose  $(\hat{v},\hat{k}) \in \mathcal{L}$  randomly. Define  $w_{\hat{v}} := \psi(p_{\hat{v},\hat{k}},g_{\hat{k}}), f_{\hat{v}} := \hat{k}, c_{\hat{v}} := c_{\hat{v},\hat{k}}$  and set  $r_{\hat{k}}^{\max} \leftarrow c_{\hat{v}}$  and  $g_{\hat{k}} \leftarrow g_{\hat{k}} + 1$ . 12if  $|Q_{\hat{k}}| \neq 0$  then  $\mathbf{13}$ Set  $A \leftarrow A \cup \{(i_{|Q_{\hat{k}}|}, \hat{v})\}$ , where  $Q_{\hat{k}} = i_1, \dots, i_{|Q_{\hat{k}}|}$ .  $\mathbf{14}$ Insert  $\hat{v}$  at the end of  $Q_{\hat{k}}$  and set  $\Pi \leftarrow \Pi \setminus {\hat{v}}$ .  $\mathbf{15}$ CriticalPath( $\mathcal{F}, f, w, Q, G, \mathcal{U}, \mathcal{P}, C_{\max}, \tau$ ).  $\mathbf{16}$ 

The simulating annealing advances from one solution to another by making perturbations of the solution consisting of a random movement of removal and insertion (described in Algorithm 8). The main feature is that, for a new solution to be accepted, it need not be better than the current solution. On the other hand, the probability of accepting a solution that is worse than the current solution decreases as the method progresses, i.e. as the temperature decreases. The method has as parameters the initial and final temperatures  $T_0$  and  $T_f$ . The temperature decreases as the method progresses being multiplied by a parameter  $\delta \in (0, 1)$ . The amount of perturbations for a fixed temperature is given by a parameter  $\bar{\ell} \in \mathbb{N}, \ \bar{\ell} \geq 1$ . The method as a whole is described in Algorithm 13.

## 4 Numerical experiments

In this section, we present numerical experiments with the proposed local search and the considered metaheuristics. In all experiments, we consider the 60 small-sized instances introduced Algorithm 11: Computes a feasible solution using a randomization of the earliest completion time (ECT) rule.

**Input:**  $\mathcal{O}, \mathcal{F}, p, \widehat{A}, \alpha$ **Output:**  $f, w, Q, G, \mathcal{P}, C_{\max}$ 1 function RandomizedECT( $\mathcal{O}, \mathcal{F}, p, \hat{A}, \alpha, f, w, Q, G, \mathcal{P}, C_{\max}$ ) Set  $A \leftarrow \widehat{A} \cup \{(s,j) \mid (\cdot,j) \notin \widehat{A}\} \cup \{(i,t) \mid (i,\cdot) \notin \widehat{A}\}$  and define  $V := \mathcal{O} \cup \{s,t\}$  and 2 G = (V, A).Set  $r_v^{\text{op}} \leftarrow +\infty$  and define  $r_s^{\text{op}} := 0$ ,  $w_s := w_t := 0$ , and  $c_s := 0$ . 3 Set  $r_k^{\text{mac}} \leftarrow 0$  and  $g_k \leftarrow 1$  for all  $k \in \mathcal{F}$ .  $\mathbf{4}$ Initialize  $\Pi \leftarrow V \setminus \{s, t\}$  as the set of non-scheduled operations, and  $Q_k$  as an empty 5 list for all  $k \in \mathcal{F}$ . while  $\Pi \neq \emptyset$  do 6  $\mathbf{7}$ for  $v \in \Pi$  do  $\begin{array}{l} \mathbf{if} \ \Pi \cap \{i \mid (i,v) \in A\} = \emptyset \ \mathbf{then} \\ \mid \ r_v^{\mathrm{op}} \leftarrow \max\{c_i \mid i \in V \setminus \Pi \ \mathrm{such} \ \mathrm{that} \ (i,v) \in A\} \end{array}$ 8 9 for  $v \in \Pi$  do  $\mathbf{10}$ for  $k \in \mathcal{F}_v$  do 11  $\begin{bmatrix} c_{v,k} \leftarrow \max(r_v^{\text{op}}, r_k^{\text{mac}}) + \psi(p_{v,k}, g_k) \end{bmatrix}$ 12Set  $c^{\min} \leftarrow \min\{c_{v,k} \mid v \in \Pi, k \in \mathcal{F}_v\}, c^{\max} \leftarrow \max\{c_{v,k} \mid v \in \Pi, k \in \mathcal{F}_v\}$  and RCL  $\leftarrow \{(v,k) \mid c_{v,k} \le c^{\min} + \alpha(c^{\max} - c^{\min}), v \in \Pi, k \in \mathcal{F}_v\}.$  $\mathbf{13}$ Choose  $(\hat{v}, \hat{k})$  randomly in RCL.  $\mathbf{14}$ Define  $w_{\hat{v}} := \psi(p_{\hat{v},\hat{k}},g_{\hat{k}}), f_{\hat{v}} := \hat{k}, c_{\hat{v}} := c_{\hat{v},\hat{k}}$  and set  $r_{\hat{k}}^{\text{mac}} \leftarrow c_{\hat{v}}$  and  $g_{\hat{k}} \leftarrow g_{\hat{k}} + 1$ .  $\mathbf{15}$ if  $|Q_{\hat{k}}| \neq 0$  then 16Let  $Q_{\hat{k}} = i_1, \dots, i_{|Q_{\hat{k}}|}$ . Set  $A \leftarrow A \cup \{(i_{|Q_{\hat{k}}|}, \hat{v})\}$ .  $\mathbf{17}$ Insert  $\hat{v}$  at the end of  $Q_{\hat{k}}$  and set  $\Pi \leftarrow \Pi \setminus {\hat{v}}$ . 18 CriticalPath( $\mathcal{F}, f, w, Q, G, \mathcal{U}, \mathcal{P}, C_{\max}, \tau$ ). 19

in [4] and the 50 large-sized instances introduced in [8], with learning rate  $\alpha \in \{0.1, 0.2, 0.3\}$ , totaling 330 instances. Small-sized instances have between 5 and 7 machines and between 9 and 24 operations. The operations are divided into up to 6 tasks, which correspond to connected components of the DAG of precedence relations, and the DAGs have up to 21 edges. The MILP models [4, p.7, Eq.(1-4)] of the small-sized instances have between 5 and 26 machines and between 25 and 12,000 constraints. Large-sized instances have between 5 and 26 machines and between 25 and 289 operations. The operations are divided into up to 17 tasks and the DAGs representing the precedence relations have up to 272 edges. Their MILP models have up to 73,000 binary variables and 3,800,000 constraints. It is worth recalling that the considered problem has two types of flexibility: routing flexibility and sequencing flexibility. The first refers to the fact that an operation can be processed by a machine within a set of machines instead of a single machine and corresponds to the "flexible" of the FJS. The second corresponds to the fact

Algorithm 12: Tabu Search.

Input:  $\mathcal{O}, \mathcal{F}, p, \overline{A}, t_{\max}$ **Output:**  $f^{\star}, w^{\star}, Q^{\star}, G^{\star}, C_{\max}^{\star}$ 1 function  $TS(\mathcal{O}, \mathcal{F}, p, \widehat{A}, t_{\max}, f^{\star}, w^{\star}, Q^{\star}, G^{\star}, C_{\max}^{\star})$ ECT( $\mathcal{O}, \mathcal{F}, p, \widehat{A}, f^1, w^1, Q^1, G^1, \mathcal{U}^1, \mathcal{P}^1, C^1_{\max}, \tau^1$ )  $\mathbf{2}$  $\mathrm{EST}(\mathcal{O}, \mathcal{F}, p, \widehat{A}, f^2, w^2, Q^2, G^2, \mathcal{U}^2, \mathcal{P}^2, C^2_{\mathrm{max}}, \tau^2)$ 3  $\begin{array}{l} \textbf{if} \ C_{\max}^1 < C_{\max}^2 \ \textbf{then} \\ \mid \ f^\star \leftarrow f^1, \ w^\star \leftarrow w^1, \ Q^\star \leftarrow Q^1, \ G^\star \leftarrow G^1 \ \textbf{and} \ C_{\max}^\star \leftarrow C_{\max}^1 \end{array}$  $\mathbf{4}$  $\mathbf{5}$ 6 else  $f^{\star} \leftarrow f^2, w^{\star} \leftarrow w^2, Q^{\star} \leftarrow Q^2, G^{\star} \leftarrow G^2 \text{ and } C^{\star}_{\max} \leftarrow C^2_{\max}$ 7 Initialize  $\mathcal{T}$  as an empty list. 8 while the stopping criterion is not satisfied do 9  $C'_{\max} \leftarrow +\infty$ 10 for  $v \in \mathcal{O}$  do 11 RemoveOp( $\mathcal{O}, p, v, f, Q, w, G, f^-, Q^-, w^-, G_v^-, \mathcal{P}^-, \xi, \mathcal{R}_v^{\leftarrow}, \mathcal{R}_v^{\rightarrow}, \tau$ ) 12for  $k \in \mathcal{F}_v$  do  $\mathbf{13}$ Let  $\underline{\gamma}$  be the position of the last operation in  $Q_k^- = i_1, \ldots, i_{|Q_k^-|}$  such that  $\mathbf{14}$  $i_{\gamma} \in \mathcal{R}_{v}^{\leftarrow}$  and let  $\underline{\gamma} = 0$  if  $i_{\ell} \notin \mathcal{R}_{v}^{\leftarrow}$  for  $\ell = 1, \ldots, |Q_{k}^{-}|$ . Let  $\bar{\gamma}$  be the position of the first operation in  $Q_k^- = i_1, \ldots, i_{|Q_k^-|}$  such that 15 $i_{\bar{\gamma}} \in \bar{R}_v^{\to}$  and let  $\bar{\gamma} = |Q_k^-| + 1$  if  $i_\ell \notin \mathcal{R}_v^{\to}$  for  $\ell = 1, \dots, |Q_k^-|$ . if  $\xi \geq C_{\max}$  then  $\mathbf{16}$  $\bar{\gamma} \leftarrow \min\{\bar{\gamma}, \tau_k\}$ , where  $\tau_k$  is such that there is no critical operation  $\mathbf{17}$ after  $\tau_k$  in  $Q_k^-$  ( $\tau_k = 0$  if there is no critical operation in  $Q_k^-$ ). for  $\gamma = \gamma + 1, \dots, \bar{\gamma}$  do  $\mathbf{18}$ InsertOp( $\mathcal{O}, p, v, \gamma, \kappa, f^-, Q^-, w^-, G_v^-, f^+, Q^+, w^+, G_v^+, \mathcal{P}^+, C_{\max}^+$ ) 19  $\begin{array}{l} \mathbf{if} \ (C_{\max}^+ < C_{\max}' \text{ and } (v,k) \notin \mathcal{T}) \text{ or } C_{\max}^+ < \min\{C_{\max}', C_{\max}^\star\} \ \mathbf{then} \\ | \ \ G' \leftarrow G_v^+, \ f' \leftarrow f^+, \ w' \leftarrow w^+, \ \mathcal{P}' \leftarrow \mathcal{P}^+ \ \text{and} \ C_{\max}' \leftarrow C_{\max}^+ \end{array}$  $\mathbf{20}$  $\mathbf{21}$  $v' \leftarrow v, \; k' \leftarrow k$  $\mathbf{22}$ If  $(v', k') \in \mathcal{T}$  then remove it from  $\mathcal{T}$ . Anyhow, insert (v', k') at the end of  $\mathcal{T}$ . 23 if  $|\mathcal{T}| > t_{\max}$  then  $\mathbf{24}$ Remove the first element of  $\mathcal{T}$  $\mathbf{25}$  $G \leftarrow G'_v, f \leftarrow f', w \leftarrow w', \mathcal{P} \leftarrow \mathcal{P}' \text{ and } C_{\max} \leftarrow C'_{\max}$  $\mathbf{26}$ if  $C_{\max} < C^{\star}_{\max}$  then  $\mathbf{27}$  $G^{\star} \leftarrow G_v, f^{\star} \leftarrow f, w^{\star} \leftarrow w', \mathcal{P}^{\star} \leftarrow \mathcal{P} \text{ and } C^{\star}_{\max} \leftarrow C_{\max}$ 28

that the operations of the same task have their precedences represented by an arbitrary DAG instead of obeying a linear order. The sum of these two flexibilities causes the problem to have a large search space and makes it difficult to find a proven optimal solution even in instances

Algorithm 13: Simulated Annealing.

Input:  $\mathcal{O}, \mathcal{F}, p, \widehat{A}, \overline{\ell}, \delta, T_0, T_f$ **Output:**  $f^*$ ,  $w^*$ ,  $Q^*$ ,  $G^*$ ,  $C^*_{\max}$ 1 function SA( $\mathcal{O}, \mathcal{F}, p, \widehat{A}, \overline{\ell}, \delta, T_0, T_f, f^{\star}, w^{\star}, Q^{\star}, G^{\star}, C_{\max}^{\star}$ )  $ECT(\mathcal{O}, \mathcal{F}, p, \widehat{A}, f^1, w^1, Q^1, G^1, \mathcal{U}^1, \mathcal{P}^1, C^1_{\max}, \tau^1)$  $\mathbf{2}$  $\mathrm{EST}(\mathcal{O},\,\mathcal{F},\,p,\,\widehat{A},\,f^2,\,w^2,\,Q^2,\,G^2,\,\mathcal{U}^2,\,\mathcal{P}^2,\,C^2_{\mathrm{max}},\,\tau^2)$ 3  $\begin{array}{l} \textbf{if} \ C_{\max}^1 < C_{\max}^2 \ \textbf{then} \\ \mid \ f \leftarrow f^1, \ w \leftarrow w^1, \ Q \leftarrow Q^1, \ G \leftarrow G^1 \ \textbf{and} \ C_{\max} \leftarrow C_{\max}^1 \end{array}$  $\mathbf{4}$  $\mathbf{5}$ 6 else  $f \leftarrow f^2, w \leftarrow w^2, Q \leftarrow Q^2, G \leftarrow G^2 \text{ and } C_{\max} \leftarrow C^2_{\max}$ 7  $f^{\star} \leftarrow f, w^{\star} \leftarrow w, Q^{\star} \leftarrow Q, G^{\star} \leftarrow G \text{ and } C^{\star}_{\max} \leftarrow C_{\max}$ 8 Set  $T \leftarrow T_0$ . 9 while the stopping criterion is not satisfied do 10 for  $\ell = 1, \ldots, \overline{\ell}$  do 11 Perturb( $\mathcal{O}, \mathcal{F}, p, f, w, Q, G, f', w', Q', G', \mathcal{P}', C'_{\max}$ ) 12 Set  $\Delta C \leftarrow (C'_{\max} - C_{\max})/C_{\max}$  and let  $r \in [0, 1]$  be a random number. 13 if  $e^{-\Delta C/T} \ge r$  then  $\mathbf{14}$ Set  $f \leftarrow f', w \leftarrow w', Q \leftarrow Q', G \leftarrow G'$  and  $C_{\max} \leftarrow C'_{\max}$ . **if**  $C'_{\max} < C^{\star}_{\max}$  **then**   $\[ Set f^{\star} \leftarrow f', w^{\star} \leftarrow w', Q^{\star} \leftarrow Q', G^{\star} \leftarrow G' \text{ and } C^{\star}_{\max} \leftarrow C'_{\max}.$ 1516  $\mathbf{17}$  $T \leftarrow \max(\delta T, T_f)$ 18

that may initially appear to be simple. For a more detailed description of the instances and their characteristics, see [4].

The local search and the metaheuristics were implemented in C++ programming language. The code was compiled using g++ 10.2.1. To ensure full reproducibility of the results presented in the present work, as well as future comparisons, the instances, code and solutions found are available at https://github.com/kennedy94/FJS. The experiments were carried out in an Intel i9-12900K (12th Gen) processor operating at 5.200GHz and 128 GB of RAM.

## 4.1 Experiments with local search variations

In this section we evaluate variations of the local search described in Algorithm 6. In [4] two constructive heuristics are introduced for the same problem being considered in this paper. The constructive heuristics are different and, while one constructs, in general, better solutions for instances of type Y, the other constructs better solutions for instances of type DA; see [4] for details. Either way, the two constructive heuristics take negligible time and, for this reason, in the present work we use, as the initial solution for the local search, the best among the solutions constructed by the two constructive heuristics introduced in [4].

As described in Algorithm 6, the local search uses the best neighbor strategy and makes

use of the neighborhood reduction described in Section 2. Therefore, we call this version of "local search with the best neighbor strategy and reduced neighborhood". The neighborhood reduction is implemented in lines 9 and 10. If we remove those two lines we obtain a version that we call "local search with the best neighbor and full neighborhood". The version with reduced neighborhood does not consider neighbors that are guaranteed to be no better than the current solution. Therefore, the solution obtained with the reduced neighborhood must be identical to the solution obtained with the full neighborhood. (In fact all iterates of the two versions must be identical and not just the final solution). Only a reduction of CPU time is expected. As already mentioned in Section 2, we decided to consider vet another version that would exhibit a more drastic reduction in CPU time, albeit with a possible loss of quality in the solution. We call this version of "local search with the best neighbor and cropped neighborhood". This version consists of changing  $v \in \mathcal{O}$  to  $v \in \mathcal{P}$  in line 4 of Algorithm 6. That is, only operations on the critical path are reallocated, since there is a greater tendency for these reallocations to generate better quality neighbors. We have then three different versions of the local search with the best neighbor strategy that are distinguished by the neighborhood used: full neighborhood, reduced neighborhood and cropped neighborhood. Each of them corresponds to minimal variations of Algorithm 6 as already described. Furthermore, we consider the same three versions but using the strategy of interrupting the inspection of the neighborhood when finding the first neighbor that improves the current solution, i.e. the first-improvement strategy. This change corresponds, in Algorithm 6, to interrupting the loop of line 4 the first time line 16 is executed.

The results of the six variations of the local search applied to the 330 considered instances are shown in Tables 1–4. Tables 1 and 2 correspond to the first-improvement strategy while Tables 3 and 4 correspond to the best-improvement strategy. In the tables, we show the makespan of the obtained solution, the number of iterations that the local search made until finding an iterate that is better than all its neighbors (this is the stopping criterion as described in Algorithm 6), and the CPU time in seconds. In the case of the small-sized instances introduced in [4], the tables do not show the CPU time because it was always less than 1 millisecond. The tables also do not show anything related to the full neighborhood. What should be said about the use of the full neighborhood is that, in all instances, as expected, the solution obtained was identical to the solution obtained with the reduced neighborhood, the number of iterations was also the same, and the reduced neighborhood promoted a reduction of 52.51% in the CPU time.

When we compare the first-improvement and best-improvement strategies (Tables 1 and 2 versus Tables 3 and 4), the results are quite similar, but the best-improvement strategy always finds better quality solutions using less CPU time. Specifically, the best improvement strategy returns solutions that are on average 1.02% and 0.70% better than the solutions returned by the first-improvement strategy, when we consider the reduced and cropped neighborhoods, respectively. Therefore, from now on, we focus on evaluating the reduced neighborhood and the cropped neighborhood associated with the best-improvement strategy.

The cropped neighborhood eliminates, on average, 90.34% of the neighbors of the reduced neighborhood, promoting a proportional reduction in CPU time. However, adopting the cropped neighborhood can lead to a loss of quality in the final solution obtained by the local search method. On average, when compared to the local search with the reduced neighborhood, the local search with the cropped neighborhood finds solution with a makespan 0.69% worse. When we compare the final solution with the initial solution, the local search using the reduced neighborhood neighborhood neighborhood finds solution.

borhood improves the initial solution by, on average, 6.88%, while the local search using the cropped neighborhood improves the initial solution by 6.11%. In conclusion, the local search with the cropped neighborhood is significantly faster than the local search with the reduced neighborhood and finds solutions that are only slightly worse than the solutions found by the latter.

### 4.2 Experiments with the metaheuristics in the large-sized instances

In this section we report experiments to evaluate the behavior of the metaheuristics on the 50 large-sized instances, totaling 150 instances as we vary  $\alpha \in \{0.1, 0.2, 0.3\}$ . The ILS and GRASP metaheuristics (Algorithms 7 and 9, respectively) make use of the local search (Algorithm 6). We analyzed these two metaheuristics in connection with the local search using the reduced neighborhood (RN) and in connection with the local search using the cropped neighborhood (CN). We call these versions of ILS-RN, ILS-CN, GRASP-RN and GRASP-CN, respectively, hereafter. The tabu search metaheuristic was already conceived using the reduced neighborhood (see lines 16 and 17 of Algorithm 12), and applying to it the concept of cropped neighborhood corresponds simply to changing in line 11 of Algorithm 12,  $v \in \mathcal{O}$  by  $v \in \mathcal{P}$ . Hereafter we refer to these two versions as TS-RN and TS-CN, respectively. The simulated annealing metaheuristic does not use local search and therefore we considered only a single version of it, which we denote SA hereafter. In all metaheuristics we used the total CPU time as a stopping criterion and considered a maximum limit of 5 minutes. Additionally, and only during the parameters calibration phase, we placed an additional stopping criterion, also based on CPU time, which is satisfied if 5 seconds elapse without improvement of the incumbent solution.

The ILS metaheuristic has as parameters  $\ell_{\min}^p$  and  $\ell_{\max}^p \in \mathbb{N}$  which must satisfy  $1 \leq \ell_{\min}^p \leq \ell_{\max}^p$ . In the calibration experiments, we evaluated  $\ell_{\min}^p, \ell_{\max}^p \in \{1, 2, 3, 4, 5\}$ . The GRASP metaheuristic has as a single parameter  $\alpha \in \mathbb{R}$  which must satisfy  $0 \leq \alpha \leq 1$ . In the calibration experiments we evaluated  $\alpha \in \{0.10, 0.11, \ldots, 0.99\}$ . The TS metaheuristic has as a single parameter  $t_{\max} \in \mathbb{N}$ . In the calibration experiments, we evaluated  $t_{\max} = \lceil (|\mathcal{O}| + |\mathcal{F}|) \times t \rceil$  with  $t \in \{0.1, 0.2, \ldots, 5.0\}$ . In the SA metaheuristic, the parameters are  $\bar{\ell} \in \mathbb{N}$  and  $T_0, T_f, \delta \in \mathbb{R}$  and must satisfy  $1 \leq \bar{\ell}, T_0 \geq T_f > 0$  and  $\delta \in (0, 1)$ . In the calibration experiments, we evaluated  $\bar{\ell} \in \{1,000,2,000,\ldots,5,000\}, T_0 = -T_0^m/\ln(T_0^p)$  with  $T_0^m \in \{0.10,0.11,\ldots,0.99\}$  and  $T_0^p \in \{0.10,0.11,\ldots,0.99\}, T_f \in \{10^{-1},10^{-3},10^{-5}\}$ , and  $\delta \in \{0.80,0.81,\ldots,0.99\}$ . (See [30] for details on how to choose the initial temperature in SA). We calibrated the seven methods independently using the irace package [40]. In irace all default parameters were considered, except for maxExperiments = 10,000. We considered in the calibration only the 50 large-sized instances with learning rate  $\alpha = 0.2$ . We separated these instances into two sets of 25 instances each, one for training and the other for testing. As a result, irace returned the following parameters: ILS-RN:  $\ell_{\min}^p = 2$  and  $\ell_{\max}^p = 4$ , ILS-CN:  $\ell_{\min}^p = 1$  and  $\ell_{\max}^p = 3$ , GRASP-RN:  $\alpha = 0.38$ , GRASP-CN:  $\alpha = 0.59$ , TS-RN:  $t_{\max} = \lceil (|\mathcal{O} + |\mathcal{F}|) \times t \rceil$  with t = 0.9, TS-CN:  $t_{\max} = \lceil (|\mathcal{O} + |\mathcal{F}|) \times t \rceil$  with t = 0.9, TS-CN:  $t_{\max} = \lceil (|\mathcal{O} + |\mathcal{F}|) \times t \rceil$  with t = 0.9, TS-CN:

With the selected parameters, we ran the metaheuristics on the 50 large instances by varying the learning rate  $\alpha \in \{0.1, 0.2, 0.3\}$ . Since methods ILS-RN, ILS-CN, GRASP-RN, GRASP-CN, and SA have random components, these methods were applied 5 times to each instance. The same does not apply for methods TS-RN and TS-CN, which were run only once for each

instance			0.1				0.9				0.2	
	Croppe		0.1 Reduce	ed	Croppe		0.2 Reduce	ed	Croppe		0.3 Reduce	ed
motomot	Cmax	#it	Cmax	#it	Cmax	#it	Cmax	#it	Cmax	#it	Cmax	#it
miniDAFJS01	23,264	1	23.019	2	22,099	3	21,741	4	20,007	4	19,767	7
miniDAFJS02	23,242	1	22,927	4	22,161	1	22,046	2	21,136	2	20,987	2
miniDAFJS03	18,363	1	18,363	1	17,972	1	17,972	1	17,619	2	17,619	2
miniDAFJS04	21,690	1	21,151	4	20,757	2	19,602	5	19,867	2	18,800	5
miniDAFJS05	22,598	1	22,418	2	20,826	1	20,523	2	19,253	1	18,878	2
miniDAFJS06	23,370	1	23,370	1	20,783	2	20,783	2	18,712	3	18,712	3
miniDAFJS07	28,644	1	28,644	1	25,088	1	24,715	2	24,636	2	24,256	4
miniDAFJS08	19,878	1	19,878	1	18,857	1	18,857	1 2	17,900	2	17,900	2 2
miniDAFJS09 miniDAFJS10	25,425 21,563	1 1	25,425 20,359	4	23,830 21,021	1 1	23,715 18,823	6	22,398 19,723	1 2	22,258 17,466	6
miniDAFJS11	33,689	2	33,686	3	30,941	2	30,550	5	28,510	2	27,907	6
miniDAFJS12	20,342	1	20,342	1	19,624	1	19,624	1	19,094	1	19,094	1
miniDAFJS13	17,091	2	16,313	3	16,616	2	15,143	3	15,278	2	15,053	2
miniDAFJS14	23,248	4	23,140	5	21,990	5	21,817	5	20,711	5	20,620	5
miniDAFJS15	22,472	1	22,472	1	20,653	4	20,620	5	18,628	3	20,328	2
miniDAFJS16	25,691	1	25,426	2	24,593	1	24,114	2	22,939	3	22,939	3
miniDAFJS17	21,070	1	20,155	3	20,183	2	20,183	2	19,139	2	19,139	2
miniDAFJS18	18,512	3	18,135	7	18,829	1	18,201	4	17,784	1	17,295	2
miniDAFJS19	21,293	1	20,945	3	20,107	1	19,642	3	19,030	1	18,474	3
miniDAFJS20	23,443	2	23,212	3	21,286	1	21,286	1	19,587	1	19,587	1
miniDAFJS21	24,404	3	24,274	4	22,215	2	22,151	6	21,182	3	20,368	5
miniDAFJS22	25,923	4 2	25,923	4	24,273	4 2	24,273	4	22,767	3	22,767	3
miniDAFJS23 miniDAFJS24	25,839	2	25,788	3 4	24,253 24,500	2	24,164 23,709	3 3	21,772 22,524	5 1	21,561 21,714	6 4
miniDAFJS25	26,932 23,370	1	26,610 22,982	2	24,500	1	23,709 21,946	2	19,900	3	19,900	3
miniDAFJS25	22,306	6	22,332	9	22,013	5	21,340	7	19,300	5	19,333	7
miniDAFJS27	27,086	3	27,086	3	23,865	6	23,145	9	22,513	3	22,334	4
miniDAFJS28	23,841	10	23,841	11	22,745	7	22,745	7	20,020	2	20,020	2
miniDAFJS29	21,151	1	21,057	2	19,789	1	19,789	1	18,560	1	18,414	3
miniDAFJS30	26,428	2	26,126	5	23,736	2	22,973	5	21,356	2	20,760	5
mean	23,405.60	2.03	23,176.57	3.30	21,897.63	2.17	21,519.20	3.50	20,395.93	2.33	20,141.67	3.47
wins	12		30		10		30		12		19	
·												
[		α =	0.1			α =	: 0.2			α =	- 0.3	
instance	Croppe	$\alpha =$ ed	0.1 Reduce	ed	Croppe		= 0.2 Reduce	ed	Croppe		0.3 Reduce	ed
	Croppe C <sub>max</sub>			ed #it	Croppe C <sub>max</sub>			ed #it				ed #it
		ed	Reduce			ed	Reduce		Croppe	ed	Reduce	
instance miniYFJS01 miniYFJS02	C <sub>max</sub> 35,243 28,688	ed #it 1 1	Reduce C <sub>max</sub> 35,046 28,688	#it 2 1	C <sub>max</sub> 34,443 27,557	ed #it 1 1	Reduce C <sub>max</sub> 33,132 27,557	#it 4 1	Croppe C <sub>max</sub> 33,697 25,969	ed #it 1 1	Reduce C <sub>max</sub> 32,199 25,969	#it 2 1
instance miniYFJS01 miniYFJS02 miniYFJS03	$C_{max}$ 35,243 28,688 48,141	ed #it 1 1 3	$\begin{array}{c} {\rm Reduce} \\ \hline C_{\rm max} \\ 35,046 \\ 28,688 \\ 47,391 \end{array}$	#it 2 1 6	$C_{max}$ 34,443 27,557 44,195	ed #it 1 1 3	$\begin{array}{c} {\rm Reduce} \\ \hline C_{\rm max} \\ 33,132 \\ 27,557 \\ 42,896 \end{array}$	#it 4 1 6	Croppe C <sub>max</sub> 33,697 25,969 39,880	ed #it 1 1 8	$\begin{array}{c} {\rm Reduce} \\ \hline C_{\rm max} \\ 32,199 \\ 25,969 \\ 38,935 \end{array}$	#it 2 1 11
instance miniYFJS01 miniYFJS02 miniYFJS03 miniYFJS04	$\begin{array}{r} \hline C_{\rm max} \\ \hline 35,243 \\ 28,688 \\ 48,141 \\ 25,394 \\ \end{array}$	ed #it 1 1 3 1	Reduce           Cmax           35,046           28,688           47,391           25,394	#it 2 1 6 1	$\begin{array}{c} C_{\rm max} \\ \hline 34,443 \\ 27,557 \\ 44,195 \\ 24,669 \end{array}$	ed #it 1 3 1	Reduce C <sub>max</sub> 33,132 27,557 42,896 24,485	#it 4 1 6 2	$\begin{array}{c} Croppo \\ \hline C_{max} \\ 33,697 \\ 25,969 \\ 39,880 \\ 24,017 \end{array}$	ed #it 1 1 8 1	Reduce C <sub>max</sub> 32,199 25,969 38,935 23,774	#it 2 1 11 2
instance miniYFJS01 miniYFJS02 miniYFJS03 miniYFJS04 miniYFJS05	$\begin{array}{c} C_{\rm max} \\ 35,243 \\ 28,688 \\ 48,141 \\ 25,394 \\ 26,371 \end{array}$	ed #it 1 3 1 2	$\begin{array}{r} {\rm Reduce} \\ \hline C_{\rm max} \\ 35,046 \\ 28,688 \\ 47,391 \\ 25,394 \\ 25,750 \end{array}$	#it 2 1 6 1 3	$\begin{array}{c} C_{\rm max} \\ \hline \\ 34,443 \\ 27,557 \\ 44,195 \\ 24,669 \\ 25,635 \end{array}$	ed #it 1 3 1 3	$\begin{array}{r} {\rm Reduce} \\ \hline C_{\rm max} \\ 33,\!132 \\ 27,\!557 \\ 42,\!896 \\ 24,\!485 \\ 24,\!235 \end{array}$	#it 4 1 6 2 3	Croppe C <sub>max</sub> 33,697 25,969 39,880 24,017 24,743	ed #it 1 1 8 1 1 1	Reduce           Cmax           32,199           25,969           38,935           23,774           24,743	#it 2 1 11 2 1
instance miniYFJS01 miniYFJS02 miniYFJS03 miniYFJS05 miniYFJS06	$\begin{array}{c} C_{\rm max} \\ 35,243 \\ 28,688 \\ 48,141 \\ 25,394 \\ 26,371 \\ 30,952 \end{array}$	ed #it 1 3 1 2 1	$\begin{array}{r} {\rm Reduce} \\ \hline C_{\rm max} \\ 35,046 \\ 28,688 \\ 47,391 \\ 25,394 \\ 25,750 \\ 30,952 \end{array}$	#it 2 1 6 1 3 1	$\begin{array}{c} C_{\rm max} \\ 34,443 \\ 27,557 \\ 44,195 \\ 24,669 \\ 25,635 \\ 29,080 \end{array}$	ed #it 1 3 1 3 1 3	$\begin{array}{r} {\rm Reduce} \\ \hline C_{\rm max} \\ 33,132 \\ 27,557 \\ 42,896 \\ 24,485 \\ 24,235 \\ 29,080 \\ \end{array}$	#it 4 1 6 2 3 1	$\begin{array}{c} Croppe \\ \hline C_{max} \\ \hline 33,697 \\ 25,969 \\ 39,880 \\ 24,017 \\ 24,743 \\ 27,366 \\ \end{array}$	ed #it 1 1 8 1 1 1 1	$\begin{array}{r} \text{Reduce} \\ \hline C_{\text{max}} \\ 32,199 \\ 25,969 \\ 38,935 \\ 23,774 \\ 24,743 \\ 27,366 \\ \end{array}$	#it 2 1 11 2 1 1 1
instance miniYFJS01 miniYFJS02 miniYFJS03 miniYFJS05 miniYFJS06 miniYFJS07	$\begin{array}{r} \hline C_{\rm max} \\ 35,243 \\ 28,688 \\ 48,141 \\ 25,394 \\ 26,371 \\ 30,952 \\ 46,782 \end{array}$	ed #it 1 3 1 2 1 2	$\begin{array}{c} {\rm Reduce} \\ \hline C_{\rm max} \\ 35,046 \\ 28,688 \\ 47,391 \\ 25,394 \\ 25,750 \\ 30,952 \\ 45,705 \end{array}$	#it 2 1 6 1 3 1 6	$\begin{array}{c} C_{\rm max} \\ 34,443 \\ 27,557 \\ 44,195 \\ 24,669 \\ 25,635 \\ 29,080 \\ 43,886 \end{array}$	ed #it 1 3 1 3 1 3	$\begin{array}{c} {\rm Reduce} \\ \hline C_{\rm max} \\ 33,132 \\ 27,557 \\ 42,896 \\ 24,485 \\ 24,235 \\ 29,080 \\ 42,578 \end{array}$	#it 4 1 6 2 3 1 5	$\begin{array}{c} Croppe \\ \hline C_{max} \\ 33,697 \\ 25,969 \\ 39,880 \\ 24,017 \\ 24,743 \\ 27,366 \\ 41,487 \\ \end{array}$	ed #it 1 1 8 1 1 1 3	$\begin{array}{c} {\rm Reduce} \\ \hline C_{\rm max} \\ 32,199 \\ 25,969 \\ 38,935 \\ 23,774 \\ 24,743 \\ 27,366 \\ 39,694 \end{array}$	#it 2 1 11 2 1 1 5
instance miniYFJS01 miniYFJS02 miniYFJS03 miniYFJS04 miniYFJS05 miniYFJS07 miniYFJS08	$\begin{array}{c} \hline C_{\rm max} \\ 35,243 \\ 28,688 \\ 48,141 \\ 25,394 \\ 26,371 \\ 30,952 \\ 46,782 \\ 33,954 \end{array}$	ed #it 1 3 1 2 1 2 2	$\begin{array}{c} \text{Reduce} \\ \hline C_{\text{max}} \\ \hline 35,046 \\ 28,688 \\ 47,391 \\ 25,394 \\ 25,750 \\ 30,952 \\ 45,705 \\ 33,883 \\ \end{array}$	#it 2 1 6 1 3 1 6 7	$\begin{array}{c} \hline C_{\rm max} \\ 34,443 \\ 27,557 \\ 44,195 \\ 24,669 \\ 25,635 \\ 29,080 \\ 43,886 \\ 31,992 \end{array}$	ed #it 1 3 1 3 1 3 2	$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$	#it 4 1 6 2 3 1 5 7	$\begin{array}{c} Croppo \\ \hline C_{max} \\ 33,697 \\ 25,969 \\ 39,880 \\ 24,017 \\ 24,743 \\ 27,366 \\ 41,487 \\ 30,276 \\ \end{array}$	ed #it 1 8 1 1 1 1 3 2	$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$	#it 2 1 11 2 1 1 5 6
instance miniYFJS01 miniYFJS02 miniYFJS03 miniYFJS05 miniYFJS05 miniYFJS07 miniYFJS08 miniYFJS09	$\begin{array}{c} \hline C_{\rm max} \\ \hline 35,243 \\ 28,688 \\ 48,141 \\ 25,394 \\ 26,371 \\ 30,952 \\ 46,782 \\ 33,954 \\ 37,049 \\ \end{array}$	ed #it 1 3 1 2 1 2 2 2 2	$\begin{array}{c} \text{Reduce} \\ \hline C_{\text{max}} \\ \hline 35,046 \\ 28,688 \\ 47,391 \\ 25,394 \\ 25,750 \\ 30,952 \\ 45,705 \\ 33,883 \\ 37,049 \\ \end{array}$	#it 2 1 6 1 3 1 6 7 2	$\begin{array}{c} \hline C_{\rm max} \\ \hline 34,443 \\ 27,557 \\ 44,195 \\ 24,669 \\ 25,635 \\ 29,080 \\ 43,886 \\ 31,992 \\ 36,098 \end{array}$	ed #it 1 3 1 3 1 3 2 2	$\begin{array}{c} \text{Reduce} \\ \hline C_{\max} \\ \hline 33,132 \\ 27,557 \\ 42,896 \\ 24,485 \\ 24,235 \\ 29,080 \\ 42,578 \\ 31,773 \\ 36,098 \end{array}$	#it 4 1 6 2 3 1 5 7 2	$\begin{array}{c} Croppe \\ \hline C_{max} \\ 33,697 \\ 25,969 \\ 39,880 \\ 24,017 \\ 24,743 \\ 27,366 \\ 41,487 \\ 30,276 \\ 34,357 \\ \end{array}$	ed #it 1 8 1 1 1 3 2 1	$\begin{array}{c} \text{Reduce} \\ \hline C_{\text{max}} \\ \hline 32,199 \\ 25,969 \\ 38,935 \\ 23,774 \\ 24,743 \\ 27,366 \\ 39,694 \\ 29,990 \\ 34,357 \\ \end{array}$	#it 2 1 11 2 1 1 5 6 1
instance miniYFJS01 miniYFJS03 miniYFJS04 miniYFJS06 miniYFJS06 miniYFJS07 miniYFJS09 miniYFJS09	$\begin{array}{c} \hline C_{\rm max} \\ \hline 35,243 \\ 28,688 \\ 48,141 \\ 25,394 \\ 26,371 \\ 30,952 \\ 46,782 \\ 33,954 \\ 37,049 \\ 29,416 \\ \end{array}$	ed #it 1 3 1 2 1 2 2	$\begin{array}{c} \text{Reduce} \\ \hline C_{\text{max}} \\ \hline 35,046 \\ 28,688 \\ 47,391 \\ 25,394 \\ 25,750 \\ 30,952 \\ 45,705 \\ 33,883 \\ 37,049 \\ 29,416 \\ \end{array}$	#it 2 1 6 1 3 1 6 7	$\begin{array}{c} \hline C_{\rm max} \\ \hline 34,443 \\ 27,557 \\ 44,195 \\ 24,669 \\ 25,635 \\ 29,080 \\ 43,886 \\ 31,992 \\ 36,098 \\ 30,290 \\ \end{array}$	ed #it 1 3 1 3 1 3 2	$\begin{array}{c} \text{Reduce} \\ \hline C_{\max} \\ \hline 33,\!132 \\ 27,\!557 \\ 42,\!896 \\ 24,\!485 \\ 24,\!235 \\ 29,\!080 \\ 42,\!578 \\ 31,\!773 \\ 36,\!098 \\ 29,\!858 \\ \end{array}$	#it 4 1 6 2 3 1 5 7	$\begin{array}{c} Croppe \\ \hline C_{max} \\ 33,697 \\ 25,969 \\ 39,880 \\ 24,017 \\ 24,743 \\ 27,366 \\ 41,487 \\ 30,276 \\ 34,357 \\ 27,547 \\ \end{array}$	ed #it 1 8 1 1 1 1 3 2	$\begin{array}{c} \text{Reduce} \\ \hline C_{\text{max}} \\ \hline 32,199 \\ 25,969 \\ 38,935 \\ 23,774 \\ 24,743 \\ 27,366 \\ 39,694 \\ 29,990 \\ 34,357 \\ 27,425 \\ \end{array}$	#it 2 1 11 2 1 1 5 6
instance miniYFJS01 miniYFJS02 miniYFJS03 miniYFJS05 miniYFJS05 miniYFJS07 miniYFJS08 miniYFJS09	$\begin{array}{c} \hline C_{\rm max} \\ \hline 35,243 \\ 28,688 \\ 48,141 \\ 25,394 \\ 26,371 \\ 30,952 \\ 46,782 \\ 33,954 \\ 37,049 \\ \end{array}$	ed #it 1 3 1 2 1 2 2 2 6	$\begin{array}{c} \text{Reduce} \\ \hline C_{\text{max}} \\ \hline 35,046 \\ 28,688 \\ 47,391 \\ 25,394 \\ 25,750 \\ 30,952 \\ 45,705 \\ 33,883 \\ 37,049 \\ \end{array}$	#it 2 1 6 1 3 1 6 7 2 6	$\begin{array}{c} \hline C_{\rm max} \\ \hline 34,443 \\ 27,557 \\ 44,195 \\ 24,669 \\ 25,635 \\ 29,080 \\ 43,886 \\ 31,992 \\ 36,098 \end{array}$	ed #it 1 3 1 3 1 3 2 2 3	$\begin{array}{c} \text{Reduce} \\ \hline C_{\max} \\ \hline 33,132 \\ 27,557 \\ 42,896 \\ 24,485 \\ 24,235 \\ 29,080 \\ 42,578 \\ 31,773 \\ 36,098 \\ \end{array}$	#it 4 1 6 2 3 1 5 7 2 2 2	$\begin{array}{c} Croppe \\ \hline C_{max} \\ 33,697 \\ 25,969 \\ 39,880 \\ 24,017 \\ 24,743 \\ 27,366 \\ 41,487 \\ 30,276 \\ 34,357 \\ \end{array}$	ed #it 1 8 1 1 1 3 2 1 2	$\begin{array}{c} \text{Reduce} \\ \hline C_{\text{max}} \\ \hline 32,199 \\ 25,969 \\ 38,935 \\ 23,774 \\ 24,743 \\ 27,366 \\ 39,694 \\ 29,990 \\ 34,357 \\ \end{array}$	#it 2 1 11 2 1 1 5 6 1 2
instance miniYFJS01 miniYFJS03 miniYFJS03 miniYFJS04 miniYFJS06 miniYFJS06 miniYFJS07 miniYFJS08 miniYFJS08 miniYFJS10 miniYFJS11	$\begin{array}{c} \hline C_{\rm max} \\ \hline 35,243 \\ 28,688 \\ 48,141 \\ 25,394 \\ 26,371 \\ 30,952 \\ 46,782 \\ 33,954 \\ 37,049 \\ 29,416 \\ 51,212 \\ \end{array}$	ed #it 1 3 1 2 1 2 2 2 6 1	$\begin{array}{c} \text{Reduce} \\ \hline C_{\text{max}} \\ 35,046 \\ 28,688 \\ 47,391 \\ 25,394 \\ 25,750 \\ 30,952 \\ 45,705 \\ 33,883 \\ 37,049 \\ 29,416 \\ 51,129 \end{array}$	#it 2 1 6 1 3 1 6 7 2 6 2	$\begin{array}{c} \hline C_{\rm max} \\ \hline 34,443 \\ 27,557 \\ 44,195 \\ 24,669 \\ 25,635 \\ 29,080 \\ 43,886 \\ 31,992 \\ 36,098 \\ 30,290 \\ 47,079 \\ \end{array}$	$ \begin{array}{c}                                     $	$\begin{array}{r} \text{Reduce} \\ \hline C_{\max} \\ 33,132 \\ 27,557 \\ 42,896 \\ 24,485 \\ 24,235 \\ 29,080 \\ 42,578 \\ 31,773 \\ 36,098 \\ 29,858 \\ 46,939 \\ \end{array}$	#it 4 1 6 2 3 1 5 7 2 2 2 2	$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$	ed #it 1 8 1 1 1 3 2 1 2 1 2	$\begin{array}{c} \text{Reduce} \\ \hline C_{\text{max}} \\ 32,199 \\ 25,969 \\ 38,935 \\ 23,774 \\ 24,743 \\ 27,366 \\ 39,694 \\ 29,990 \\ 34,357 \\ 27,425 \\ 43,254 \\ \end{array}$	#it 2 1 11 2 1 1 5 6 1 2 1
instance miniYFJS01 miniYFJS02 miniYFJS03 miniYFJS05 miniYFJS05 miniYFJS07 miniYFJS08 miniYFJS08 miniYFJS09 miniYFJS10 miniYFJS11 miniYFJS12	$\begin{array}{c} \hline C_{\rm max} \\ \hline 35,243 \\ 28,688 \\ 48,141 \\ 25,394 \\ 26,371 \\ 30,952 \\ 46,782 \\ 33,954 \\ 37,049 \\ 29,416 \\ 51,212 \\ 36,343 \\ \end{array}$	$ \begin{array}{r} \text{ed} \\ \hline \#\text{it} \\ 1 \\ 1 \\ 3 \\ 1 \\ 2 \\ 1 \\ 2 \\ 2 \\ 2 \\ 6 \\ 1 \\ 4 \\ \end{array} $	$\begin{array}{c} \text{Reduce} \\ \hline C_{\text{max}} \\ \hline 35,046 \\ 28,688 \\ 47,391 \\ 25,394 \\ 25,750 \\ 30,952 \\ 45,705 \\ 33,883 \\ 37,049 \\ 29,416 \\ 51,129 \\ 36,343 \\ \end{array}$	#it 2 1 6 1 3 1 6 7 2 6 2 6 2 6 8 9	$\begin{array}{c} \hline C_{\rm max} \\ \hline 34,443 \\ 27,557 \\ 44,195 \\ 24,669 \\ 25,635 \\ 29,080 \\ 43,886 \\ 31,992 \\ 36,098 \\ 30,290 \\ 47,079 \\ 33,404 \\ 30,219 \\ 31,284 \end{array}$	$     \frac{\text{ed}}{\text{#it}}     \frac{1}{1}     \begin{array}{c}       3 \\       1 \\       3 \\       1 \\       3 \\       2 \\       2 \\       3 \\       1 \\       5 \\       5 \\       4     \end{array}   $	$\begin{array}{c} {\rm Reduce} \\ \hline C_{\rm max} \\ 33,132 \\ 27,557 \\ 42,896 \\ 24,485 \\ 24,235 \\ 29,080 \\ 42,578 \\ 31,773 \\ 36,098 \\ 29,858 \\ 46,939 \\ 33,404 \\ 30,219 \\ 31,284 \\ \end{array}$	#it 4 1 6 2 3 1 5 7 2 2 2 5	$\begin{array}{c} Croppp\\ C_{max}\\ 33,697\\ 25,969\\ 39,880\\ 24,017\\ 24,743\\ 27,366\\ 41,487\\ 30,276\\ 34,357\\ 43,254\\ 29,989\\ 25,881\\ 28,131\\ \end{array}$	ed #it 1 1 8 1 1 1 3 2 1 2 1 5	$\begin{array}{c} \text{Reduce} \\ \hline C_{\text{max}} \\ \hline 32,199 \\ 25,969 \\ 38,935 \\ 23,774 \\ 24,743 \\ 27,366 \\ 39,694 \\ 29,990 \\ 34,357 \\ 27,425 \\ 43,254 \\ 29,989 \\ \end{array}$	#it 2 1 11 2 1 1 5 6 1 2 1 5 4 6
instance miniYFJS01 miniYFJS02 miniYFJS03 miniYFJS04 miniYFJS05 miniYFJS06 miniYFJS07 miniYFJS08 miniYFJS00 miniYFJS10 miniYFJS11 miniYFJS13 miniYFJS13 miniYFJS14 miniYFJS15	$\begin{array}{c} \hline C_{\rm max} \\ \hline 35,243 \\ 28,688 \\ 48,141 \\ 25,394 \\ 26,371 \\ 30,952 \\ 46,782 \\ 33,954 \\ 37,049 \\ 29,416 \\ 51,212 \\ 36,343 \\ 32,915 \\ 31,826 \\ 45,901 \\ \end{array}$	$\begin{array}{c} \text{ed} \\ \hline \#\text{it} \\ 1 \\ 1 \\ 3 \\ 1 \\ 2 \\ 1 \\ 2 \\ 2 \\ 2 \\ 6 \\ 1 \\ 4 \\ 7 \\ 7 \\ 4 \end{array}$	$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$	#it 2 1 6 1 3 1 6 7 2 6 2 6 2 6 8 9 6	$\begin{array}{c} C_{\rm max} \\ \hline \\ 34,443 \\ 27,557 \\ 44,195 \\ 24,669 \\ 25,635 \\ 29,080 \\ 43,886 \\ 31,992 \\ 36,098 \\ 30,290 \\ 47,079 \\ 33,049 \\ 30,219 \\ 41,284 \\ 42,828 \end{array}$	$ \begin{array}{r} \text{ad} \\ \hline \#\text{it} \\ 1 \\ 1 \\ 3 \\ 1 \\ 3 \\ 1 \\ 3 \\ 2 \\ 2 \\ 3 \\ 1 \\ 5 \\ 5 \\ 4 \\ 4 \\ 4 \\ \end{array} $	$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$	#it 4 1 6 2 3 1 5 7 2 2 2 5 7 4 5	Cropp           Graax           33,697           25,969           39,880           24,017           24,743           27,566           30,276           34,357           27,547           43,254           29,989           25,881           28,131           39,862	$\begin{array}{c} \text{ed} \\ \hline \#\text{it} \\ 1 \\ 1 \\ 8 \\ 1 \\ 1 \\ 1 \\ 3 \\ 2 \\ 1 \\ 2 \\ 1 \\ 5 \\ 3 \\ 6 \\ 4 \end{array}$	$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$	#it 2 1 11 2 1 1 5 6 1 2 1 5 4 6 2
instance miniYFJS01 miniYFJS03 miniYFJS03 miniYFJS05 miniYFJS06 miniYFJS06 miniYFJS07 miniYFJS09 miniYFJS10 miniYFJS10 miniYFJS11 miniYFJS13 miniYFJS13 miniYFJS15 miniYFJS16	$\begin{array}{c} \hline C_{max} \\ \hline 35,243 \\ 28,688 \\ 48,141 \\ 25,394 \\ 26,371 \\ 30,952 \\ 33,954 \\ 37,049 \\ 29,416 \\ 33,954 \\ 37,049 \\ 29,416 \\ 31,212 \\ 36,343 \\ 32,915 \\ 31,826 \\ 45,901 \\ 33,965 \\ \end{array}$	$\begin{array}{c} \text{ed} \\ \hline \#\text{it} \\ 1 \\ 1 \\ 3 \\ 1 \\ 2 \\ 1 \\ 2 \\ 2 \\ 2 \\ 2 \\ 6 \\ 1 \\ 4 \\ 7 \\ 7 \\ 4 \\ 3 \end{array}$	$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$	#it     2     1     6     1     3     1     6     7     2     6     2     6     8     9     6     7     7	$\begin{array}{c} C_{\rm max} \\ \hline \\ 34,443 \\ 27,557 \\ 44,195 \\ 24,669 \\ 25,635 \\ 29,080 \\ 43,886 \\ 31,992 \\ 36,098 \\ 30,290 \\ 33,404 \\ 30,219 \\ 33,404 \\ 30,219 \\ 31,284 \\ 42,828 \\ 32,481 \end{array}$	$ \begin{array}{r} \underline{\text{ad}} \\ \underline{\text{\#it}} \\ 1 \\ 1 \\ 3 \\ 1 \\ 3 \\ 1 \\ 3 \\ 2 \\ 2 \\ 3 \\ 1 \\ 5 \\ 5 \\ 4 \\ 4 \\ 3 \end{array} $	$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$	#it     4     1     6     2     3     1     5     7     2     2     5     7     4     5     7	$\begin{tabular}{ c c c c c }\hline Cropp & C\\ \hline C_{max} & 33,697 \\ \hline 25,969 & 39,880 \\ 24,017 & 24,743 \\ 27,366 & 41,487 \\ 30,276 & 41,487 \\ 34,357 & 27,547 \\ 34,357 & 27,547 \\ 34,357 & 27,547 \\ 34,357 & 25,881 \\ 28,131 & 39,862 \\ 28,131 & 39,863 \\ 30,483 & 30,483 \end{tabular}$	$\begin{array}{c} \text{ed} \\ \hline \#\text{it} \\ 1 \\ 1 \\ 8 \\ 1 \\ 1 \\ 1 \\ 3 \\ 2 \\ 1 \\ 2 \\ 1 \\ 5 \\ 3 \\ 6 \\ 4 \\ 2 \end{array}$	$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$	$ \begin{array}{c} \# it \\ 2 \\ 1 \\ 11 \\ 2 \\ 1 \\ 5 \\ 6 \\ 1 \\ 5 \\ 4 \\ 6 \\ 2 \\ 2 \\ 2 \end{array} $
instance miniYFJS01 miniYFJS03 miniYFJS04 miniYFJS06 miniYFJS06 miniYFJS06 miniYFJS09 miniYFJS10 miniYFJS10 miniYFJS11 miniYFJS13 miniYFJS13 miniYFJS14 miniYFJS16 miniYFJS16 miniYFJS17	$\begin{array}{c} \hline C_{max} \\ \hline 35,243 \\ 28,684 \\ 48,141 \\ 25,394 \\ 26,371 \\ 30,952 \\ 46,782 \\ 33,954 \\ 37,049 \\ 29,416 \\ 51,212 \\ 36,343 \\ 32,915 \\ 31,826 \\ 45,901 \\ 33,965 \\ 33,965 \\ 33,965 \\ 33,965 \\ 34,181 \\ \end{array}$	$\begin{array}{c} \text{ed} \\ \hline \#\text{it} \\ \hline 1 \\ 1 \\ 3 \\ 1 \\ 2 \\ 2 \\ 2 \\ 2 \\ 6 \\ 1 \\ 4 \\ 7 \\ 7 \\ 4 \\ 3 \\ 5 \end{array}$	$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$	$ \begin{array}{c} \# it \\ 2 \\ 1 \\ 6 \\ 1 \\ 3 \\ 1 \\ 6 \\ 7 \\ 2 \\ 6 \\ 2 \\ 6 \\ 8 \\ 9 \\ 6 \\ 7 \\ 3 \\ \end{array} $	$\begin{array}{c} C_{\rm max} \\ \hline \\ 34,443 \\ 27,557 \\ 44,195 \\ 24,669 \\ 25,635 \\ 29,080 \\ 43,886 \\ 31,992 \\ 36,098 \\ 30,290 \\ 47,079 \\ 33,404 \\ 30,219 \\ 31,284 \\ 42,828 \\ 32,481 \\ 41,316 \end{array}$	$\begin{array}{c} \text{ad} \\ \hline \#\text{it} \\ 1 \\ 1 \\ 3 \\ 1 \\ 3 \\ 1 \\ 3 \\ 2 \\ 2 \\ 3 \\ 1 \\ 5 \\ 5 \\ 4 \\ 4 \\ 3 \\ 5 \end{array}$	$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$	#it     4     1     6     2     3     1     5     7     2     2     5     7     4     5     7     4	$\begin{array}{c} Cropp\\ C_{max}\\ 33,697\\ 25,969\\ 39,880\\ 24,017\\ 24,743\\ 27,564\\ 41,487\\ 30,276\\ 34,357\\ 43,254\\ 29,989\\ 27,547\\ 43,254\\ 29,989\\ 25,881\\ 28,131\\ 39,862\\ 30,483\\ 30,483\\ 38,739\\ \end{array}$	$\begin{array}{c} \text{ed} \\ \hline \#\text{it} \\ 1 \\ 1 \\ 8 \\ 1 \\ 1 \\ 1 \\ 1 \\ 3 \\ 2 \\ 1 \\ 2 \\ 1 \\ 5 \\ 3 \\ 6 \\ 4 \\ 2 \\ 5 \\ \end{array}$	$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$	$ \begin{array}{c} \# it \\ 2 \\ 1 \\ 11 \\ 2 \\ 1 \\ 5 \\ 6 \\ 1 \\ 5 \\ 4 \\ 6 \\ 2 \\ 2 \\ 3 \\ \end{array} $
instance miniYFJS01 miniYFJS03 miniYFJS03 miniYFJS04 miniYFJS05 miniYFJS06 miniYFJS07 miniYFJS00 miniYFJS10 miniYFJS10 miniYFJS11 miniYFJS13 miniYFJS13 miniYFJS14 miniYFJS15 miniYFJS17 miniYFJS18	$\begin{tabular}{ c c c c c }\hline \hline $C_{max}$ & $35,243$ \\ $28,684$ & $48,141$ \\ $25,394$ & $26,371$ \\ $30,952$ & $46,782$ \\ $33,954$ & $37,049$ \\ $29,416$ & $51,212$ \\ $36,343$ & $32,915$ & $31,826$ \\ $45,901$ & $33,965$ & $44,181$ \\ $34,133$ & $41,333$ \\ \end{tabular}$	$\begin{array}{c} \text{ed} \\ \hline \#\text{it} \\ \hline 1 \\ 1 \\ 3 \\ 1 \\ 2 \\ 2 \\ 2 \\ 2 \\ 6 \\ 1 \\ 4 \\ 7 \\ 7 \\ 4 \\ 3 \\ 5 \\ 4 \end{array}$	$\begin{array}{c} \mbox{Reduce}\\ \hline $C_{max}$ \\ $35,046$ \\ $28,688$ \\ $47,391$ \\ $25,750$ \\ $30,952$ \\ $45,750$ \\ $30,952$ \\ $45,705$ \\ $33,883$ \\ $37,049$ \\ $29,416$ \\ $51,129$ \\ $36,343$ \\ $37,704$ \\ $32,792$ \\ $31,826$ \\ $45,442$ \\ $33,791$ \\ $52,936$ \\ $34,044$ \\ \end{array}$	$ \begin{array}{c} \# it \\ 2 \\ 1 \\ 6 \\ 1 \\ 3 \\ 1 \\ 6 \\ 7 \\ 2 \\ 6 \\ 2 \\ 6 \\ 8 \\ 9 \\ 6 \\ 7 \\ 3 \\ 9 \end{array} $	$\begin{array}{c} C_{\rm max} \\ \hline \\ 34,443 \\ 27,557 \\ 44,195 \\ 24,669 \\ 25,635 \\ 29,080 \\ 43,886 \\ 31,992 \\ 36,098 \\ 30,290 \\ 47,079 \\ 33,404 \\ 30,219 \\ 31,284 \\ 42,828 \\ 32,481 \\ 41,316 \\ 29,883 \end{array}$	$\begin{array}{c} \text{ad} \\ \hline \#\text{it} \\ 1 \\ 1 \\ 3 \\ 1 \\ 3 \\ 1 \\ 3 \\ 2 \\ 2 \\ 3 \\ 1 \\ 5 \\ 5 \\ 4 \\ 4 \\ 3 \\ 5 \\ 3 \\ \end{array}$	$\begin{tabular}{lllllllllllllllllllllllllllllllllll$	$ \begin{array}{r} \#it \\ 4 \\ 1 \\ 6 \\ 2 \\ 3 \\ 1 \\ 5 \\ 7 \\ 2 \\ 2 \\ 5 \\ 7 \\ 4 \\ 5 \\ 7 \\ 7 \\ 7 \\ 7 \\ 7 \\ 7 \\ 7 \\ 7 \\ 7 \\ 7$	$\begin{array}{c} Croppo \\ C_{max} \\ 33,697 \\ 25,969 \\ 39,880 \\ 24,017 \\ 24,743 \\ 27,564 \\ 41,487 \\ 30,276 \\ 34,357 \\ 27,547 \\ 29,989 \\ 25,881 \\ 39,862 \\ 30,483 \\ 38,739 \\ 38,739 \\ 38,739 \\ 27,944 \end{array}$	$\begin{array}{c} \text{ed} \\ \hline \#\text{it} \\ 1 \\ 1 \\ 8 \\ 1 \\ 1 \\ 3 \\ 2 \\ 1 \\ 2 \\ 1 \\ 2 \\ 1 \\ 5 \\ 3 \\ 6 \\ 4 \\ 2 \\ 5 \\ 3 \\ \end{array}$	$\begin{tabular}{ c c c c c c c } \hline Reduct \\ \hline $C_{max}$ \\ \hline $32,199$ \\ \hline $25,969$ \\ \hline $38,935$ \\ \hline $23,774$ \\ \hline $24,743$ \\ \hline $27,366$ \\ \hline $39,694$ \\ \hline $29,990$ \\ \hline $34,357$ \\ \hline $27,425$ \\ \hline $43,254$ \\ \hline $29,989$ \\ \hline $25,619$ \\ \hline $28,131$ \\ \hline $46,387$ \\ \hline $30,483$ \\ \hline $44,650$ \\ \hline $29,698$ \\ \hline \end{tabular}$	$ \begin{array}{c} \# it \\ 2 \\ 1 \\ 11 \\ 2 \\ 1 \\ 5 \\ 6 \\ 1 \\ 2 \\ 1 \\ 5 \\ 4 \\ 6 \\ 2 \\ 3 \\ 2 \\ 3 \\ 2 \end{array} $
instance miniYFJS01 miniYFJS03 miniYFJS03 miniYFJS05 miniYFJS06 miniYFJS06 miniYFJS09 miniYFJS09 miniYFJS09 miniYFJS10 miniYFJS11 miniYFJS13 miniYFJS13 miniYFJS16 miniYFJS16 miniYFJS18 miniYFJS18 miniYFJS18 miniYFJS19	$\begin{array}{c} C_{\max} \\ 35,243 \\ 28,684 \\ 48,141 \\ 25,304 \\ 26,371 \\ 30,952 \\ 46,782 \\ 33,954 \\ 46,782 \\ 33,954 \\ 46,782 \\ 33,946 \\ 32,915 \\ 31,826 \\ 32,915 \\ 31,826 \\ 45,901 \\ 33,965 \\ 44,181 \\ 34,133 \\ 39,165 \\ \end{array}$	$\begin{array}{c} \text{ed} \\ \hline \#\text{it} \\ \hline 1 \\ 1 \\ 2 \\ 1 \\ 2 \\ 2 \\ 2 \\ 2 \\ 6 \\ 1 \\ 4 \\ 7 \\ 7 \\ 4 \\ 3 \\ 5 \\ 4 \\ 4 \\ 4 \\ \end{array}$	$\begin{array}{c} \mbox{Reduce} \\ \hline $C_{\rm max}$ \\ \hline $35,046$ \\ 28,688$ \\ 47,391$ \\ 25,750$ \\ 30,952$ \\ 45,705$ \\ 30,952$ \\ 45,705$ \\ 33,983$ \\ 37,049$ \\ 29,416$ \\ 51,129$ \\ 36,343$ \\ 32,792$ \\ 31,826$ \\ 45,442$ \\ 33,791$ \\ 52,936$ \\ 34,044$ \\ 36,706$ \\ \end{array}$	$ \begin{array}{r} \#it \\ 2 \\ 1 \\ 6 \\ 1 \\ 3 \\ 1 \\ 6 \\ 7 \\ 2 \\ 6 \\ 2 \\ 6 \\ 2 \\ 6 \\ 8 \\ 9 \\ 6 \\ 7 \\ 3 \\ 9 \\ 14 \\ \end{array} $	$\begin{array}{c} C_{\rm max} \\ 34,443 \\ 27,557 \\ 44,195 \\ 24,669 \\ 25,635 \\ 29,080 \\ 43,886 \\ 31,992 \\ 36,098 \\ 30,290 \\ 47,079 \\ 33,404 \\ 30,219 \\ 33,404 \\ 30,219 \\ 33,404 \\ 30,219 \\ 31,284 \\ 42,828 \\ 32,481 \\ 41,316 \\ 29,883 \\ 33,965 \end{array}$	#it           1           1           3           1           3           1           3           2           3           1           3           1           3           1           3           1           3           2           3           1           5           4           3           5           4           3           5           3           6	$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$	$ \begin{array}{r} \#it \\ 4 \\ 1 \\ 6 \\ 2 \\ 3 \\ 1 \\ 5 \\ 7 \\ 2 \\ 2 \\ 5 \\ 7 \\ 4 \\ 5 \\ 12 \\ \end{array} $	$\begin{tabular}{ c c c c c } \hline Cropp \\ \hline C_{max} & 33,697 \\ \hline 25,969 & 39,880 \\ \hline 24,017 & 24,743 \\ \hline 27,366 & 41,487 \\ \hline 30,276 & 41,487 \\ \hline 30,276 & 41,487 \\ \hline 34,357 & 27,547 \\ \hline 34,357 & 32,7547 \\ \hline 34,357 & 33,754 \\ \hline 39,862 & 30,483 \\ \hline 39,863 & 30,483 \\ \hline 39,863 & 30,483 \\ \hline 39,864 & 30,484 \\ \hline 3$	#it           #it           1           1           8           1           1           3           2           1           5           3           6           4           2           3           6           3           6	$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$	$\begin{array}{c} \# it \\ 2 \\ 1 \\ 111 \\ 2 \\ 1 \\ 1 \\ 5 \\ 6 \\ 1 \\ 2 \\ 1 \\ 5 \\ 4 \\ 6 \\ 2 \\ 2 \\ 3 \\ 2 \\ 9 \end{array}$
instance miniYFJS01 miniYFJS03 miniYFJS04 miniYFJS04 miniYFJS06 miniYFJS06 miniYFJS07 miniYFJS09 miniYFJS10 miniYFJS10 miniYFJS11 miniYFJS13 miniYFJS13 miniYFJS15 miniYFJS16 miniYFJS19 miniYFJS19 miniYFJS19 miniYFJS19 miniYFJS19 miniYFJS19	$\begin{array}{c} \hline C_{max} \\ \hline 35,243 \\ 28,684 \\ 48,141 \\ 25,394 \\ 26,371 \\ 30,952 \\ 46,782 \\ 33,954 \\ 37,049 \\ 29,416 \\ 51,212 \\ 36,343 \\ 32,915 \\ 31,826 \\ 45,901 \\ 33,965 \\ 44,181 \\ 34,133 \\ 39,165 \\ 36,071 \\ \end{array}$	ed #it 1 1 3 1 2 2 2 2 6 1 1 2 2 2 6 1 4 3 5 4 4 9	$\begin{tabular}{ c c c c c c c } \hline Reduct \\ \hline $C_{\rm max}$ & $35,046$ \\ \hline $28,688$ \\ $47,391$ \\ $25,750$ \\ $30,952$ \\ $45,705$ \\ $30,952$ \\ $45,705$ \\ $30,952$ \\ $45,705$ \\ $30,952$ \\ $45,705$ \\ $30,952$ \\ $45,705$ \\ $33,791$ \\ $29,316$ \\ $32,792$ \\ $31,826$ \\ $45,442$ \\ $33,791$ \\ $52,936$ \\ $34,044$ \\ $36,771$ \\ $36,071$ \\ \end{tabular}$	$\begin{array}{c} \# \mathrm{it} \\ 2 \\ 1 \\ 6 \\ 1 \\ 3 \\ 1 \\ 6 \\ 7 \\ 2 \\ 6 \\ 2 \\ 6 \\ 8 \\ 9 \\ 6 \\ 7 \\ 3 \\ 9 \\ 14 \\ 11 \end{array}$	$\begin{array}{c} C_{\rm max} \\ \hline \\ 34,443 \\ 27,557 \\ 44,195 \\ 24,669 \\ 25,635 \\ 29,080 \\ 43,886 \\ 31,992 \\ 30,290 \\ 47,079 \\ 33,040 \\ 47,079 \\ 33,249 \\ 41,284 \\ 42,828 \\ 41,316 \\ 29,883 \\ 33,965 \\ 35,100 \\ \end{array}$	$\begin{array}{c} \text{#it} \\ \text{#it} \\ 1 \\ 1 \\ 3 \\ 1 \\ 3 \\ 1 \\ 3 \\ 2 \\ 2 \\ 3 \\ 1 \\ 5 \\ 5 \\ 4 \\ 4 \\ 3 \\ 5 \\ 3 \\ 6 \\ 4 \end{array}$	$\begin{tabular}{ c c c c c c c } \hline Reduct \\ \hline $C_{\rm max}$ & $3,132$ \\ $27,557$ \\ $42,896$ \\ $24,255$ \\ $29,080$ \\ $42,578$ \\ $31,773$ \\ $36,098$ \\ $29,858$ \\ $46,939$ \\ $33,404$ \\ $30,219$ \\ $31,284$ \\ $45,903$ \\ $32,165$ \\ $48,475$ \\ $30,201$ \\ $33,805$ \\ $46,899$ \\ \end{tabular}$	$\begin{array}{c} \# \mathrm{it} \\ 4 \\ 1 \\ 6 \\ 2 \\ 3 \\ 1 \\ 5 \\ 7 \\ 2 \\ 2 \\ 2 \\ 5 \\ 7 \\ 4 \\ 5 \\ 12 \\ 8 \end{array}$	$\begin{tabular}{ c c c c c } \hline $C$ roppy $C$ max $$ $$ $$ $$ $$ $$ $$ $$ $$ $$ $$ $$ $$$	#it           #it           1           1           1           3           2           1           2           1           5           3           6           4           2           3           6           4           2           3           6           4	Reduct           Cmax           32,199           25,969           38,935           23,774           24,743           27,366           39,694           29,990           28,357           25,619           28,131           46,857           30,483           44,650           29,648           30,483           30,483           31,743           32,718	$ \begin{array}{c} \# it \\ 2 \\ 1 \\ 1 \\ 1 \\ 5 \\ 6 \\ 1 \\ 2 \\ 1 \\ 5 \\ 4 \\ 6 \\ 2 \\ 3 \\ 2 \\ 9 \\ 5 \\ \end{array} $
instance miniYFJS01 miniYFJS03 miniYFJS04 miniYFJS05 miniYFJS06 miniYFJS07 miniYFJS07 miniYFJS09 miniYFJS10 miniYFJS10 miniYFJS11 miniYFJS13 miniYFJS13 miniYFJS14 miniYFJS15 miniYFJS16 miniYFJS18 miniYFJS18 miniYFJS18 miniYFJS20 miniYFJS20	$\begin{tabular}{ c c c c c }\hline \hline $C_{max}$ & $35,243$ \\ $28,684$ & $48,141$ \\ $25,394$ & $48,141$ \\ $25,394$ & $26,371$ \\ $30,952$ & $30,952$ \\ $37,049$ & $29,416$ \\ $51,212$ & $36,354$ \\ $37,049$ & $29,416$ \\ $51,212$ & $36,354$ \\ $36,365$ & $44,181$ \\ $34,133$ & $39,165$ \\ $36,071$ & $40,994$ \\ \hline \end{tabular}$	ed #it 1 3 1 2 2 2 6 1 4 7 7 4 3 5 4 4 9 7	$\begin{tabular}{ c c c c c c c } \hline Reduct \\ \hline $C_{max}$ & $35,046$ & $28,688$ & $47,391$ & $25,750$ & $30,952$ & $45,750$ & $33,883$ & $37,049$ & $29,416$ & $51,129$ & $36,343$ & $32,792$ & $31,826$ & $45,442$ & $37,791$ & $52,936$ & $45,442$ & $33,791$ & $52,936$ & $34,044$ & $36,707$ & $36,071$ & $39,978$ & $\end{tabular}$	$\begin{array}{c} \# \mathrm{it} \\ 2 \\ 1 \\ 6 \\ 1 \\ 3 \\ 1 \\ 6 \\ 7 \\ 2 \\ 6 \\ 2 \\ 6 \\ 2 \\ 6 \\ 8 \\ 9 \\ 6 \\ 7 \\ 3 \\ 9 \\ 14 \\ 11 \\ 10 \end{array}$	$\begin{array}{c} C_{\rm max} \\ \hline \\ 34,443 \\ 27,557 \\ 44,195 \\ 24,669 \\ 25,635 \\ 29,080 \\ 31,992 \\ 36,098 \\ 30,290 \\ 47,079 \\ 33,404 \\ 30,219 \\ 47,079 \\ 33,404 \\ 30,219 \\ 42,828 \\ 32,481 \\ 42,828 \\ 32,481 \\ 41,316 \\ 29,883 \\ 33,965 \\ 35,100 \\ 37,414 \end{array}$	$\begin{array}{c} \text{#it} \\ \hline \\ 1 \\ 1 \\ 1 \\ 3 \\ 1 \\ 3 \\ 1 \\ 3 \\ 2 \\ 2 \\ 3 \\ 1 \\ 5 \\ 5 \\ 4 \\ 4 \\ 3 \\ 5 \\ 3 \\ 6 \\ 4 \\ 5 \\ \end{array}$	$\begin{tabular}{ c c c c c } \hline Reduct \\ \hline C_{max} \\ \hline 33,132 \\ \hline 27,557 \\ \hline 42,896 \\ \hline 24,485 \\ \hline 24,235 \\ \hline 29,080 \\ \hline 42,578 \\ \hline 31,773 \\ \hline 36,098 \\ \hline 29,858 \\ \hline 42,578 \\ \hline 31,773 \\ \hline 36,098 \\ \hline 42,578 \\ \hline 33,404 \\ \hline 30,219 \\ \hline 33,404 \\ \hline 45,903 \\ \hline 32,165 \\ \hline 48,475 \\ \hline 30,201 \\ \hline 33,805 \\ \hline 34,689 \\ \hline 35,570 \end{tabular}$	$\begin{array}{c} \# \mathrm{it} \\ 4 \\ 1 \\ 6 \\ 2 \\ 3 \\ 1 \\ 5 \\ 7 \\ 2 \\ 2 \\ 2 \\ 2 \\ 5 \\ 7 \\ 4 \\ 5 \\ 7 \\ 4 \\ 5 \\ 7 \\ 4 \\ 5 \\ 12 \\ 8 \\ 16 \end{array}$	$\begin{array}{c} Cropp0\\ C_{max}\\ 33,697\\ 25,969\\ 39,880\\ 24,017\\ 24,743\\ 27,546\\ 41,487\\ 30,276\\ 34,357\\ 43,254\\ 29,989\\ 25,881\\ 39,862\\ 30,483\\ 39,862\\ 30,483\\ 39,862\\ 30,483\\ 38,739\\ 27,944\\ 31,743\\ 32,603\\ 33,355\\ \end{array}$	#it           #it           1           1           8           1           3           2           1           2           1           5           3           6           4           2           5           3           6           4           5           3           6           4           5	$\begin{tabular}{ c c c c c } \hline Reduct \\ \hline $C_{max}$ \\ \hline $32,109$ \\ \hline $25,969$ \\ \hline $38,935$ \\ \hline $23,774$ \\ \hline $24,743$ \\ \hline $27,366$ \\ \hline $39,694$ \\ \hline $29,990$ \\ \hline $34,357$ \\ \hline $27,425$ \\ \hline $43,254$ \\ \hline $29,989$ \\ \hline $25,619$ \\ \hline $28,131$ \\ \hline $46,387$ \\ \hline $30,483$ \\ \hline $44,650$ \\ \hline $29,698$ \\ \hline $31,743$ \\ \hline $32,718$ \\ \hline $33,355$ \\ \hline \end{tabular}$	#it           2           1           11           2           1           5           6           1           5           6           1           5           6           2           3           2           3           9           5           7
instance miniYFJS01 miniYFJS03 miniYFJS04 miniYFJS04 miniYFJS06 miniYFJS06 miniYFJS07 miniYFJS09 miniYFJS10 miniYFJS10 miniYFJS11 miniYFJS13 miniYFJS13 miniYFJS15 miniYFJS16 miniYFJS19 miniYFJS19 miniYFJS19 miniYFJS19 miniYFJS19 miniYFJS19	$\begin{array}{c} C_{\max} \\ \hline \\ 35,243 \\ 28,684 \\ 48,141 \\ 25,304 \\ 26,371 \\ 30,952 \\ 46,782 \\ 33,955 \\ 46,782 \\ 37,049 \\ 29,416 \\ 51,212 \\ 36,343 \\ 32,915 \\ 31,826 \\ 45,901 \\ 33,965 \\ 44,181 \\ 39,165 \\ 36,071 \\ 40,994 \\ 35,319 \end{array}$	ed #it 1 1 3 1 2 2 2 2 6 1 1 2 2 2 6 1 4 3 5 4 4 9	$\begin{tabular}{ c c c c c c c } \hline Reduct \\ \hline $C_{\rm max}$ & $35,046$ \\ \hline $28,688$ \\ $47,391$ \\ $25,750$ \\ $30,952$ \\ $45,705$ \\ $30,952$ \\ $45,705$ \\ $30,952$ \\ $45,705$ \\ $30,952$ \\ $45,705$ \\ $30,952$ \\ $45,705$ \\ $31,924$ \\ $31,924$ \\ $31,924$ \\ $32,792$ \\ $31,826$ \\ $45,442$ \\ $33,791$ \\ $52,936$ \\ $34,044$ \\ $36,771$ \\ $36,071$ \\ \end{tabular}$	$\begin{array}{c} \# \mathrm{it} \\ 2 \\ 1 \\ 6 \\ 1 \\ 3 \\ 1 \\ 6 \\ 7 \\ 2 \\ 6 \\ 2 \\ 6 \\ 8 \\ 9 \\ 6 \\ 7 \\ 3 \\ 9 \\ 14 \\ 11 \\ 10 \\ 15 \end{array}$	$\begin{array}{c} C_{\rm max} \\ 34,443 \\ 27,557 \\ 44,195 \\ 24,669 \\ 29,080 \\ 43,886 \\ 31,992 \\ 36,098 \\ 30,290 \\ 47,079 \\ 33,404 \\ 30,219 \\ 33,404 \\ 30,219 \\ 31,284 \\ 42,828 \\ 32,481 \\ 41,316 \\ 29,883 \\ 33,965 \\ 35,100 \\ 37,414 \\ 32,485 \end{array}$	$\begin{array}{c} \text{ad} \\ \hline \#\text{it} \\ 1 \\ 1 \\ 3 \\ 1 \\ 3 \\ 1 \\ 3 \\ 2 \\ 2 \\ 3 \\ 1 \\ 5 \\ 5 \\ 4 \\ 4 \\ 3 \\ 5 \\ 3 \\ 6 \\ 4 \\ 5 \\ 1 \\ \end{array}$	$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$	$\begin{array}{c} \# \mathrm{it} \\ 4 \\ 1 \\ 6 \\ 2 \\ 3 \\ 1 \\ 5 \\ 7 \\ 2 \\ 2 \\ 2 \\ 5 \\ 7 \\ 4 \\ 5 \\ 12 \\ 8 \end{array}$	$\begin{tabular}{ c c c c c } \hline $C$ roppy $C$ max $$ $$ $$ $$ $$ $$ $$ $$ $$ $$ $$ $$ $$$	#it           #it           1           1           1           3           2           1           2           1           5           3           6           4           2           3           6           4           2           3           6           4	$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$	$ \begin{array}{c} \# it \\ 2 \\ 1 \\ 1 \\ 1 \\ 5 \\ 6 \\ 1 \\ 2 \\ 1 \\ 5 \\ 4 \\ 6 \\ 2 \\ 3 \\ 2 \\ 9 \\ 5 \\ \end{array} $
instance miniYFJS01 miniYFJS03 miniYFJS03 miniYFJS04 miniYFJS06 miniYFJS06 miniYFJS07 miniYFJS09 miniYFJS10 miniYFJS10 miniYFJS13 miniYFJS13 miniYFJS13 miniYFJS15 miniYFJS16 miniYFJS16 miniYFJS17 miniYFJS19 miniYFJS20 miniYFJS22 miniYFJS23	$\begin{array}{c} \hline C_{max} \\ \hline 35,243 \\ 28,684 \\ 48,141 \\ 25,394 \\ 26,371 \\ 30,952 \\ 46,782 \\ 33,954 \\ 37,049 \\ 29,416 \\ 51,212 \\ 36,343 \\ 32,915 \\ 31,826 \\ 45,901 \\ 33,965 \\ 44,181 \\ 34,133 \\ 39,165 \\ 36,071 \\ 40,994 \\ 35,319 \\ 45,713 \\ \end{array}$	$\begin{array}{c} \text{ed} \\ \frac{\#\text{it}}{1} \\ 1 \\ 3 \\ 1 \\ 2 \\ 1 \\ 2 \\ 2 \\ 2 \\ 6 \\ 1 \\ 4 \\ 3 \\ 5 \\ 4 \\ 4 \\ 9 \\ 7 \\ 7 \\ 9 \end{array}$	$\begin{tabular}{ c c c c c c c } \hline Reduct \\ \hline $C_{\rm max}$ & $$35,046$ \\ \hline $28,688$ \\ \hline $47,391$ \\ \hline $28,688$ \\ \hline $47,391$ \\ \hline $28,5750$ \\ \hline $30,952$ \\ \hline $45,705$ \\ \hline $30,952$ \\ \hline $45,705$ \\ \hline $33,883$ \\ \hline $37,049$ \\ \hline $29,416$ \\ \hline $51,129$ \\ \hline $36,343$ \\ \hline $32,792$ \\ \hline $31,826$ \\ \hline $45,422$ \\ \hline $33,791$ \\ \hline $52,936$ \\ \hline $34,044$ \\ \hline $36,706$ \\ \hline $36,071$ \\ \hline $39,978$ \\ \hline $34,282$ \\ \hline $45,725$ \\ \hline $52,55$ \\ \hline $52,55$ \\ \hline $53,120$ \\ \hline $53,120$$	$\begin{array}{c} \# \mathrm{it} \\ 2 \\ 1 \\ 6 \\ 1 \\ 3 \\ 1 \\ 6 \\ 7 \\ 2 \\ 6 \\ 2 \\ 6 \\ 2 \\ 6 \\ 8 \\ 9 \\ 6 \\ 7 \\ 3 \\ 9 \\ 14 \\ 11 \\ 10 \end{array}$	$\begin{array}{c} C_{\rm max} \\ \hline \\ 34,443 \\ 27,557 \\ 44,195 \\ 24,669 \\ 25,635 \\ 29,080 \\ 43,886 \\ 31,992 \\ 30,290 \\ 47,079 \\ 33,040 \\ 47,079 \\ 33,290 \\ 47,079 \\ 33,248 \\ 41,316 \\ 29,883 \\ 32,481 \\ 41,316 \\ 29,883 \\ 33,965 \\ 35,100 \\ 37,414 \\ 32,485 \\ 42,016 $	$\begin{array}{c} \text{#it} \\ \hline \\ 1 \\ 1 \\ 1 \\ 3 \\ 1 \\ 3 \\ 1 \\ 3 \\ 2 \\ 2 \\ 3 \\ 1 \\ 5 \\ 5 \\ 4 \\ 4 \\ 3 \\ 5 \\ 3 \\ 6 \\ 4 \\ 5 \\ \end{array}$	$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$	$\begin{array}{c} \#\mathrm{it} \\ 4 \\ 1 \\ 6 \\ 2 \\ 3 \\ 1 \\ 5 \\ 7 \\ 2 \\ 2 \\ 5 \\ 7 \\ 4 \\ 5 \\ 12 \\ 8 \\ 16 \\ 2 \\ 7 \end{array}$	$\begin{array}{c} Croppp\\ C_{max}\\ 33,697\\ 25,969\\ 39,880\\ 24,017\\ 24,743\\ 27,366\\ 34,37\\ 30,275\\ 34,375\\ 27,547\\ 43,254\\ 29,989\\ 27,547\\ 43,254\\ 29,989\\ 25,881\\ 28,131\\ 39,862\\ 30,483\\ 38,739\\ 27,944\\ 31,743\\ 32,603\\ 33,355\\ 30,212\\ 38,777\\ \end{array}$	ad #it 1 8 1 1 8 1 1 3 2 1 2 1 2 1 2 1 2 1 2 1 2 1 5 3 6 4 2 5 3 6 4 5 1 4	$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$	#it           2           1           11           2           1           5           6           1           5           4           2           3           2           9           5           7           4
instance miniYFJS01 miniYFJS03 miniYFJS03 miniYFJS05 miniYFJS06 miniYFJS06 miniYFJS09 miniYFJS09 miniYFJS10 miniYFJS11 miniYFJS13 miniYFJS13 miniYFJS16 miniYFJS16 miniYFJS18 miniYFJS18 miniYFJS19 miniYFJS21 miniYFJS21	$\begin{array}{c} C_{\max} \\ \hline \\ 35,243 \\ 28,684 \\ 48,141 \\ 25,304 \\ 26,371 \\ 30,952 \\ 46,782 \\ 33,955 \\ 46,782 \\ 37,049 \\ 29,416 \\ 51,212 \\ 36,343 \\ 32,915 \\ 31,826 \\ 45,901 \\ 33,965 \\ 44,181 \\ 39,165 \\ 36,071 \\ 40,994 \\ 35,319 \end{array}$	ed #it 1 3 1 2 2 2 6 1 4 7 7 4 3 5 4 4 9 7 7 7	$\begin{tabular}{ c c c c c } \hline Reduct \\ \hline $C_{max}$ & $35,046$ \\ $28,688$ \\ $47,391$ \\ $25,750$ \\ $30,952$ \\ $45,705$ \\ $30,952$ \\ $45,705$ \\ $33,883$ \\ $37,049$ \\ $29,416$ \\ $51,129$ \\ $33,883$ \\ $37,049$ \\ $29,416$ \\ $51,129$ \\ $36,343$ \\ $32,792$ \\ $31,826$ \\ $45,442$ \\ $35,791$ \\ $52,936$ \\ $45,442$ \\ $35,791$ \\ $52,936$ \\ $45,442$ \\ $36,706$ \\ $36,071$ \\ $39,978$ \\ $34,282$ \\ \end{tabular}$	$\begin{array}{c} \# \mathrm{it} \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\$	$\begin{array}{c} C_{\rm max} \\ 34,443 \\ 27,557 \\ 44,195 \\ 24,669 \\ 29,080 \\ 43,886 \\ 31,992 \\ 36,098 \\ 30,290 \\ 47,079 \\ 33,404 \\ 30,219 \\ 33,404 \\ 30,219 \\ 31,284 \\ 42,828 \\ 32,481 \\ 41,316 \\ 29,883 \\ 33,965 \\ 35,100 \\ 37,414 \\ 32,485 \\ \end{array}$	$\begin{array}{c} \text{d} \\ \hline \#\text{it} \\ 1 \\ 1 \\ 3 \\ 1 \\ 3 \\ 1 \\ 3 \\ 2 \\ 2 \\ 3 \\ 1 \\ 5 \\ 5 \\ 4 \\ 4 \\ 3 \\ 5 \\ 3 \\ 6 \\ 4 \\ 5 \\ 1 \\ 3 \end{array}$	$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$	$\begin{array}{c} \# \mathrm{it} \\ 4 \\ 1 \\ 6 \\ 2 \\ 3 \\ 1 \\ 5 \\ 7 \\ 2 \\ 2 \\ 2 \\ 2 \\ 5 \\ 7 \\ 4 \\ 5 \\ 7 \\ 4 \\ 5 \\ 7 \\ 4 \\ 5 \\ 12 \\ 8 \\ 16 \\ 2 \end{array}$	$\begin{tabular}{ c c c c c } \hline Cropp \\ \hline C_{max} & \hline C_{max} \\ \hline & \hline & C_{max} \\ \hline & 2f_{max} $	$\begin{array}{c} \text{ded} \\ \hline \#\text{it} \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ $	$\begin{tabular}{ c c c c c c c } \hline Reduct \\ \hline $C_{\rm max}$ & $32,199$ \\ $25,969$ & $38,935$ \\ $23,774$ & $24,743$ \\ $27,366$ & $39,694$ \\ $29,990$ & $34,357$ \\ $27,425$ & $43,254$ \\ $43,254$ & $43,254$ \\ $29,989$ & $25,619$ \\ $29,989$ & $25,619$ \\ $29,989$ & $25,619$ \\ $29,989$ & $25,619$ \\ $29,989$ & $25,619$ \\ $29,608$ & $31,743$ \\ $32,718$ & $33,355$ \\ $29,512$ \\ \hline \end{tabular}$	$\begin{array}{c} \#\mathrm{it} \\ 2 \\ 1 \\ 1 \\ 2 \\ 1 \\ 1 \\ 5 \\ 6 \\ 1 \\ 2 \\ 1 \\ 5 \\ 6 \\ 1 \\ 2 \\ 2 \\ 3 \\ 2 \\ 9 \\ 5 \\ 7 \\ 4 \\ 9 \end{array}$
instance miniYFJS01 miniYFJS03 miniYFJS04 miniYFJS05 miniYFJS06 miniYFJS07 miniYFJS07 miniYFJS09 miniYFJS10 miniYFJS10 miniYFJS11 miniYFJS13 miniYFJS13 miniYFJS14 miniYFJS13 miniYFJS16 miniYFJS17 miniYFJS18 miniYFJS19 miniYFJS20 miniYFJS21 miniYFJS23 miniYFJS23 miniYFJS23	$\begin{tabular}{ c c c c c }\hline \hline $C_{max}$ & $35,243$ \\ $28,684$ & $48,141$ \\ $25,394$ & $48,141$ \\ $25,394$ & $26,371$ \\ $30,952$ & $46,782$ \\ $33,954$ & $37,049$ \\ $29,416$ & $51,212$ \\ $36,034$ & $37,049$ \\ $29,416$ & $51,212$ \\ $36,034$ & $32,915$ \\ $31,826$ & $44,181$ \\ $34,133$ & $39,165$ \\ $36,071$ & $40,994$ \\ $35,319$ & $35,319$ \\ $45,713$ & $40,291$ \\ $43,592$ & $43,792$ \\ $54,739$ & $54,739$ \\ \end{tabular}$	$\begin{array}{c} \text{ed} \\ \frac{\#\text{it}}{1} \\ 1 \\ 1 \\ 3 \\ 1 \\ 2 \\ 2 \\ 2 \\ 2 \\ 2 \\ 6 \\ 1 \\ 4 \\ 7 \\ 7 \\ 4 \\ 3 \\ 5 \\ 4 \\ 4 \\ 9 \\ 7 \\ 7 \\ 9 \\ 6 \end{array}$	$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$	$\begin{array}{c} \# it \\ \hline \\ 2 \\ 1 \\ 6 \\ 1 \\ 3 \\ 1 \\ 6 \\ 7 \\ 2 \\ 6 \\ 2 \\ 6 \\ 8 \\ 9 \\ 6 \\ 7 \\ 3 \\ 9 \\ 14 \\ 11 \\ 10 \\ 15 \\ 10 \\ 14 \\ \end{array}$	$\begin{array}{c} C_{\rm max} \\ \hline \\ 34,443 \\ 27,557 \\ 44,195 \\ 24,669 \\ 25,635 \\ 29,080 \\ 31,992 \\ 36,098 \\ 30,290 \\ 47,079 \\ 33,404 \\ 30,219 \\ 31,284 \\ 42,828 \\ 32,481 \\ 41,316 \\ 29,883 \\ 33,965 \\ 35,100 \\ 37,414 \\ 32,485 \\ 42,016 \\ 35,101 \\ 37,414 \\ 32,485 \\ 42,016 \\ 38,144 \\ \end{array}$	$\begin{array}{c} \text{d} \\ \hline \# \text{it} \\ 1 \\ 1 \\ 3 \\ 1 \\ 3 \\ 1 \\ 3 \\ 2 \\ 2 \\ 3 \\ 1 \\ 5 \\ 5 \\ 4 \\ 4 \\ 3 \\ 5 \\ 5 \\ 4 \\ 4 \\ 3 \\ 5 \\ 1 \\ 3 \\ 2 \\ \end{array}$	$\begin{tabular}{ c c c c c } \hline Reduct \\ \hline C_{max} \\ \hline 33,132 \\ \hline 27,557 \\ \hline 42,896 \\ \hline 24,425 \\ \hline 29,080 \\ \hline 42,578 \\ \hline 29,080 \\ \hline 42,573 \\ \hline 30,008 \\ \hline 31,284 \\ \hline 46,903 \\ \hline 33,404 \\ \hline 30,219 \\ \hline 31,284 \\ \hline 45,903 \\ \hline 32,165 \\ \hline 48,475 \\ \hline 30,201 \\ \hline 33,805 \\ \hline 34,689 \\ \hline 35,570 \\ \hline 32,337 \\ \hline 42,016 \\ \hline 38,144 \end{tabular}$	$\begin{array}{c} \#\mathrm{it} \\ 4 \\ 1 \\ 6 \\ 2 \\ 3 \\ 1 \\ 5 \\ 7 \\ 2 \\ 2 \\ 2 \\ 5 \\ 7 \\ 4 \\ 5 \\ 7 \\ 4 \\ 5 \\ 12 \\ 8 \\ 16 \\ 2 \\ 7 \\ 4 \end{array}$	$\begin{array}{c} Cropp0\\ C_{max}\\ 33,697\\ 25,969\\ 39,880\\ 24,017\\ 24,743\\ 27,546\\ 41,487\\ 30,276\\ 34,357\\ 43,254\\ 29,989\\ 25,881\\ 39,862\\ 28,131\\ 39,862\\ 28,131\\ 39,862\\ 30,483\\ 38,739\\ 27,944\\ 31,743\\ 32,603\\ 38,739\\ 27,944\\ 33,355\\ 30,212\\ 38,757\\ 30,212\\ 38,779\\ 30,173\\ \end{array}$	$\begin{array}{c} \text{ad} \\ \hline \#\text{it} \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 2 \\ 1 \\ 2 \\ 1 \\ 2 \\ 1 \\ 2 \\ 1 \\ 5 \\ 3 \\ 6 \\ 4 \\ 2 \\ 5 \\ 3 \\ 6 \\ 4 \\ 5 \\ 1 \\ 4 \\ 11 \end{array}$	$\begin{tabular}{ c c c c c } \hline Reduce \\ \hline $C_{max}$ & $32,199$ \\ $25,969$ & $38,395$ \\ $23,774$ & $24,743$ \\ $24,743$ & $29,990$ \\ $39,694$ & $29,990$ \\ $24,745$ & $43,254$ \\ $29,989$ & $26,619$ \\ $28,131$ & $46,387$ \\ $30,483$ & $44,650$ \\ $29,698$ & $31,743$ \\ $32,718$ & $33,355$ \\ $29,512$ & $37,963$ \\ $31,054$ & $31,054$ \\ \hline \end{tabular}$	$\begin{array}{c} \#\mathrm{it} \\ 2 \\ 1 \\ 111 \\ 2 \\ 1 \\ 1 \\ 5 \\ 6 \\ 1 \\ 2 \\ 1 \\ 5 \\ 4 \\ 6 \\ 2 \\ 2 \\ 3 \\ 2 \\ 9 \\ 5 \\ 7 \\ 4 \\ 9 \\ 14 \end{array}$
instance miniYFJS01 miniYFJS03 miniYFJS03 miniYFJS04 miniYFJS06 miniYFJS06 miniYFJS09 miniYFJS09 miniYFJS10 miniYFJS10 miniYFJS11 miniYFJS13 miniYFJS13 miniYFJS14 miniYFJS13 miniYFJS16 miniYFJS17 miniYFJS18 miniYFJS19 miniYFJS20 miniYFJS23 miniYFJS23 miniYFJS24 miniYFJS24 miniYFJS26 miniYFJS26 miniYFJS27	$\begin{tabular}{ c c c c c }\hline \hline $C_{max}$ & $35,243$ \\ $35,243$ & $28,684$ \\ $48,141$ & $28,394$ \\ $26,371$ & $30,952$ \\ $30,952$ & $37,049$ \\ $29,416$ & $51,212$ \\ $36,33,965$ & $37,049$ \\ $29,416$ & $51,212$ \\ $36,33,965$ & $31,826$ \\ $45,901$ & $32,915$ \\ $31,826$ & $44,181$ \\ $34,133$ & $39,165$ \\ $36,071$ & $40,994$ \\ $35,319$ & $45,713$ \\ $40,291$ & $43,592$ \\ $54,739$ & $54,739$ \\ $54,739$ & $56,899$ \\ \end{tabular}$	$\begin{array}{c} \text{ded} \\ \#\text{it} \\ 1 \\ 1 \\ 1 \\ 3 \\ 1 \\ 2 \\ 2 \\ 2 \\ 2 \\ 6 \\ 1 \\ 4 \\ 4 \\ 7 \\ 7 \\ 4 \\ 3 \\ 5 \\ 4 \\ 4 \\ 9 \\ 7 \\ 7 \\ 9 \\ 6 \\ 3 \\ 2 \\ 6 \end{array}$	$\begin{tabular}{ c c c c c c c } \hline Reduct \\ \hline $C_{max}$ & $35,046$ \\ \hline $26,688$ \\ $47,391$ \\ $25,750$ \\ $30,952$ \\ $45,750$ \\ $30,952$ \\ $45,705$ \\ $33,883$ \\ $37,049$ \\ $29,416$ \\ $51,129$ \\ $31,826$ \\ $45,442$ \\ $37,791$ \\ $52,936$ \\ $45,442$ \\ $33,791$ \\ $52,936$ \\ $45,442$ \\ $37,791$ \\ $52,936$ \\ $45,442$ \\ $37,791$ \\ $52,936$ \\ $45,725$ \\ $54,675$ \\ $36,367$ \\ $43,555$ \\ $54,675$ \\ $56,675$ \\ $56,$	$\begin{array}{c} \# \mathrm{it} \\ \# \mathrm{it} \\ 2 \\ 1 \\ 6 \\ 1 \\ 3 \\ 1 \\ 6 \\ 7 \\ 2 \\ 6 \\ 8 \\ 9 \\ 6 \\ 7 \\ 3 \\ 9 \\ 9 \\ 6 \\ 7 \\ 3 \\ 9 \\ 14 \\ 11 \\ 10 \\ 15 \\ 10 \\ 14 \\ 4 \\ 3 \\ 18 \end{array}$	$\begin{array}{c} C_{\rm max} \\ \hline \\ 34,443 \\ 27,557 \\ 44,195 \\ 24,669 \\ 25,635 \\ 29,080 \\ 43,886 \\ 31,992 \\ 36,098 \\ 30,290 \\ 47,079 \\ 33,404 \\ 30,219 \\ 31,284 \\ 42,828 \\ 32,481 \\ 41,316 \\ 29,883 \\ 33,965 \\ 35,100 \\ 37,414 \\ 32,485 \\ 42,016 \\ 38,144 \\ 40,933 \\ 49,412 \\ 43,359 \\ \end{array}$	$\begin{array}{c} \text{#it} \\ \hline \\ \text{#it} \\ 1 \\ 1 \\ 3 \\ 1 \\ 3 \\ 1 \\ 3 \\ 2 \\ 2 \\ 3 \\ 1 \\ 5 \\ 5 \\ 4 \\ 4 \\ 3 \\ 5 \\ 3 \\ 6 \\ 4 \\ 5 \\ 1 \\ 3 \\ 2 \\ 1 \\ 1 \\ 7 \end{array}$	$\begin{tabular}{ c c c c c } \hline Reduct \\ \hline $C_{max}$ \\ \hline $3,132$ \\ \hline $27,557$ \\ \hline $42,896$ \\ \hline $24,855$ \\ \hline $24,855$ \\ \hline $24,908$ \\ \hline $24,235$ \\ \hline $31,284$ \\ \hline $46,235$ \\ \hline $30,201$ \\ \hline $32,216$ \\ \hline $32,237$ \\ \hline $42,016$ \\ \hline $38,144$ \\ \hline $40,425$ \\ \hline $49,413$ \\ \hline $44,943$ \\ \hline \hline \hline \hline $44,943$ \\ \hline \hline \hline \hline $44,943$ \\ \hline \hline \hline \hline \hline \hline $44,943$ \\ \hline $	$\begin{array}{c} \#\mathrm{it} \\ 4 \\ 1 \\ 6 \\ 2 \\ 3 \\ 1 \\ 5 \\ 7 \\ 2 \\ 2 \\ 2 \\ 5 \\ 7 \\ 4 \\ 5 \\ 7 \\ 4 \\ 5 \\ 12 \\ 8 \\ 16 \\ 2 \\ 7 \\ 4 \\ 3 \\ 1 \\ 7 \end{array}$	$\begin{array}{c} Croppp\\ C_{max}\\ 33,697\\ 25,969\\ 39,880\\ 24,017\\ 24,743\\ 27,569\\ 41,487\\ 30,276\\ 34,357\\ 41,487\\ 30,276\\ 34,357\\ 43,254\\ 29,989\\ 27,547\\ 43,254\\ 29,989\\ 27,547\\ 43,254\\ 29,989\\ 25,881\\ 28,131\\ 39,862\\ 30,483\\ 38,739\\ 27,944\\ 31,743\\ 32,603\\ 33,355\\ 30,212\\ 33,355\\ 30,212\\ 33,355\\ 30,212\\ 33,355\\ 30,212\\ 33,355\\ 30,212\\ 33,355\\ 30,173\\ 34,388\\ 44,766\\ 44,766\\ 52,539\\ \end{array}$	ad #it 1 1 8 1 1 8 1 1 3 2 1 2 2 1 2 2 1 2 2 1 2 2 1 2 3 6 4 4 2 5 3 6 4 4 2 5 3 6 4 4 5 1 4 4 5 1 4 4 5 1 4 4 5 3 6 8 3 6 8 3 6 8 3 8 3 6 8 3 8 8 8 8 8 8 8 8 8 8 8 8 8	$\begin{tabular}{ c c c c c c c } \hline Reduct \\ \hline $C_{max}$ \\ \hline $32,199$ \\ $25,969$ \\ $38,935$ \\ $23,774$ \\ $24,743$ \\ $24,743$ \\ $29,990$ \\ $34,357$ \\ $27,425$ \\ $43,254$ \\ $29,989$ \\ $25,619$ \\ $28,131$ \\ $46,387$ \\ $30,483$ \\ $44,650$ \\ $29,698$ \\ $31,743$ \\ $32,718$ \\ $33,355$ \\ $29,512$ \\ $37,963$ \\ $31,054$ \\ $34,388$ \\ $43,452$ \\ $31,749$ \\ \hline \end{tabular}$	$\begin{array}{c} \#\mathrm{it} \\ \\ \#\mathrm{it} \\ 2 \\ 1 \\ 1 \\ 1 \\ 2 \\ 1 \\ 5 \\ 6 \\ 1 \\ 5 \\ 4 \\ 6 \\ 2 \\ 2 \\ 3 \\ 2 \\ 9 \\ 5 \\ 7 \\ 4 \\ 9 \\ 14 \\ 5 \\ 18 \\ 7 \end{array}$
instance miniYFJS01 miniYFJS03 miniYFJS03 miniYFJS05 miniYFJS06 miniYFJS06 miniYFJS09 miniYFJS09 miniYFJS09 miniYFJS10 miniYFJS11 miniYFJS11 miniYFJS13 miniYFJS16 miniYFJS16 miniYFJS16 miniYFJS18 miniYFJS19 miniYFJS21 miniYFJS22 miniYFJS22 miniYFJS23 miniYFJS25 miniYFJS27 miniYFJS28	$\begin{tabular}{ c c c c c }\hline \hline $C_{max}$ & $35,243$ \\ $28,683$ & $48,141$ \\ $25,394$ & $26,371$ \\ $30,952$ & $46,782$ \\ $33,954$ & $47,782$ \\ $33,954$ & $47,782$ \\ $33,946$ & $36,343$ \\ $32,915$ & $31,826$ \\ $34,133$ & $39,165$ \\ $36,965$ & $44,181$ \\ $39,165$ & $36,071$ \\ $40,994$ & $41,813$ \\ $39,165$ & $36,071$ \\ $40,994$ & $45,319$ \\ $44,181$ & $35,319$ \\ $45,713$ & $40,291$ \\ $45,592$ & $54,739$ \\ $36,899$ & $56,899$ \\ $36,899$ $	$\begin{array}{c} \text{#it} \\ \text{#it} \\ 1 \\ 1 \\ 3 \\ 1 \\ 2 \\ 2 \\ 2 \\ 2 \\ 6 \\ 1 \\ 4 \\ 4 \\ 7 \\ 7 \\ 4 \\ 3 \\ 5 \\ 4 \\ 4 \\ 9 \\ 7 \\ 7 \\ 9 \\ 6 \\ 3 \\ 2 \\ 6 \\ 2 \\ \end{array}$	$\begin{array}{r} \mbox{Reduce} \\ \hline $C_{max}$ \\ \hline $35,046$ \\ $28,688$ \\ $47,391$ \\ $25,750$ \\ $30,952$ \\ $45,705$ \\ $33,883$ \\ $37,049$ \\ $29,416$ \\ $51,129$ \\ $29,416$ \\ $51,129$ \\ $33,883$ \\ $37,049$ \\ $29,416$ \\ $51,129$ \\ $34,338$ \\ $37,049$ \\ $29,416$ \\ $36,343$ \\ $32,792$ \\ $34,344$ \\ $36,771$ \\ $36,774$ \\ $36,776$ \\ $36,766$ \\ $36,776$ \\ $36,767$ \\ $36,367$ \\ $54,675$ \\ $54,675$ \\ $54,675$ \\ $54,675$ \\ $54,675$ \\ $54,675$ \\ $54,675$ \\ $54,675$ \\ $54,675$ \\ $54,675$ \\ $54,675$ \\ $54,675$ \\ $54,675$ \\ $54,675$ \\ $56,765$ \\ $54,675$ \\ $56,765$ \\ $54,675$ \\ $56,765$ \\ $54,675$ \\ $56,765$ \\ $54,675$ \\ $56,765$ \\ $54,675$ \\ $56,765$ \\ $54,675$ \\ $56,765$ \\ $54,675$ \\ $56,765$ \\ $54,675$ \\ $56,765$ \\ $54,675$ \\ $56,765$ \\ $54,675$ \\ $56,765$ \\ $56,755$ \\ $56,7$	$\begin{array}{c} \#\mathrm{it} \\ \#\mathrm{it} \\ 2 \\ 1 \\ 6 \\ 1 \\ 3 \\ 1 \\ 6 \\ 7 \\ 2 \\ 6 \\ 8 \\ 9 \\ 6 \\ 7 \\ 3 \\ 9 \\ 6 \\ 7 \\ 3 \\ 9 \\ 14 \\ 11 \\ 10 \\ 15 \\ 10 \\ 14 \\ 4 \\ 3 \\ 18 \\ 3 \end{array}$	$\begin{array}{c} C_{\rm max} \\ 34,443 \\ 27,557 \\ 44,195 \\ 24,669 \\ 25,635 \\ 29,080 \\ 43,886 \\ 30,290 \\ 43,886 \\ 30,290 \\ 47,079 \\ 33,404 \\ 30,219 \\ 33,404 \\ 30,219 \\ 33,404 \\ 30,219 \\ 33,404 \\ 30,219 \\ 33,404 \\ 33,404 \\ 30,219 \\ 33,404 \\ 33,404 \\ 33,405 \\ 33,965 \\ 35,100 \\ 37,414 \\ 32,485 \\ 42,016 \\ 38,144 \\ 32,485 \\ 42,016 \\ 38,144 \\ 32,485 \\ 42,016 \\ 38,144 \\ 34,359 \\ 35,640 \\ \end{array}$	$ \begin{array}{c} \text{dd} \\ \#\text{it} \\ 1 \\ 1 \\ 3 \\ 1 \\ 3 \\ 1 \\ 3 \\ 2 \\ 2 \\ 3 \\ 1 \\ 5 \\ 5 \\ 4 \\ 4 \\ 3 \\ 5 \\ 3 \\ 6 \\ 4 \\ 5 \\ 1 \\ 3 \\ 2 \\ 1 \\ 1 \\ 7 \\ 2 \end{array} $	$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$	$\begin{array}{c} \#\mathrm{it} \\ 4 \\ 1 \\ 6 \\ 2 \\ 3 \\ 1 \\ 5 \\ 7 \\ 2 \\ 2 \\ 2 \\ 2 \\ 5 \\ 7 \\ 4 \\ 5 \\ 7 \\ 4 \\ 5 \\ 12 \\ 8 \\ 16 \\ 2 \\ 7 \\ 4 \\ 3 \\ 1 \\ 7 \\ 8 \end{array}$	$\begin{array}{c} Croppo \\ C_{max} \\ \hline \\ & C_{max} \\ \hline \\ & 25,969 \\ 39,880 \\ 24,017 \\ 24,743 \\ 27,564 \\ 41,487 \\ 30,276 \\ 34,357 \\ 27,547 \\ 29,989 \\ 25,881 \\ 30,275 \\ 25,881 \\ 28,131 \\ 39,862 \\ 30,483 \\ 30,483 \\ 30,483 \\ 30,483 \\ 30,483 \\ 33,355 \\ 30,212 \\ 34,388 \\ 44,766 \\ 32,539 \\ 35,729 \\ \end{array}$	#it           1           1           8           1           1           3           2           1           3           2           1           5           3           6           4           5           1           4           11           6           8           2	$\begin{tabular}{ c c c c c c c } \hline Reduct \\ \hline $C_{max}$ & $32,199$ \\ $25,969$ & $38,935$ \\ $23,774$ & $25,939$ \\ $24,743$ & $24,743$ \\ $27,366$ & $39,694$ & $29,999$ \\ $24,743$ & $29,989$ \\ $25,619$ & $29,989$ \\ $25,619$ & $29,989$ \\ $25,619$ & $29,989$ \\ $25,619$ & $29,989$ \\ $25,619$ & $29,989$ \\ $25,619$ & $29,989$ \\ $26,619$ & $29,989$ \\ $26,619$ & $29,989$ \\ $26,619$ & $29,989$ \\ $26,619$ & $29,989$ \\ $26,619$ & $29,989$ \\ $26,619$ & $29,989$ \\ $26,619$ & $29,989$ \\ $26,619$ & $29,989$ \\ $26,619$ & $29,989$ \\ $26,619$ & $29,989$ \\ $26,619$ & $20,989$ \\ $26,619$ & $20,989$ \\ $26,619$ & $20,989$ \\ $26,619$ & $20,989$ \\ $26,619$ & $20,989$ \\ $26,619$ & $20,989$ \\ $26,619$ & $20,989$ \\ $26,619$ & $20,989$ \\ $26,619$ & $20,989$ \\ $26,619$ & $20,989$ \\ $26,619$ & $20,999$ \\ $26,619$ & $20,989$ \\ $26,619$ & $20,999$ \\ $26,61$	$\begin{array}{c} \#\mathrm{it} \\ 2 \\ 1 \\ 1 \\ 1 \\ 2 \\ 1 \\ 1 \\ 5 \\ 6 \\ 1 \\ 2 \\ 1 \\ 5 \\ 4 \\ 6 \\ 2 \\ 2 \\ 9 \\ 5 \\ 7 \\ 4 \\ 9 \\ 14 \\ 5 \\ 18 \\ 7 \\ 7 \end{array}$
instance miniYFJS01 miniYFJS03 miniYFJS03 miniYFJS05 miniYFJS06 miniYFJS06 miniYFJS09 miniYFJS09 miniYFJS10 miniYFJS10 miniYFJS13 miniYFJS13 miniYFJS13 miniYFJS15 miniYFJS16 miniYFJS16 miniYFJS18 miniYFJS18 miniYFJS19 miniYFJS20 miniYFJS23 miniYFJS23 miniYFJS23 miniYFJS26 miniYFJS26 miniYFJS28 miniYFJS28 miniYFJS28 miniYFJS28 miniYFJS28	$\begin{tabular}{ c c c c c }\hline \hline $C_{max}$ & $$35,243$ \\ $28,688$ & $$48,141$ \\ $25,334$ & $$26,371$ \\ $26,371$ & $$30,952$ \\ $46,782$ & $$33,954$ \\ $47,749$ & $$29,416$ \\ $51,212$ & $$36,343$ \\ $32,915$ & $$31,826$ \\ $45,913$ & $$36,925$ \\ $44,181$ & $$33,965$ \\ $44,181$ & $$34,183$ \\ $39,165$ & $$36,071$ \\ $40,994$ & $$45,713$ \\ $40,291$ & $$45,713$ \\ $40,291$ & $$45,713$ \\ $40,291$ & $$45,713$ \\ $40,291$ & $$45,713$ \\ $40,525$ & $$54,739$ \\ $36,899$ & $$41,951$ \\ $44,930$ \\ \end{tabular}$		$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$	$\begin{array}{c} \# \mathrm{it} \\ \# \mathrm{it} \\ 2 \\ 1 \\ 6 \\ 1 \\ 3 \\ 1 \\ 6 \\ 7 \\ 2 \\ 6 \\ 2 \\ 6 \\ 8 \\ 9 \\ 6 \\ 7 \\ 3 \\ 9 \\ 14 \\ 11 \\ 10 \\ 15 \\ 10 \\ 14 \\ 4 \\ 3 \\ 18 \\ 3 \\ 4 \end{array}$	$\begin{tabular}{ c c c c c }\hline \hline $C_{max}$ & $34,443$ \\ $27,557$ & $44,195$ \\ $24,669$ & $25,635$ \\ $29,080$ & $43,886$ \\ $31,992$ & $36,098$ \\ $30,290$ & $43,886$ \\ $30,290$ & $47,079$ \\ $33,404$ & $42,886$ \\ $30,219$ & $31,284$ \\ $42,816$ & $32,481$ \\ $41,316$ & $29,883$ \\ $32,481$ & $42,816$ \\ $32,481$ & $42,816$ \\ $32,481$ & $42,816$ \\ $32,481$ & $42,816$ \\ $33,965$ & $35,100$ \\ $37,114$ & $32,485$ \\ $42,016$ & $38,144$ \\ $40,933$ & $32,481$ \\ $42,016$ & $38,144$ \\ $40,933$ & $36,640$ \\ $38,993$ & $38,993$ \\ \end{tabular}$	$\begin{array}{c} \text{dd} \\ \#\text{it} \\ 1 \\ 1 \\ 3 \\ 1 \\ 3 \\ 1 \\ 3 \\ 2 \\ 2 \\ 3 \\ 1 \\ 5 \\ 5 \\ 4 \\ 4 \\ 3 \\ 5 \\ 3 \\ 6 \\ 4 \\ 5 \\ 1 \\ 3 \\ 2 \\ 1 \\ 1 \\ 7 \\ 2 \\ 3 \end{array}$	$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$	$\begin{array}{c} \#\mathrm{it} \\ 4 \\ 1 \\ 6 \\ 2 \\ 3 \\ 1 \\ 5 \\ 7 \\ 2 \\ 2 \\ 5 \\ 7 \\ 4 \\ 5 \\ 12 \\ 8 \\ 16 \\ 2 \\ 7 \\ 4 \\ 3 \\ 1 \\ 7 \\ 8 \\ 9 \end{array}$	$\begin{tabular}{ c c c c c } \hline $C$ ropp $$ $$ $$ $$ $$ $$ $$ $$ $$ $$ $$ $$ $$	#it           1           1           8           1           3           2           1           3           2           1           5           6           4           2           1           5           6           4           1           6           4           1           6           8           3           2           3	$\begin{tabular}{ c c c c c c c } \hline Reduct \\ \hline $C_{max}$ \\ \hline $32,199$ \\ $25,969$ \\ $38,935$ \\ $23,774$ \\ $24,743$ \\ $24,743$ \\ $24,743$ \\ $24,743$ \\ $29,959$ \\ $25,619$ \\ $29,959$ \\ $25,619$ \\ $29,959$ \\ $25,619$ \\ $29,959$ \\ $25,619$ \\ $29,959$ \\ $29,959$ \\ $29,952$ \\ $29,952$ \\ $29,952$ \\ $29,952$ \\ $29,952$ \\ $29,952$ \\ $29,952$ \\ $29,952$ \\ $29,952$ \\ $29,952$ \\ $29,952$ \\ $29,952$ \\ $29,952$ \\ $29,952$ \\ $30,483$ \\ $44,650$ \\ $29,652$ \\ $29,512$ \\ $37,963$ \\ $31,054$ \\ $43,355$ \\ $29,512$ \\ $37,963$ \\ $31,054$ \\ $43,452$ \\ $31,749$ \\ $35,729$ \\ $38,122$ \\ \end{tabular}$	$\begin{array}{c} \#\mathrm{it} \\ 2 \\ 1 \\ 11 \\ 2 \\ 1 \\ 1 \\ 1 \\ 5 \\ 6 \\ 1 \\ 2 \\ 1 \\ 5 \\ 4 \\ 6 \\ 2 \\ 2 \\ 3 \\ 2 \\ 9 \\ 5 \\ 7 \\ 4 \\ 9 \\ 14 \\ 5 \\ 18 \\ 7 \\ 7 \\ 5 \end{array}$
instance miniYFJS01 miniYFJS03 miniYFJS03 miniYFJS04 miniYFJS06 miniYFJS06 miniYFJS07 miniYFJS09 miniYFJS10 miniYFJS10 miniYFJS11 miniYFJS13 miniYFJS13 miniYFJS13 miniYFJS16 miniYFJS16 miniYFJS17 miniYFJS16 miniYFJS20 miniYFJS22 miniYFJS23 miniYFJS23 miniYFJS25 miniYFJS25 miniYFJS26 miniYFJS27 miniYFJS29 miniYFJS29 miniYFJS29 miniYFJS29 miniYFJS29 miniYFJS29 miniYFJS29 miniYFJS29 miniYFJS20	$\begin{tabular}{ c c c c c }\hline \hline $C_{max}$ & $35,243$ \\ $28,688$ & $48,141$ \\ $25,394$ & $48,141$ \\ $25,394$ & $26,371$ \\ $30,952$ & $46,782$ \\ $33,954$ & $37,049$ \\ $37,049$ & $29,416$ \\ $51,212$ & $36,395$ \\ $36,901$ & $32,915$ \\ $31,826$ & $44,181$ \\ $34,133$ & $39,165$ \\ $36,071$ & $40,994$ \\ $35,719$ & $40,291$ \\ $45,713$ & $40,291$ \\ $45,713$ & $40,291$ \\ $45,713$ & $40,291$ \\ $45,713$ & $40,291$ \\ $45,713$ & $40,291$ \\ $45,713$ & $40,291$ \\ $45,713$ & $40,291$ \\ $45,713$ & $40,291$ \\ $45,713$ & $40,291$ \\ $45,713$ & $40,291$ \\ $45,713$ & $40,291$ \\ $45,713$ & $40,291$ \\ $45,713$ & $40,291$ \\ $45,713$ & $40,291$ \\ $45,713$ & $40,291$ \\ $45,733$ & $40,293$ \\ $45,733$ & $40,293$ \\ $45,733$ & $40,293$ \\ $45,733$ & $40,293$ \\ $45,733$ & $40,293$ \\ $45,733$ & $40,293$ \\ $45,733$ & $40,293$ \\ $45,733$ & $40,293$ \\ $45,733$ & $40,293$ \\ $45,733$ & $40,293$ \\ $45,733$ & $40,293$ \\ $45,733$ & $40,293$ \\ $45,733$ & $40,293$ \\ $45,733$ & $40,293$ \\ $45,733$ & $40,293$ \\ $45,733$ & $40,293$ \\ $45,733$ & $40,293$ \\ $45,733$ & $40,293$ \\ $45,733$ $	$\begin{array}{c} \#\mathrm{it} \\ \#\mathrm{it} \\ 1 \\ 1 \\ 1 \\ 3 \\ 1 \\ 2 \\ 1 \\ 2 \\ 2 \\ 2 \\ 6 \\ 1 \\ 4 \\ 7 \\ 7 \\ 4 \\ 3 \\ 5 \\ 4 \\ 4 \\ 9 \\ 7 \\ 7 \\ 9 \\ 6 \\ 3 \\ 2 \\ 6 \\ 2 \\ 9 \\ 3 \end{array}$	$\begin{tabular}{ c c c c c } \hline Reduct \\ \hline C_{max} \\ \hline S.046 \\ \hline S.046 \\ \hline S.046 \\ \hline S.052 \\ \hline $	#it           2           1           6           1           3           6           7           6           2           6           2           6           2           6           9           6           7           3           9           11           10           14           4           3           18           3           4           8	$\begin{tabular}{ c c c c }\hline \hline $C_{max}$ & $$34,547$ & $$44,195$ & $$44,195$ & $$24,669$ & $$2,635$ & $$29,080$ & $$43,886$ & $$31,992$ & $$36,098$ & $$30,290$ & $$47,079$ & $$36,098$ & $$30,290$ & $$47,079$ & $$31,284$ & $$42,816$ & $$30,219$ & $$31,284$ & $$42,816$ & $$42,816$ & $$42,816$ & $$33,965$ & $$5,100$ & $$37,414$ & $$2,883$ & $$35,100$ & $$37,414$ & $$2,885$ & $$$42,016$ & $$8,144$ & $$40,933$ & $$$,144$ & $$40,933$ & $$$$,441,390$ & $$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$	$ \begin{array}{c} \mathrm{d} \\ \frac{\mathrm{\#it}}{\mathrm{t}} \\ 1 \\ 1 \\ 1 \\ 3 \\ 1 \\ 3 \\ 2 \\ 2 \\ 3 \\ 1 \\ 5 \\ 5 \\ 4 \\ 4 \\ 3 \\ 5 \\ 3 \\ 6 \\ 4 \\ 5 \\ 1 \\ 1 \\ 7 \\ 2 \\ 3 \\ 3 \\ \end{array} $	$\begin{tabular}{ c c c c c } \hline Reduct \\ \hline C_{max} \\ \hline 33,132 \\ \hline 27,557 \\ \hline 42,896 \\ 24,255 \\ 29,080 \\ 42,578 \\ 31,773 \\ 36,098 \\ 29,858 \\ 46,939 \\ 33,404 \\ 30,219 \\ 33,404 \\ 45,903 \\ 32,165 \\ 46,939 \\ 31,284 \\ 45,903 \\ 32,165 \\ 48,475 \\ 30,201 \\ 33,805 \\ 33,404 \\ 45,903 \\ 32,165 \\ 48,475 \\ 30,201 \\ 33,805 \\ 35,570 \\ 32,337 \\ 44,943 \\ 33,096 \\ 36,561 \\ 36,561 \\ 41,640 \\ \hline \end{tabular}$	$\begin{array}{c} \#\mathrm{it} \\ 4 \\ 1 \\ 6 \\ 2 \\ 3 \\ 1 \\ 5 \\ 7 \\ 2 \\ 2 \\ 2 \\ 5 \\ 7 \\ 4 \\ 5 \\ 7 \\ 4 \\ 5 \\ 12 \\ 8 \\ 16 \\ 2 \\ 7 \\ 4 \\ 3 \\ 1 \\ 7 \\ 8 \\ 9 \\ 5 \\ \end{array}$	$\begin{tabular}{ c c c c } \hline $C$ roppy $C$ max $C$ roppy $C$ max $15,969 $3,860 $24,017 $24,743 $27,564 $41,487 $30,276 $34,357 $41,487 $30,276 $34,357 $41,487 $30,276 $34,357 $43,254 $29,989 $27,547 $43,254 $29,989 $25,881 $28,131 $39,862 $30,483 $36,739 $27,944 $31,743 $32,603 $33,355 $30,212 $38,777 $30,173 $34,388 $44,766 $32,539 $35,729 $35,729 $35,729 $35,729 $35,729 $35,729 $35,729 $35,729 $35,729 $35,729 $35,729 $35,729 $35,729 $35,729 $35,729 $35,729 $35,729 $35,729 $35,728 $32,238 $32,238 $32,238 $32,238 $32,238 $32,238 $32,238 $32,238 $32,238 $32,238 $32,238 $32,238 $33,255 $32,238 $33,255 $32,238 $33,255 $32,238 $33,255 $32,238 $33,255 $32,238 $35,725 $35,726 $32,238 $35,726 $35,726 $32,238 $35,726 $32,238 $35,726 $35,726 $32,238 $35,726 $32,238 $35,726 $32,238 $35,726 $32,238 $35,726 $35,726 $32,238 $355 $35,726$	#it           1           1           8           1           1           3           2           1           3           2           1           3           6           4           5           3           6           4           11           6           4           11           6           3           6           3           6	$\begin{tabular}{ c c c c c } \hline Reduct \\ \hline $C_{max}$ \\ \hline $32,109$ \\ $25,969$ \\ $38,935$ \\ $23,774$ \\ $24,743$ \\ $27,366$ \\ $39,694$ \\ $29,990$ \\ $24,743$ \\ $29,990$ \\ $26,112$ \\ $29,989$ \\ $26,112$ \\ $29,989$ \\ $26,112$ \\ $28,131$ \\ $46,387$ \\ $30,483$ \\ $44,650$ \\ $29,698$ \\ $31,743$ \\ $32,718$ \\ $33,355$ \\ $29,512$ \\ $37,963$ \\ $31,054$ \\ $34,388$ \\ $43,452$ \\ $31,749$ \\ $35,729$ \\ $33,215$ \\ \hline \end{tabular}$	$\begin{array}{c} \#\mathrm{it} \\ 2 \\ 1 \\ 11 \\ 2 \\ 1 \\ 1 \\ 5 \\ 6 \\ 1 \\ 2 \\ 1 \\ 5 \\ 6 \\ 1 \\ 2 \\ 2 \\ 3 \\ 2 \\ 9 \\ 5 \\ 7 \\ 4 \\ 9 \\ 14 \\ 5 \\ 18 \\ 7 \\ 7 \\ 5 \\ 13 \end{array}$
instance miniYFJS01 miniYFJS03 miniYFJS03 miniYFJS05 miniYFJS06 miniYFJS06 miniYFJS09 miniYFJS09 miniYFJS10 miniYFJS10 miniYFJS13 miniYFJS13 miniYFJS13 miniYFJS15 miniYFJS16 miniYFJS16 miniYFJS18 miniYFJS18 miniYFJS19 miniYFJS20 miniYFJS23 miniYFJS23 miniYFJS23 miniYFJS26 miniYFJS26 miniYFJS28 miniYFJS28 miniYFJS28 miniYFJS28 miniYFJS28	$\begin{tabular}{ c c c c c }\hline \hline $C_{max}$ & $$3,243$ \\ $28,688$ & $$48,141$ \\ $25,394$ & $$2,394$ \\ $26,371$ & $$3,955$ \\ $46,782$ & $$3,955$ \\ $47,704$ & $$2,915$ \\ $37,049$ & $$2,915$ \\ $36,343$ & $$2,915$ \\ $36,343$ & $$32,915$ \\ $36,343$ & $$32,915$ \\ $36,343$ & $$32,915$ \\ $36,343$ & $$32,915$ \\ $36,343$ & $$32,915$ \\ $36,343$ & $$32,915$ \\ $36,915$ & $$34,915$ \\ $36,071$ & $$41,813$ \\ $35,319$ & $$45,713$ \\ $40,291$ & $$45,713$ \\ $40,291$ & $$45,713$ \\ $40,291$ & $$45,713$ \\ $40,525$ & $$54,739$ \\ $36,899$ & $$41,951$ \\ $41,930$ \\ \end{tabular}$		$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$	$\begin{array}{c} \# \mathrm{it} \\ \# \mathrm{it} \\ 2 \\ 1 \\ 6 \\ 1 \\ 3 \\ 1 \\ 6 \\ 7 \\ 2 \\ 6 \\ 2 \\ 6 \\ 8 \\ 9 \\ 6 \\ 7 \\ 3 \\ 9 \\ 14 \\ 11 \\ 10 \\ 15 \\ 10 \\ 14 \\ 4 \\ 3 \\ 18 \\ 3 \\ 4 \end{array}$	$\begin{tabular}{ c c c c c }\hline \hline $C_{max}$ & $34,443$ \\ $27,557$ & $44,195$ \\ $24,669$ & $25,635$ \\ $29,080$ & $43,886$ \\ $31,992$ & $36,098$ \\ $30,290$ & $43,886$ \\ $30,290$ & $47,079$ \\ $33,404$ & $42,886$ \\ $30,219$ & $31,284$ \\ $42,816$ & $32,481$ \\ $41,316$ & $29,883$ \\ $32,481$ & $42,816$ \\ $32,481$ & $42,816$ \\ $32,481$ & $42,816$ \\ $32,481$ & $42,816$ \\ $33,965$ & $35,100$ \\ $37,114$ & $32,485$ \\ $42,016$ & $38,144$ \\ $40,933$ & $32,481$ \\ $42,016$ & $38,144$ \\ $40,933$ & $36,640$ \\ $38,993$ & $38,993$ \\ \end{tabular}$	$\begin{array}{c} \text{dd} \\ \#\text{it} \\ 1 \\ 1 \\ 3 \\ 1 \\ 3 \\ 1 \\ 3 \\ 2 \\ 2 \\ 3 \\ 1 \\ 5 \\ 5 \\ 4 \\ 4 \\ 3 \\ 5 \\ 3 \\ 6 \\ 4 \\ 5 \\ 1 \\ 3 \\ 2 \\ 1 \\ 1 \\ 7 \\ 2 \\ 3 \end{array}$	$\begin{tabular}{ c c c c c c c } \hline Reduct \\ \hline $C_{max}$ & $3,132$ \\ $27,557$ \\ $27,557$ \\ $42,896$ \\ $24,235$ \\ $29,080$ \\ $42,578$ \\ $31,773$ \\ $36,098$ \\ $29,858$ \\ $46,998$ \\ $29,858$ \\ $46,998$ \\ $29,858$ \\ $46,998$ \\ $29,858$ \\ $46,998$ \\ $33,404$ \\ $30,219$ \\ $33,404$ \\ $30,219$ \\ $33,404$ \\ $30,219$ \\ $32,165$ \\ $48,475$ \\ $30,219$ \\ $32,165$ \\ $48,475$ \\ $30,219$ \\ $32,165$ \\ $48,475$ \\ $30,219$ \\ $33,805$ \\ $34,689$ \\ $35,570$ \\ $32,337$ \\ $42,016$ \\ $38,144$ \\ $40,425$ \\ $49,412$ \\ $34,943$ \\ $30,966$ \\ $36,561$ \\ \end{tabular}$	$\begin{array}{c} \#\mathrm{it} \\ 4 \\ 1 \\ 6 \\ 2 \\ 3 \\ 1 \\ 5 \\ 7 \\ 2 \\ 2 \\ 5 \\ 7 \\ 4 \\ 5 \\ 12 \\ 8 \\ 16 \\ 2 \\ 7 \\ 4 \\ 3 \\ 1 \\ 7 \\ 8 \\ 9 \end{array}$	$\begin{tabular}{ c c c c c } \hline $C$ ropp $$ $$ $$ $$ $$ $$ $$ $$ $$ $$ $$ $$ $$	#it           1           1           8           1           3           2           1           3           2           1           5           6           4           2           1           5           6           4           1           6           4           1           6           8           3           2           3	$\begin{tabular}{ c c c c c c c } \hline Reduct \\ \hline $C_{max}$ \\ \hline $32,199$ \\ $25,969$ \\ $38,935$ \\ $23,774$ \\ $24,743$ \\ $24,743$ \\ $24,743$ \\ $24,743$ \\ $29,959$ \\ $25,619$ \\ $29,959$ \\ $25,619$ \\ $29,959$ \\ $25,619$ \\ $29,959$ \\ $25,619$ \\ $29,959$ \\ $29,959$ \\ $29,952$ \\ $29,952$ \\ $29,952$ \\ $29,952$ \\ $29,952$ \\ $29,952$ \\ $29,952$ \\ $29,952$ \\ $29,952$ \\ $29,952$ \\ $29,952$ \\ $29,952$ \\ $29,952$ \\ $30,483$ \\ $44,650$ \\ $29,652$ \\ $31,743$ \\ $32,718$ \\ $33,752$ \\ $29,512$ \\ $37,963$ \\ $31,054$ \\ $43,452$ \\ $31,749$ \\ $35,729$ \\ $38,122$ \\ \end{tabular}$	$\begin{array}{c} \#\mathrm{it} \\ 2 \\ 1 \\ 11 \\ 2 \\ 1 \\ 1 \\ 1 \\ 5 \\ 6 \\ 1 \\ 2 \\ 1 \\ 5 \\ 4 \\ 6 \\ 2 \\ 2 \\ 3 \\ 2 \\ 9 \\ 5 \\ 7 \\ 4 \\ 9 \\ 14 \\ 5 \\ 18 \\ 7 \\ 7 \\ 5 \end{array}$

Table 1: Local search results with the first-improvement strategy using the reduced neighborhood
and the cropped neighborhood, applied to the small-sized instances with learning rate $\alpha \in$
$\{0.1, 0.2, 0.3\}.$

			$\alpha =$	0.1					$\alpha =$	0.2					$\alpha =$			
instance	Cr	opped			educed		Cı	opped		Re	educed		Cr	opped			educed	
	$C_{\text{max}}$	#it	Time	$C_{\text{max}}$	#it	Time	$C_{\text{max}}$	#it	Time	$C_{\text{max}}$	#it	Time	$C_{\text{max}}$	#it	Time	$C_{\text{max}}$	#it	Time
DAFJS01	28,036	4	0.001	26,794	14	0.004	26,371	3	0.000	25,970	19	0.001	21,685	3	0.000	21,439	5	0.000
DAFJS02	28,098	9	0.002	28,098	10	0.001	28,141	2	0.000	27,860	5	0.000	23,672	8	0.000	23,808	7	0.000
DAFJS03	53,688	1	0.001	51,579	15	0.005	47,879	3	0.000	45,458	37	0.011	43,509	3	0.000	42,867	13	0.005
DAFJS04	54,082	1	0.001	52,563	15	0.001	47,778	5	0.000	46,577	8	0.001	41,899	2	0.000	41,697	3	0.000
DAFJS05	40,195	25	0.004	41,604	24	0.002	39,771	16	0.001	37,797	36	0.006	35,610	9	0.000	31,254	47	0.009
DAFJS06	41,271	37	0.006	50,586	10	0.002	38,087	20	0.001	36,252	69	0.014	32,168	29	0.002	31,122	36	0.006
DAFJS07	54,989	7	0.004	54,802	36	0.026	45,737	34	0.006	48,959	29	0.021	40,830	6	0.001	39,662	24	0.024
DAFJS08	58,930	13	0.006	60,359	27	0.026	52,816	5	0.001	50,928	28	0.022	44,590	4	0.001	42,777	43	0.038
DAFJS09	45,139	11	0.001	44,917	17	0.003	36,871	29	0.002	36,735	39	0.009	34,185	19	0.002	34,025	39	0.011
DAFJS10	53,977	6	0.001	51,565	50	0.011	45,971	4	0.000	45,560	12	0.003	36,279	8	0.001	34,289	42	0.010
DAFJS11	66,872	6	0.003	63,878	55	0.052	51,746	37	0.016	54,661	30	0.049	45,657	17	0.006	44,809	46	0.068
DAFJS12	62,198	31	0.014	59,612	157	0.155	53,738	9	0.002	52,467	38	0.040	44,490	8	0.004	43,717	28	0.043
DAFJS13	57,874	16	0.005	57,310	36	0.021	48,847	22	0.004	48,816	29	0.016	41,717	4	0.001	41,960	11	0.006
DAFJS14	70,169	39	0.008	65,321	59	0.029	56,639	35	0.006	55,881	44	0.027	46,392	26	0.006	44,707	54	0.035
DAFJS15	61,882	62	0.032	63,408	124	0.166	53,807	6	0.003	53,686	14	0.031	47,692	10	0.004	47,474	33	0.067
DAFJS16	70,727	40	0.017	70,838	84	0.125	63,277	11	0.005	58,436	107	0.183	55,112	12	0.006	53,095	78	0.172
DAFJS17	68,446	50	0.018	70,306	26	0.016	57,893	41	0.009	57,518	54	0.031	46,340	80	0.026	47,331	96	0.087
DAFJS18	71,871	31	0.006	74,631	21	0.015	58,533	19	0.004	58,907	29	0.019	50,818	7	0.002	48,672	26	0.015
DAFJS19	63,999	12	0.002	63,314	26	0.019	52,824	24	0.006	57,082	10	0.014	41,426	28	0.004	41,865	56	0.029
DAFJS20	64,005	75	0.020	63,841	225	0.207	61,871	5	0.002	57,378	99	0.115	46,868	53	0.018	48,600	40	0.051
DAFJS21	72,142	57	0.020	76,433	31	0.032	61,483	12	0.004	62,677	9	0.009	50,318	15	0.005	49,422	39	0.040
DAFJS22	60,081	132	0.043	60,143	315	0.448	53,248	44	0.014	54,318	42	0.097	43,566	17	0.011	41,615	94	0.235
DAFJS23	48,338	9	0.001	48,054	18	0.012	41,433	17	0.003	44,473	31	0.018	39,105	3	0.000	38,334	12	0.006
DAFJS24	55,507	9	0.004	55,353	33	0.032	47,277	14	0.004	47,656	9	0.007	40,921	17	0.004	42,473	27	0.019
DAFJS25	79,286	26	0.011	76,253	92	0.227	59,672	68	0.033	61,805	92	0.184	48,469	25	0.013	49,390	39	0.098
DAFJS26	73,969	54	0.020	75,329	96	0.190	70,211	8	0.003	65,524	109	0.373	53,944	39	0.023	55,269	39	0.117
DAFJS27	79,234	13	0.004	79,064	23	0.053	62,437	21	0.010	62,596	29	0.079	53,719	46	0.023	55,569	46	0.134
DAFJS28	59,201	18	0.003	54,866	109	0.103	48,414	21	0.004	47,884	46	0.039	41,408	11	0.003	40,097	34	0.050
DAFJS29	68,684	21	0.006	66,929	80	0.106	57,356	16	0.005	57,179	34	0.044	49,819	7	0.005	49,519	24	0.050
DAFJS30	$57,\!350$	17	0.005	60,016	13	0.013	51,283	14	0.004	50,961	45	0.052	43,426	3	0.001	42,592	6	0.008
mean	59,008.00	27.73	0.009	58,925.53	61.37	0.070	50,713.70	18.83	0.005	50,400.03	39.40	0.051	42,854.47	17.30	0.006	42,315.00	36.23	0.048
wins	12			19			10			20			9			12		

			$\alpha =$	0.1					$\alpha =$	0.2					$\alpha =$	0.3		
instance	Cr	opped		Re	educed		Cı	opped		Re	educed		Cr	opped		Re	educed	
	$C_{\text{max}}$	#it	Time	$C_{\text{max}}$	#it	Time	$C_{\text{max}}$	#it	Time	$C_{\text{max}}$	#it	Time	$C_{\text{max}}$	#it	Time	$C_{\text{max}}$	#it	Time
YFJS01	79,662	10	0.000	79,737	21	0.003	74,547	9	0.000	70,624	31	0.004	66,246	9	0.000	67,588	10	0.001
YFJS02	76,529	3	0.000	76,813	4	0.000	66,853	1	0.000	66,853	1	0.000	59,211	3	0.000	59,001	4	0.001
YFJS03	38,424	3	0.000	35,936	14	0.000	33,273	5	0.000	33,273	5	0.000	30,995	3	0.000	31,407	2	0.000
YFJS04	45,683	3	0.000	45,533	4	0.000	42,553	4	0.000	42,553	4	0.000	38,092	5	0.000	38,092	5	0.000
YFJS05	45,421	4	0.000	45,421	4	0.000	40,738	2	0.000	40,738	2	0.000	38,324	5	0.000	38,324	9	0.000
YFJS06	44,848	13	0.000	47,384	12	0.001	43,384	15	0.000	42,207	21	0.002	45,370	2	0.000	45,370	2	0.000
YFJS07	48,980	7	0.000	45,722	21	0.001	43,925	12	0.000	45,971	11	0.000	38,453	5	0.000	38,453	5	0.000
YFJS08	43,073	7	0.000	41,658	19	0.001	42,901	3	0.000	41,573	10	0.000	35,429	2	0.000	33,432	17	0.001
YFJS09	25,067	3	0.000	24,350	4	0.000	23,059	3	0.000	22,211	5	0.000	20,916	7	0.000	20,916	7	0.000
YFJS10	42,583	1	0.000	42,278	2	0.000	39,126	5	0.000	38,683	7	0.000	$34,\!487$	8	0.000	36,415	7	0.000
YFJS11	55,765	4	0.000	55,416	7	0.001	49,781	2	0.000	49,160	6	0.001	45,051	1	0.000	44,455	4	0.000
YFJS12	56,674	24	0.001	54,852	59	0.007	55,174	11	0.000	53,329	21	0.003	47,092	3	0.000	44,873	12	0.001
YFJS13	44,083	16	0.000	45,844	16	0.001	42,442	10	0.000	39,720	27	0.003	35,776	16	0.000	35,524	19	0.003
YFJS14	119,977	27	0.016	124,518	60	0.141	104,506	19	0.010	105,770	58	0.181	89,687	12	0.007	87,368	61	0.182
YFJS15	126,713	33	0.016	127,073	171	0.481	106,511	28	0.016	108,412	58	0.192	93,075	14	0.007	86,141	166	0.529
YFJS16	116,201	37	0.018	121,141	73	0.196	101,164	13	0.005	99,801	65	0.129	87,351	10	0.005	87,648	48	0.136
YFJS17	104,688	21	0.026	102,614	159	1.134	83,355	18	0.014	82,211	87	0.621	71,201	26	0.036	71,075	65	0.493
YFJS18	$126,\!647$	34	0.032	128,529	87	0.752	97,157	15	0.022	94,689	179	2.000	84,518	9	0.015	82,967	77	0.834
YFJS19	93,306	96	0.100	100,855	209	1.353	86,398	21	0.026	85,028	128	1.115	68,792	53	0.054	68,955	135	0.984
YFJS20	96,248	17	0.019	92,240	196	1.205	79,408	85	0.088	80,875	294	1.923	71,676	8	0.009	68,562	123	0.993
mean	71,528.60	18.15	0.011	71,895.70	57.10	0.264	62,812.75	14.05	0.009	62,184.05	51.00	0.309	55,087.10	10.05	0.007	54,328.30	38.90	0.208
wins	10			11			8			16			10			15		

Table 2: Local search results with the first-improvement strategy using the reduced neighborhood and the cropped neighborhood, applied to the large-sized instances proposed in [8] with learning rate  $\alpha \in \{0.1, 0.2, 0.3\}$ .

instance. Tables 5, 6, and 7 show the results associated with the learning rates  $\alpha \in \{0.1, 0.2, 0.3\}$ , respectively. In the tables, for each method/instance pair, when applicable, we show the best makespan (among the five runs) and the CPU time the method needed to achieve it. If a method reached its best makespan more than once, the indicated CPU time corresponds in fact to the average CPU time among all the times the method reached the indicated makespan. In the

instance         Interpart         Reduced         Croppart         Reduced         Reduced </th <th>[</th> <th></th> <th></th> <th>0.1</th> <th></th> <th></th> <th>-</th> <th>0.9</th> <th></th> <th></th> <th>-</th> <th>0.2</th> <th></th>	[			0.1			-	0.9			-	0.2	
$\begin{split} \hline   c_{main} DeF   sol $2, $2041 $1 $2, $21, $48 $3 $2, $1, $46 $4 $2, $21, $46 $4 $2, $21, $46 $4 $2, $21, $46 $4 $2, $21, $47 $4 $2, $20, $67 $4, $2, $20, $67 $4, $2, $20, $67 $4, $2, $20, $67 $4, $2, $21, $46 $4 $2, $21, $46 $4, $2, $21, $46 $4, $2, $21, $48 $4, $2, $20, $58 $1, $21, $51 $4, $20, $61 $1, $22, $25, $30 $1, $22, $25, $30 $1, $22, $25, $30 $1, $22, $25, $30 $1, $22, $25, $30 $1, $22, $25, $30 $1, $22, $25, $30 $1, $22, $25, $30 $1, $22, $25, $30 $1, $22, $25, $30 $1, $22, $25, $30 $1, $22, $25, $30 $1, $22, $25, $30 $1, $22, $25, $30 $1, $22, $25, $30 $1, $22, $25, $30 $1, $22, $25, $30 $1, $22, $25, $30 $1, $22, $25, $10 $2, $20, $26 $1, $10, $20 $2, $20, $26 $1, $10, $20 $2, $20, $26 $1, $10, $20 $2, $20, $26 $1, $10, $20 $2, $20, $26 $1, $10, $20 $2, $20, $26 $1, $10, $20 $2, $20, $26 $1, $10, $20 $2, $20, $26 $1, $10, $20 $2, $20, $26 $2, $10 $2, $20, $20 $2, $20, $20 $2, $20, $20$	instanco	Croppy			d	Croppy			-d	Croppy			ad a
$\begin{split} \begin{tabular}{ c c c c c c c c c c c c c c c c c c c$	instance	~ ~ ~											
mimDAFJS02         23,242         1         22,278         3         22,118         1         1         17,772         1         17,775         1         17,755         1         17,755         1         17,755         1         17,755         1         17,755         1         17,755         1         17,755         1         17,755         1         <	: :DAE1001												
mimDAF1800         1         1.2.1.51         4         1.2.9.2         1         1.7.1.9.1         2         1.8.800         4           mimDAF1805         2.2.5.98         1         2.2.1.51         4         2.0.07.3         2         1.9.2.5.3         1         1.8.807         4         1.8.807         1         1.8.807         1         1.8.807         1         1.8.807         1         2.7.813         2         1.9.7.8         1         2.7.813         2         1.9.7.8         1         1.8.827         1         2.7.813         2         1.7.9.00         2         2.7.9.81         2.7.888         1         2.7.9.81         2         1.7.9.00         2         2.7.9.81         1         2.7.9.81         2         1.7.9.90         2         1.7.9.90         2         1.7.9.90         2         1.7.9.90         2         1.7.9.90         2         1.7.9.90         2         1.7.9.90         2         1.7.9.90         2         1.7.9.90         2         1.7.9.90         2         1.7.9.90         2         1.7.9.9         1         1.7.9.9         1         1.7.9.9         1         1.7.9.9         1         1.7.9.9.9         1         1.7.9.9.9         1         1.7.9.9.9 <th< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></th<>													
minDAFLS00         21,09         1         21,29         1         22,418         2         09,23         2         19,234         1         19,333         2         13,233         2         12,233         1         19,334         2         13,335         4         19,334         1         19,334         1         19,334         1         19,334         1         19,334         1         19,334         1         19,334         1         19,334         1         19,334         1         19,334         1         19,334         1         19,334         1         19,334         1         19,334         1         19,334         1         19,334         1         19,334         1         19,334													
minDAFJS00         22,598         1         22,370         1         22,370         1         22,370         1         23,370											-		
minDAFLS00         23.370         1         29.78         2         9.78         2         9.965         3         1         9.965         3         1         9.965         3         2         9.965         3         2         9.965         3         2         9.965         3         2         9.965         3         2         9.965         3         2													
minDAF1807         28,64         1         29,78         1         21,75         2         24,66         2         22,62         2           minDAF1809         24,25         1         29,878         1         22,828         1         17,900         2         22,838         1         22,228         2           minDAF1810         30,869         2         30,358         4         30,911         18,825         5         18,723         2         23,838         2         23,848         2         30,838         2         30,838         2         30,838         2         30,838         2         30,838         2         30,838         2         30,838         3         30,838         3         30,838         3         30,838         3         30,838         3         30,838         3         30,838         3         30,838         3         30,838         3         30,838         3         30,838         3         30,838         3         30,838         3         30,838         30,838         30,838         30,838         30,838         30,838         30,838         30,838         30,838         30,838         30,838         30,838         30,838         30,838 <th< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></th<>													
minDAFIS00         95,425         1         19,878         1         18,857         1         18,857         1         17,900         2         2,900         2           minDAFIS10         02,5425         1         22,425         1         23,858         4         20,011         1         18,823         5         19,723         2         23,858         2           minDAFIS12         20,305         1         24,814         1         19,624         1         19,624         1         19,624         1         19,624         1         19,624         1         19,624         1         19,624         1         19,624         1         19,624         1         19,624         1         19,624         1         11,780         2         23,835         3         1         22,837         3         15,625         3         11,847         1         19,624         1         19,612         1         19,612         1         19,612         1         11,847         3         11,847         3         11,847         3         11,847         3         11,847         3         11,847         3         11,847         3         11,847         3         11,847         3													
minDAFLSIO0         25,45         1         23,80         1         23,715         2         23,385         1         23,715         2         23,385         4         20,034         1         18,823         5         19,732         2         17,466         5           minDAFLSI3         20,342         1         90,344         1         19,044         1         19,044         1         19,044         1         19,044         1         19,044         1         19,044         1         19,044         1         19,044         1         19,044         1         19,044         1         19,042         3         18,028         3         20,039         3         22,049         3         18,028         3         22,049         3         11,0139         2         20,038         4         21,013         4         17,474         1         17,039         1         19,039         1         19,039         1         19,039         1         19,039         1         17,039         2         20,037         1         12,046         1         15,057         1         14,043         14,142         1         17,045         1         11,045         1         11,0144         1													
minDAFISI0         21.63         1         22.39         4         20.21         1         18.823         5         19.723         2         19.736         2         23.385         4         30.941         2         30.550         2         30.550         2         25.3355         2         23.3455         4         30.941         1         19.024													
nminDAFISII         33.68         2         33.58         4         30.941         2         30.50         5         25.710         2         19.044         1         19.044         1         19.044         1         19.044         1         19.044         1         19.044         1         19.044         1         19.044         1         19.044         1         19.044         1         19.044         1         19.044         1         19.044         1         19.044         1         19.045         3         20.020         3         19.042         2         20.033         2         20.033         3         20.045													
ninDAFISI2         20.42         1         10.624         1         10.624         1         10.674         1         10.747         1         10.74         1         10.74         1         10.745         1         10.74         1 <th10.74< th="">         1         <th10.74< th=""> <th1< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></th1<></th10.74<></th10.74<>													
nminDAFSI31         17.00         2         16.313         3         16.616         2         15.143         3         15.278         2         15.03         2           minDAFSI55         22.472         1         20.620         3         20.620         3         18.628         3         18.628         3           minDAFSI57         25.070         1         25.472         1         20.620         3         20.630         3         18.628         3         20.239         3         22.939         3         22.939         3         22.939         3         22.939         3         22.939         3         22.939         3         22.939         3         22.939         3         22.939         3         22.918         1         19.139         2         19.139         2         19.139         2         19.139         2         19.139         2         19.139         2         19.139         2         19.139         2         19.139         2         19.139         2         19.139         2         19.139         2         19.139         2         19.139         2         2.1710         3         2.2710         3         2.2710         3         3					-								
nminDAFIS14         22.472         1         22.472         1         22.472         1         22.472         1         22.472         1         22.473         3         20.603         3         20.603         3         20.683         3         22.939         3           minDAFIS16         21.070         1         20.155         3         20.183         2         10.183         2         10.193         2         10.193         2         10.193         2         10.193         2         10.193         2         10.193         2         10.193         2         10.193         2         10.193         2         10.193         2         10.193         2         10.193         2         10.193         2         10.193         2         10.193         2         10.193         2         10.193         2         10.193         1         10.193         2         10.193         1         10.193         1         10.193         1         10.193         1         10.193         1         10.193         1         10.193         1         10.193         1         10.193         1         10.193         1         10.193         1         10.193         1         10.193													
minDAFSN5         22,472         1         20,620         3         20,620         3         18,628         3         18,628         3           minDAFSN7         21,070         1         23,155         3         20,183         2         20,183         2         20,393         3         22,393         3         22,393         3         22,393         3         22,393         3         22,393         3         22,393         3         22,393         3         22,393         3         22,393         3         22,393         3         20,103         2         3         10,1642         3         10,1030         1         11,8,474         3           minDAFS23         23,433         2         23,212         3         24,273         3         24,273         3         24,273         3         24,274         3         22,767         3         22,767         3         22,767         3         22,777         3         22,777         3         23,777         3         23,777         3         23,777         3         23,777         3         23,777         3         23,773         4         13,772         53         23,773         4         13,772         13,73<													
minDAFIS16         21.00         1         2.4.503         1         24.114         2         2.2.399         3         2.2.399         3         2.2.399         3         2.2.399         3         2.2.399         3         2.2.319         2         3.3         2         3.3         2         3.3         2         3.3         3.3         3.3         3.3         3.3         3.3         3.3         3.2.777         3         2.2.767         3         2.2.777         3         3         2.2.777         3         3         2.2.777         3         3         2.2.773         4         2.3.786         2         2.3.786         2         2.3.786         2 <th2< td=""><td></td><td></td><td></td><td></td><td>~</td><td></td><td></td><td></td><td></td><td></td><td>~</td><td>· · ·</td><td></td></th2<>					~						~	· · ·	
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minDAFN318         18,45         2         18,135         4         18,820         1         18,201         4         17,744         1         17,295         2           minDAFN321         21,434         2         23,212         3         21,286         1         21,286         1         19,642         3         10,030         1         18,474         3           minDAFN322         25,424         3         24,274         4         22,2151         4         21,182         3         24,773         3         24,773         3         22,767         3         22,714         4         18,921         4         18,921         4         18,921         4         18,921         4         18,921 <td></td> <td></td> <td></td> <td></td> <td>-</td> <td></td> <td>-</td> <td></td> <td>-</td> <td></td> <td></td> <td></td> <td></td>					-		-		-				
minDAFJS19         21,233         1         20,045         3         20,107         1         10,642         3         10,030         1         18,474         3           minDAFJS20         23,443         2         22,721         3         22,761         3         22,767         3         22,767         3         22,767         3         22,767         3         22,767         3         22,767         3         22,767         3         22,767         3         22,767         3         22,767         3         22,767         3         22,767         3         22,767         3         22,767         3         22,771         4         18,921         4 <t></t>					~								
minDAFJS20         24,443         2         23,212         3         21,286         1         12,286         1         19,887         1         19,887         1           minDAFJS21         24,443         3         22,767         3         20,888         4           minDAFJS23         25,923         3         24,273         3         24,779         3         22,767         3         22,767         3           minDAFJS25         25,370         1         22,982         2         22,161         1         21,714         4           minDAFJS25         22,306         3         22,304         4         20,73         4         20,73         4         20,73         4         20,73         4         20,708         3         22,314         5         22,145         5         22,145         3         22,364         1         18,414         2           minDAFJS25         23,403.37         1.73         23,773.20         2.80         21,470.40         3.00         20,364.37         2.3         20,187.67         2.706         3           minDAFJS20         24,423         1         35,046         2         34,437         1         31,56         2					-				-				
nminDAFUS21         24,244         3         24,273         3         24,273         3         24,273         3         22,767         3         22,767         3         22,767         3         22,767         3         22,767         3         22,767         3         22,767         3         22,717         3         22,717         3         22,718         3         24,253         2         24,713         3         22,707         3         22,714         4         22,711         3         22,714         4         22,714         4         22,714         4         22,714         4         22,714         4         22,714         4         22,714         4         22,714         4         22,714         4         22,714         4         22,714         4         22,714         4         12,917         4         10,917         22,713         3         22,314         5         22,113         3         22,314         5         22,113         3         22,314         5         22,113         3         22,316         3         24,237         23,173.20         21,012         21,017         10,017         10,017         10,017         10,017         10,017         21,017         21,0170			-										
minDAFJS23         25,923         3         24,273         3         24,273         3         24,774         3         22,710         3         22,710         3           minDAFJS23         25,830         2         25,788         3         24,503         2         24,164         3         21,772         5         22,710         3           minDAFJS25         22,307         1         22,982         2         22,613         1         21,946         2         18,472         6         20,834         3           minDAFJS25         23,341         6         23,841         6         21,927         7         21,927         7         21,927         7         21,927         7         21,927         7         21,927         7         21,973         4         21,567         2         22,973         4         21,567         2         20,020         2         20,020         2         20,020         2         20,020         2         20,020         2         20,020         2         20,020         2         20,020         2         20,020         2         20,020         2         20,020         2         20,020         2         20,020         2         20,0													
ninDAFJS24         26,839         2         25,788         3         24,253         2         24,164         3         21,714         4           nmiDAFJS24         23,370         1         22,923         4         24,500         1         23,709         3         22,524         1         21,714         4           nmiDAFJS25         23,370         1         22,230         4         20,273         4         18,472         6         20,834         4           nmiDAFJS25         27,086         3         23,145         5         22,145         5         22,153         3         22,334         4         18,814         2         23,175         2         20,125         2         20,126         4         23,736         2         22,973         4         21,356         2         20,700         3           minDAFJS30         26,428         1         21,173         23,173.20         2.80         21,111.00         2.03         21,470.40         3.00         24,435.70         2.77         3         21,375.70         1         33,12         4         33,007         1         32,199         3           mintAFJS01         35,243         1         26,046													
minDAFJS24         26,810         4         24,500         1         23,700         3         22,734         4         20,733         4         20,733         4         10,14,1525           minDAFJS25         22,306         3         22,230         4         20,733         4         10,273         4         18,921         4         18,921         4         18,921         4         18,921         4         18,921         4         18,921         4         18,921         3         22,334         4         20,202         2         20,020         2 </td <td></td>													
minDAPJS26         23,70         1         22,803         3         22,230         4         20,273         4         20,273         4         18,921         4         18,921         4           minDAPJS26         22,306         3         22,030         3         22,034         4         20,273         4         20,273         5         22,013         3         22,344         4           minDAPJS28         23,414         6         23,841         6         23,841         7         21,977         7         21,927         7         20,020         2         20,020         2           minDAFJS29         21,151         1         21,057         2         2,973         4         21,356         2         20,760         3           mean         12         -         30         -         20,364,37         2.7         20,187.67         2.7         21,470.40         3.0         20,364,37         2.3         20,187.67         2.7         1         23,047.4         2           minYFJS01         35,243         1         35,046         2         3,4443         1         31,32         4         30,312         22,047.7         3         42,787.3													
minDAFJS26         22,306         3         22,230         4         20,273         4         18,021         4         18,021         4           minDAFJS27         27,086         3         22,145         5         23,145         5         22,131         5         22,513         3         22,334         4           minDAFJS28         23,841         6         21,927         7         21,927         7         20,020         2         20,020         2         20,020         2         20,020         2         20,020         2         20,020         2         20,020         2         20,020         2         20,020         2         20,020         2         20,070         3         21,376         2         22,376         2         22,773         4         18,501         1         18         18           minVF         Min         Came         #it         Came         #it         Came         #it         Came         #it         Came         33,307         1         32,199         2           minVF         S02         25,636         3         43,787         3         44,783         1         33,31         2         52,635         3													
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$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$		· · · · · · · · · · · · · · · · · · ·	1.75	· · ·	2.80	,	2.03	,	3.00	· ·	2.57	· ·	2.11
	WIIIS	12		00								10	
$\begin{array}{c c c c c c c c c c c c c c c c c c c $			α =	0.1			α =				α =	- 0.3	
miniYFJS02         28,688         1         28,688         1         27,557         1         27,557         1         25,096         1         25,096         1           miniYFJS03         53,381         2         52,098         3         49,111         2         46,806         3         42,787         3         42,787         3           miniYFJS05         26,371         2         25,334         1         24,669         1         24,485         2         24,017         1         24,743 <td>instance</td> <td>Croppe</td> <td><math>\alpha =</math>ed</td> <td>0.1 Reduce</td> <td>ed</td> <td></td> <td></td> <td>: 0.2</td> <td>ed</td> <td>Croppe</td> <td></td> <td></td> <td>ed</td>	instance	Croppe	$\alpha =$ ed	0.1 Reduce	ed			: 0.2	ed	Croppe			ed
miniYFJS03         53,381         2         52,098         3         49,111         2         46,806         3         42,787         3         42,787         3           miniYFJS04         25,394         1         25,394         1         24,669         1         24,485         2         24,017         1         23,774         2           miniYFJS05         26,371         2         25,750         3         25,635         3         24,235         3         24,743         1         23,774         2           miniYFJS06         30,952         1         30,952         1         20,080         1         20,080         1         27,366         1         27,366         1         27,366         1         27,366         1         31,357         1         31,357         1         31,357         1         31,357         1         31,357         1         31,357         1         31,357         1         31,357         1         31,357         1         31,357         1         31,357         1         31,357         1         31,357         1         31,357         1         31,357         1         31,357         1         31,357         1         31,35	instance		ed	Reduce		Croppe	ed	= 0.2 Reduce			ed	Reduce	
miniYFJS0425,394125,394124,469124,485224,017123,7742miniYFJS0526,371225,753324,235324,243124,7431miniYFJS0630,952130,952120,908127,366127,3661miniYFJS0746,782246,089444,137242,578541,737239,2295miniYFJS0833,954237,049236,098236,098234,357134,3571miniYFJS1029,416529,416527,604429,858227,547227,4252miniYFJS1151,212151,219247,079146,939243,254143,2541miniYFJS1339,416532,792530,219430,219425,881325,26194miniYFJS1333,915533,791732,481332,165630,483439,167338,6194miniYFJS1744,181545,491431,284431,284439,187338,5845miniYFJS1744,181533,046741,136531,344633,436633,365333,355533,355533,355533,355533,35		$C_{\text{max}}$	ed #it	Reduce C <sub>max</sub>	#it	Croppe C <sub>max</sub>	ed #it	0.2 Reduce C <sub>max</sub>	#it	$C_{\rm max}$	ed #it	Reduce C <sub>max</sub>	#it
miniYFJS05         26.371         2         25,750         3         25,635         3         24,235         3         24,743         1         24,743         1           miniYFJS06         30,952         1         30,952         1         20,900         1         27,366         1         27,366         1         27,366         1         27,366         1         27,366         1         27,366         1         30,229         5           miniYFJS07         46,782         2         33,883         3         31,992         2         31,597         4         30,276         2         29,631         4           miniYFJS10         29,416         5         27,604         4         29,858         2         27,547         1         34,357         1         34,357         1         34,357         1         34,357         1         34,357         1         34,354         4         29,858         2         27,547         1         44,3264         1         44,3264         1         44,3264         1         44,3264         1         44,3264         30,417         4         31,244         4         31,244         4         31,245         4         31,314	miniYFJS01	C <sub>max</sub> 35,243	ed #it 1	Reduce C <sub>max</sub> 35,046	#it 2	Croppe C <sub>max</sub> 34,443	ed #it 1	0.2 Reduce C <sub>max</sub> 33,132	#it 4	C <sub>max</sub> 33,697	ed #it 1	Reduce C <sub>max</sub> 32,199	#it 2
miniYFJS05         26.371         2         25,750         3         25,635         3         24,235         3         24,743         1         24,743         1           miniYFJS06         30,952         1         30,952         1         20,900         1         27,366         1         27,366         1         27,366         1         27,366         1         27,366         1         27,366         1         30,229         5           miniYFJS07         46,782         2         33,883         3         31,992         2         31,597         4         30,276         2         29,631         4           miniYFJS10         29,416         5         27,604         4         29,858         2         27,547         1         34,357         1         34,357         1         34,357         1         34,357         1         34,357         1         34,354         4         29,858         2         27,547         1         44,3264         1         44,3264         1         44,3264         1         44,3264         1         44,3264         30,417         4         31,244         4         31,244         4         31,245         4         31,314	miniYFJS01 miniYFJS02	C <sub>max</sub> 35,243 28,688	ed #it 1 1	Reduce C <sub>max</sub> 35,046 28,688	#it 2 1	Croppe C <sub>max</sub> 34,443 27,557	ed #it 1 1	0.2 Reduce C <sub>max</sub> 33,132 27,557	#it 4 1	C <sub>max</sub> 33,697 25,969	ed #it 1 1	Reduce C <sub>max</sub> 32,199 25,969	#it 2 1
miniYFJS07         46,782         2         46,089         4         44,137         2         42,578         5         41,737         2         39,229         5           miniYFJS08         33,954         2         33,883         3         31,992         2         31,597         4         30,276         2         29,631         4           miniYFJS00         29,416         5         29,604         4         29,858         2         27,547         2         27,425         2           miniYFJS10         29,416         5         29,041         5         33,404         5         29,989         2         47,425         1         43,254         1           miniYFJS13         32,915         5         32,792         5         30,219         4         30,219         4         28,813         3         25,619         4           miniYFJS14         31,826         6         31,284         4         31,284         4         28,131         6         28,131         6         28,131         6         28,131         6         30,43         2         30,415         4         44,306         3         24,153         33,416         6         30,415	miniYFJS01 miniYFJS02 miniYFJS03	C <sub>max</sub> 35,243 28,688 53,381	ed #it 1 1 2	$\frac{Reduce}{C_{max}} \\ \frac{35,046}{28,688} \\ 52,098 \\ \end{array}$	#it 2 1 3	Croppe C <sub>max</sub> 34,443 27,557 49,111	ed #it 1 1 2	$\begin{array}{c} 0.2 \\ \hline \\ Reduce \\ \hline \\ C_{max} \\ 33,132 \\ 27,557 \\ 46,806 \\ \end{array}$	#it 4 1 3	$C_{max}$ 33,697 25,969 42,787	ed #it 1 1 3	$\begin{array}{r} {\rm Reduce} \\ \hline C_{\rm max} \\ 32,199 \\ 25,969 \\ 42,787 \end{array}$	#it 2 1 3
miniYFJS08         33,954         2         33,883         3         31,992         2         31,597         4         30,276         2         29,631         4           miniYFJS09         37,049         2         37,049         2         36,098         2         36,098         2         34,357         1         34,357         1           miniYFJS10         29,116         5         27,040         4         29,858         2         47,677         1         46,939         2         43,254         1         43,254         1         43,254         1         43,254         1         43,254         1         43,254         1         43,254         1         43,254         1         43,254         1         43,254         1         43,254         1         43,254         1         43,254         1         43,254         1         43,254         1         54,813         32,165         3         32,165         1         31,241         4         31,244         4         31,245         4         31,245         4         31,413         3         36,619         4         42,306         3         32,145         3         32,165         3         33,3791         7 </td <td>miniYFJS01 miniYFJS02 miniYFJS03 miniYFJS04</td> <td><math display="block">\begin{array}{c} C_{\rm max} \\ \hline \\ 35,243 \\ 28,688 \\ 53,381 \\ 25,394 \end{array}</math></td> <td>ed #it 1 1 2 1</td> <td>Reduce C<sub>max</sub> 35,046 28,688 52,098 25,394</td> <td>#it 2 1 3 1</td> <td><math display="block">\begin{array}{c} Croppo \\ \hline C_{max} \\ 34,443 \\ 27,557 \\ 49,111 \\ 24,669 \end{array}</math></td> <td>ed #it 1 1 2 1</td> <td><math display="block">\begin{array}{c} 0.2 \\ \hline \\ Reduce \\ C_{max} \\ \hline \\ 33,132 \\ 27,557 \\ 46,806 \\ 24,485 \\ \end{array}</math></td> <td>#it 4 1 3 2</td> <td><math display="block">\begin{array}{c} C_{\rm max} \\ \hline 33,697 \\ 25,969 \\ 42,787 \\ 24,017 \end{array}</math></td> <td>ed #it 1 1 3 1</td> <td>Reduce           Cmax           32,199           25,969           42,787           23,774</td> <td>#it 2 1 3 2</td>	miniYFJS01 miniYFJS02 miniYFJS03 miniYFJS04	$\begin{array}{c} C_{\rm max} \\ \hline \\ 35,243 \\ 28,688 \\ 53,381 \\ 25,394 \end{array}$	ed #it 1 1 2 1	Reduce C <sub>max</sub> 35,046 28,688 52,098 25,394	#it 2 1 3 1	$\begin{array}{c} Croppo \\ \hline C_{max} \\ 34,443 \\ 27,557 \\ 49,111 \\ 24,669 \end{array}$	ed #it 1 1 2 1	$\begin{array}{c} 0.2 \\ \hline \\ Reduce \\ C_{max} \\ \hline \\ 33,132 \\ 27,557 \\ 46,806 \\ 24,485 \\ \end{array}$	#it 4 1 3 2	$\begin{array}{c} C_{\rm max} \\ \hline 33,697 \\ 25,969 \\ 42,787 \\ 24,017 \end{array}$	ed #it 1 1 3 1	Reduce           Cmax           32,199           25,969           42,787           23,774	#it 2 1 3 2
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	miniYFJS01 miniYFJS02 miniYFJS03 miniYFJS04 miniYFJS05	$\begin{array}{c} C_{\rm max} \\ 35,243 \\ 28,688 \\ 53,381 \\ 25,394 \\ 26,371 \end{array}$	ed #it 1 2 1 2	$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$	#it 2 1 3 1 3	$\begin{array}{c} Croppe \\ \hline C_{max} \\ 34,443 \\ 27,557 \\ 49,111 \\ 24,669 \\ 25,635 \\ \end{array}$	ed #it 1 2 1 3	$\begin{array}{c} 0.2 \\ \hline \\ Reduce \\ C_{max} \\ \hline \\ 33,132 \\ 27,557 \\ 46,806 \\ 24,485 \\ 24,235 \\ \end{array}$	#it 4 1 3 2 3	$\begin{array}{c} C_{\rm max} \\ \hline \\ 33,697 \\ 25,969 \\ 42,787 \\ 24,017 \\ 24,743 \end{array}$	ed #it 1 3 1 1	$\begin{array}{r} {\rm Reduce} \\ \hline C_{\rm max} \\ 32,199 \\ 25,969 \\ 42,787 \\ 23,774 \\ 24,743 \end{array}$	#it 2 1 3 2 1
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	miniYFJS01 miniYFJS02 miniYFJS03 miniYFJS04 miniYFJS05 miniYFJS06	$\begin{array}{c} C_{\rm max} \\ 35,243 \\ 28,688 \\ 53,381 \\ 25,394 \\ 26,371 \\ 30,952 \end{array}$	ed #it 1 2 1 2 1 2 1	$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$	#it 2 1 3 1 3 1 1	$\begin{array}{c} Croppe \\ \hline C_{max} \\ 34,443 \\ 27,557 \\ 49,111 \\ 24,669 \\ 25,635 \\ 29,080 \\ \end{array}$	ed #it 1 2 1 3 1	$\begin{array}{c} 0.2 \\ \hline \\ Reduce \\ \hline \\ C_{max} \\ 33,132 \\ 27,557 \\ 46,806 \\ 24,485 \\ 24,235 \\ 29,080 \\ \end{array}$	#it 4 1 3 2 3 1	$\begin{array}{c} C_{\rm max} \\ 33,697 \\ 25,969 \\ 42,787 \\ 24,017 \\ 24,743 \\ 27,366 \end{array}$	ed #it 1 3 1 1 1 1	$\begin{array}{r} \text{Reduce} \\ \hline C_{\text{max}} \\ 32,199 \\ 25,969 \\ 42,787 \\ 23,774 \\ 24,743 \\ 27,366 \\ \end{array}$	#it 2 1 3 2 1 1 1
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	miniYFJS01 miniYFJS02 miniYFJS03 miniYFJS04 miniYFJS05 miniYFJS06 miniYFJS07	$\begin{array}{r} \hline C_{\rm max} \\ 35,243 \\ 28,688 \\ 53,381 \\ 25,394 \\ 26,371 \\ 30,952 \\ 46,782 \end{array}$	ed #it 1 2 1 2 1 2 1 2	$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$	#it 2 1 3 1 3 1 4	$\begin{array}{c} \hline \\ Croppe\\ \hline C_{max}\\ 34,443\\ 27,557\\ 49,111\\ 24,669\\ 25,635\\ 29,080\\ 44,137\\ \end{array}$	ed #it 1 2 1 3 1 2	$\begin{array}{c} 0.2 \\ \hline \\ Reduce \\ \hline \\ C_{max} \\ 33,132 \\ 27,557 \\ 46,806 \\ 24,485 \\ 24,235 \\ 29,080 \\ 42,578 \\ \end{array}$	#it 4 1 3 2 3 1 5	$\begin{array}{c} C_{\rm max} \\ 33,697 \\ 25,969 \\ 42,787 \\ 24,017 \\ 24,743 \\ 27,366 \\ 41,737 \end{array}$	ed #it 1 3 1 1 1 2	$\begin{array}{c} \text{Reduce} \\ \hline C_{\text{max}} \\ 32,199 \\ 25,969 \\ 42,787 \\ 23,774 \\ 24,743 \\ 27,366 \\ 39,229 \end{array}$	#it 2 1 3 2 1 1 5
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	miniYFJS01 miniYFJS02 miniYFJS03 miniYFJS05 miniYFJS06 miniYFJS06 miniYFJS07 miniYFJS08	$\begin{array}{c} \hline C_{\rm max} \\ 35,243 \\ 28,688 \\ 53,381 \\ 25,394 \\ 26,371 \\ 30,952 \\ 46,782 \\ 33,954 \end{array}$	ed #it 1 2 1 2 1 2 2 2	$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$	#it 2 1 3 1 3 1 4 3	$\begin{array}{c} Croppe \\ \hline C_{max} \\ 34,443 \\ 27,557 \\ 49,111 \\ 24,669 \\ 25,635 \\ 29,080 \\ 44,137 \\ 31,992 \end{array}$	ed #it 1 2 1 3 1 2 2 2	$\begin{array}{c} 0.2 \\ \hline \\ Reduce \\ C_{max} \\ 33,132 \\ 27,557 \\ 46,806 \\ 24,485 \\ 24,235 \\ 29,080 \\ 42,578 \\ 31,597 \\ \end{array}$	#it 4 1 3 2 3 1 5 4	$\begin{array}{c} \hline C_{\rm max} \\ 33,697 \\ 25,969 \\ 42,787 \\ 24,017 \\ 24,743 \\ 27,366 \\ 41,737 \\ 30,276 \\ \end{array}$	ed #it 1 3 1 1 1 2 2	$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$	#it 2 1 3 2 1 1 5 4
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	miniYFJS01 miniYFJS02 miniYFJS03 miniYFJS04 miniYFJS06 miniYFJS07 miniYFJS08 miniYFJS08 miniYFJS09	$\begin{array}{c} \hline C_{\rm max} \\ \hline 35,243 \\ 28,688 \\ 53,381 \\ 25,394 \\ 26,371 \\ 30,952 \\ 46,782 \\ 33,954 \\ 37,049 \\ \end{array}$	ed #it 1 2 1 2 1 2 2 2 2	$\begin{array}{r} {\rm Reduce} \\ \hline C_{\rm max} \\ \hline 35,046 \\ 28,688 \\ 52,098 \\ 25,394 \\ 25,750 \\ 30,952 \\ 46,089 \\ 33,883 \\ 37,049 \\ \end{array}$	#it 2 1 3 1 3 1 4 3 2 5	$\begin{array}{c} Croppe\\ \hline C_{max} \\ 34,443 \\ 27,557 \\ 49,111 \\ 24,669 \\ 25,635 \\ 29,080 \\ 44,137 \\ 31,992 \\ 36,098 \end{array}$	ed #it 1 2 1 3 1 2 2 2 2	$\begin{array}{c} 0.2 \\ \hline Reduce \\ \hline C_{max} \\ 33,132 \\ 27,557 \\ 46,806 \\ 24,485 \\ 24,235 \\ 29,080 \\ 42,578 \\ 31,597 \\ 36,098 \\ \end{array}$	#it 4 1 3 2 3 1 5 4 2 2 2	$\begin{array}{c} \hline C_{\rm max} \\ \hline 33,697 \\ 25,969 \\ 42,787 \\ 24,017 \\ 24,743 \\ 27,366 \\ 41,737 \\ 30,276 \\ 34,357 \\ \end{array}$	ed #it 1 3 1 1 1 2 2 1	$\begin{array}{c} \text{Reduce} \\ \hline C_{\text{max}} \\ \hline 32,199 \\ 25,969 \\ 42,787 \\ 23,774 \\ 24,743 \\ 27,366 \\ 39,229 \\ 29,631 \\ 34,357 \\ \end{array}$	#it 2 1 3 2 1 1 5 4 1 2
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	miniYFJS01 miniYFJS02 miniYFJS03 miniYFJS05 miniYFJS06 miniYFJS06 miniYFJS08 miniYFJS09 miniYFJS10	$\begin{array}{c} \hline C_{\rm max} \\ \hline 35,243 \\ 28,688 \\ 53,381 \\ 25,394 \\ 26,371 \\ 30,952 \\ 46,782 \\ 33,954 \\ 37,049 \\ 29,416 \\ \end{array}$	ed #it 1 2 1 2 1 2 2 2 5	$\begin{array}{r} \text{Reduce} \\ \hline C_{\max} \\ \hline 35,046 \\ 28,688 \\ 52,098 \\ 25,394 \\ 25,750 \\ 30,952 \\ 46,089 \\ 33,883 \\ 37,049 \\ 29,416 \\ \end{array}$	#it 2 1 3 1 3 1 4 3 2 5	$\begin{array}{c} Croppe \\ \hline C_{max} \\ 34,443 \\ 27,557 \\ 49,111 \\ 24,669 \\ 25,635 \\ 29,080 \\ 44,137 \\ 31,992 \\ 36,098 \\ 27,604 \end{array}$	ed #it 1 2 1 3 1 2 2 2 4	$\begin{array}{c} 0.2 \\ \hline Reduce \\ \hline C_{max} \\ 33,132 \\ 27,557 \\ 46,806 \\ 24,485 \\ 24,235 \\ 29,080 \\ 42,578 \\ 31,597 \\ 36,098 \\ 29,858 \\ \end{array}$	#it 4 1 3 2 3 1 5 4 2 2 2	$\begin{array}{c} \hline C_{\rm max} \\ \hline 33,697 \\ 25,969 \\ 42,787 \\ 24,017 \\ 24,743 \\ 27,366 \\ 41,737 \\ 30,276 \\ 34,357 \\ 27,547 \\ \end{array}$	ed #it 1 3 1 1 1 2 2 1 2	$\begin{array}{r} \text{Reduce} \\ \hline C_{\text{max}} \\ \hline 32,199 \\ 25,969 \\ 42,787 \\ 23,774 \\ 24,743 \\ 27,366 \\ 39,229 \\ 29,631 \\ 34,357 \\ 27,425 \\ \end{array}$	#it 2 1 3 2 1 1 5 4 1 2
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	miniYFJS01 miniYFJS02 miniYFJS03 miniYFJS04 miniYFJS06 miniYFJS06 miniYFJS07 miniYFJS08 miniYFJS00 miniYFJS10 miniYFJS11	$\begin{array}{c} \hline C_{\rm max} \\ \hline 35,243 \\ 28,688 \\ 53,381 \\ 25,394 \\ 26,371 \\ 30,952 \\ 46,782 \\ 33,954 \\ 37,049 \\ 29,416 \\ 51,212 \\ \end{array}$	$ \begin{array}{r} \text{ed} \\ \hline \#\text{it} \\ \hline 1 \\ 1 \\ 2 \\ 1 \\ 2 \\ 1 \\ 2 \\ 2 \\ 2 \\ 5 \\ 1 \\ \end{array} $	$\begin{array}{r} {\rm Reduce} \\ \hline C_{\rm max} \\ 35,046 \\ 28,688 \\ 52,098 \\ 25,394 \\ 25,750 \\ 30,952 \\ 46,089 \\ 33,883 \\ 37,049 \\ 29,416 \\ 51,129 \\ \end{array}$	#it 2 1 3 1 3 1 4 3 2 5 2	$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$	$ \begin{array}{c}                                     $	$\begin{array}{c} 0.2\\ \hline Reduce\\ \hline C_{max}\\ 33,132\\ 27,557\\ 46,806\\ 24,485\\ 24,235\\ 29,080\\ 42,578\\ 31,597\\ 36,098\\ 29,858\\ 46,939\\ \end{array}$	#it 4 1 3 2 3 1 5 4 2 2 2 2	$\begin{array}{c} \hline C_{\rm max} \\ \hline 33,697 \\ 25,969 \\ 42,787 \\ 24,017 \\ 24,743 \\ 27,366 \\ 41,737 \\ 30,276 \\ 34,357 \\ 27,547 \\ 43,254 \\ \end{array}$	ed #it 1 3 1 1 1 2 2 1 2 1 2 1	$\begin{array}{r} \text{Reduce} \\ \hline C_{\max} \\ 32,199 \\ 25,969 \\ 42,787 \\ 23,774 \\ 24,743 \\ 27,366 \\ 39,229 \\ 29,631 \\ 34,357 \\ 27,425 \\ 43,254 \\ \end{array}$	#it 2 1 3 2 1 1 5 4 1 2 1 2 1
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	miniYFJS01 miniYFJS02 miniYFJS03 miniYFJS05 miniYFJS05 miniYFJS07 miniYFJS07 miniYFJS09 miniYFJS10 miniYFJS11 miniYFJS11	$\begin{array}{c} \hline C_{\rm max} \\ \hline 35,243 \\ 28,688 \\ 53,381 \\ 25,394 \\ 26,371 \\ 30,952 \\ 46,782 \\ 33,954 \\ 37,049 \\ 29,416 \\ 51,212 \\ 36,343 \\ \end{array}$	$\begin{array}{r} \text{ed} \\ \hline \#\text{it} \\ 1 \\ 2 \\ 1 \\ 2 \\ 1 \\ 2 \\ 2 \\ 2 \\ 5 \\ 1 \\ 4 \\ 5 \end{array}$	$\begin{array}{r} {\rm Reduce} \\ \hline C_{\rm max} \\ 35,046 \\ 28,688 \\ 52,098 \\ 25,394 \\ 25,750 \\ 30,952 \\ 46,089 \\ 33,883 \\ 37,049 \\ 29,416 \\ 51,129 \\ 36,343 \\ \end{array}$	#it 2 1 3 1 3 1 4 3 2 5 2 4	Croppi           Cmax           34,443           27,557           49,111           24,669           25,635           29,080           44,137           31,992           36,098           27,604           47,079           33,404           30,219	$ \frac{\text{ad}}{\text{#it}} \\ \frac{\text{#it}}{1} \\ 1 \\ 2 \\ 1 \\ 3 \\ 1 \\ 2 \\ 2 \\ 4 \\ 1 \\ 5 \\ 4 $	$\begin{array}{c} 0.2\\ \hline \\ Reduce\\ \hline \\ C_{max}\\ \hline \\ 33,132\\ 27,557\\ 46,806\\ 24,485\\ 24,235\\ 29,080\\ 42,578\\ 31,597\\ 36,098\\ 29,858\\ 46,939\\ 33,404\\ \end{array}$	#it 4 1 3 2 3 1 5 4 2 2 2 5 4	$\begin{array}{c} \hline C_{\rm max} \\ \hline 33,697 \\ 25,969 \\ 42,787 \\ 24,017 \\ 24,743 \\ 27,366 \\ 41,737 \\ 30,276 \\ 34,357 \\ 27,547 \\ 43,254 \\ 29,989 \\ \end{array}$	$     \frac{\text{ed}}{\text{#it}}     \frac{1}{1}     1     1     1     1     1     2     2     1     2     1     5     5   $	$\begin{array}{r} \text{Reduce} \\ \hline C_{\text{max}} \\ \hline 32,199 \\ 25,969 \\ 42,787 \\ 23,774 \\ 24,743 \\ 27,366 \\ 39,229 \\ 29,631 \\ 34,357 \\ 27,425 \\ 43,254 \\ 29,989 \\ \end{array}$	#it 2 1 3 2 1 1 5 4 1 2 1 5 4 1 5 4
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	miniYFJS01 miniYFJS03 miniYFJS03 miniYFJS04 miniYFJS06 miniYFJS06 miniYFJS09 miniYFJS09 miniYFJS10 miniYFJS11 miniYFJS13	$\begin{array}{c} \hline C_{\rm max} \\ \hline 35,243 \\ 28,688 \\ 53,381 \\ 25,394 \\ 26,371 \\ 30,952 \\ 46,782 \\ 33,954 \\ 37,049 \\ 29,416 \\ 51,212 \\ 36,343 \\ 32,915 \\ \end{array}$	$\begin{array}{r} \text{ed} \\ \hline \#\text{it} \\ 1 \\ 2 \\ 1 \\ 2 \\ 1 \\ 2 \\ 2 \\ 2 \\ 5 \\ 1 \\ 4 \\ 5 \end{array}$	$\begin{array}{r} {\rm Reduce} \\ \hline C_{\rm max} \\ \hline 35,046 \\ 28,688 \\ 52,098 \\ 25,394 \\ 25,750 \\ 30,952 \\ 46,089 \\ 33,883 \\ 37,049 \\ 29,416 \\ 51,129 \\ 36,343 \\ 32,792 \\ \end{array}$	#it 2 1 3 1 3 1 4 3 2 5 2 4 5	Croppi           Cmax           34,443           27,557           49,111           24,669           25,635           29,080           44,137           31,992           36,098           27,604           47,079           33,404           30,219	$ \frac{\text{ad}}{\text{#it}} \\ \frac{\text{#it}}{1} \\ 1 \\ 2 \\ 1 \\ 3 \\ 1 \\ 2 \\ 2 \\ 4 \\ 1 \\ 5 \\ 4 $	$\begin{array}{c c} 0.2 \\\hline & \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ $	#it 4 1 3 2 3 1 5 4 2 2 2 5 4	$\begin{array}{c} \hline C_{\rm max} \\ \hline 33,697 \\ 25,969 \\ 42,787 \\ 24,017 \\ 24,017 \\ 24,743 \\ 27,366 \\ 41,737 \\ 30,276 \\ 34,357 \\ 27,547 \\ 43,254 \\ 29,989 \\ 25,881 \\ \end{array}$	$     \frac{\text{ed}}{\text{#it}}     \frac{1}{1}     1     1     1     1     1     2     2     1     2     1     5     3     3 $	$\begin{tabular}{ c c c c c c c } \hline Reduct \\ \hline $C_{max}$ \\ \hline $32,199$ \\ $25,969$ \\ $42,787$ \\ $23,774$ \\ $24,743$ \\ $27,746$ \\ $39,229$ \\ $29,631$ \\ $34,357$ \\ $27,425$ \\ $43,254$ \\ $29,989$ \\ $25,619$ \\ \hline \end{tabular}$	#it 2 1 3 2 1 1 5 4 1 2 1 5 4 1 5 4
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	miniYFJS01 miniYFJS03 miniYFJS03 miniYFJS05 miniYFJS05 miniYFJS07 miniYFJS07 miniYFJS10 miniYFJS10 miniYFJS11 miniYFJS13 miniYFJS13	$\begin{array}{c} \hline C_{\rm max} \\ \hline 35,243 \\ 28,688 \\ 53,381 \\ 25,394 \\ 26,371 \\ 30,952 \\ 46,782 \\ 33,954 \\ 37,049 \\ 29,416 \\ 51,212 \\ 36,343 \\ 32,915 \\ 31,826 \\ \end{array}$	$\begin{array}{c} \text{ed} \\ \hline \#\text{it} \\ 1 \\ 1 \\ 2 \\ 1 \\ 2 \\ 1 \\ 2 \\ 2 \\ 2 \\ 5 \\ 1 \\ 4 \\ 5 \\ 6 \end{array}$	$\begin{array}{c} {\rm Reduct} \\ \hline C_{\rm max} \\ 35,046 \\ 28,688 \\ 52,098 \\ 25,394 \\ 25,750 \\ 30,952 \\ 46,089 \\ 33,883 \\ 37,049 \\ 29,416 \\ 51,129 \\ 36,343 \\ 32,792 \\ 31,826 \\ \end{array}$	$ \begin{array}{r} \#it \\ 2 \\ 1 \\ 3 \\ 1 \\ 3 \\ 1 \\ 4 \\ 3 \\ 2 \\ 5 \\ 2 \\ 4 \\ 5 \\ 6 \\ \end{array} $	$\begin{array}{c} Croppe\\ C_{max}\\ 34,443\\ 27,557\\ 49,111\\ 24,669\\ 25,635\\ 29,080\\ 44,137\\ 31,992\\ 36,098\\ 27,604\\ 47,079\\ 33,404\\ 30,219\\ 31,284\\ \end{array}$	$ \begin{array}{c} \text{ad} \\ \hline \#\text{it} \\ 1 \\ 1 \\ 2 \\ 1 \\ 3 \\ 1 \\ 2 \\ 2 \\ 2 \\ 4 \\ 1 \\ 5 \\ 4 \\ 4 \end{array} $	$\begin{array}{c c} 0.2 \\\hline & \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ $	#it 4 1 3 2 3 1 5 4 2 2 2 5 4 4 4	$\begin{array}{c} \hline C_{\rm max} \\ \hline 33,697 \\ 25,969 \\ 42,787 \\ 24,017 \\ 24,743 \\ 27,366 \\ 41,737 \\ 30,276 \\ 34,357 \\ 27,547 \\ 43,254 \\ 29,989 \\ 25,881 \\ 28,131 \\ \end{array}$	$\begin{array}{c} \text{ed} \\ \hline \#\text{it} \\ 1 \\ 1 \\ 3 \\ 1 \\ 1 \\ 1 \\ 2 \\ 2 \\ 1 \\ 2 \\ 1 \\ 5 \\ 3 \\ 6 \end{array}$	$\begin{array}{c} {\rm Reduce} \\ \hline C_{\rm max} \\ 32,199 \\ 25,969 \\ 42,787 \\ 23,774 \\ 24,743 \\ 27,366 \\ 39,229 \\ 29,631 \\ 34,357 \\ 27,425 \\ 43,254 \\ 43,254 \\ 29,989 \\ 25,619 \\ 28,131 \\ \end{array}$	$ \begin{array}{c} \# it \\ 2 \\ 1 \\ 3 \\ 2 \\ 1 \\ 1 \\ 5 \\ 4 \\ 1 \\ 5 \\ 4 \\ 6 \\ 4 \end{array} $
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	miniYFJS01 miniYFJS03 miniYFJS03 miniYFJS05 miniYFJS05 miniYFJS07 miniYFJS07 miniYFJS07 miniYFJS09 miniYFJS10 miniYFJS11 miniYFJS11 miniYFJS14 miniYFJS14	$\begin{array}{c} \hline C_{\rm max} \\ \hline 35,243 \\ 28,688 \\ 53,381 \\ 25,394 \\ 26,371 \\ 30,952 \\ 46,782 \\ 33,954 \\ 37,049 \\ 29,416 \\ 51,212 \\ 36,343 \\ 32,915 \\ 31,826 \\ 45,597 \\ \end{array}$	$\begin{array}{c} \text{ed} \\ \hline \#\text{it} \\ 1 \\ 1 \\ 2 \\ 1 \\ 2 \\ 1 \\ 2 \\ 2 \\ 5 \\ 1 \\ 4 \\ 5 \\ 6 \\ 3 \end{array}$	$\begin{array}{c} \mbox{Reduce} \\ \hline C_{max} \\ \hline 35,046 \\ 28,688 \\ 52,098 \\ 25,304 \\ 25,730 \\ 30,952 \\ 46,089 \\ 33,883 \\ 37,049 \\ 29,416 \\ 51,129 \\ 36,343 \\ 32,792 \\ 31,826 \\ 45,442 \\ \end{array}$	#it     2     1     3     1     3     1     4     3     2     5     2     4     5     6     4     4	$\begin{array}{c} Croppp\\ C_{max}\\ 34,443\\ 27,557\\ 49,111\\ 24,669\\ 25,635\\ 29,080\\ 44,137\\ 31,992\\ 36,098\\ 27,604\\ 44,137\\ 31,992\\ 36,098\\ 27,604\\ 47,079\\ 33,404\\ 30,219\\ 31,284\\ 42,306\\ \end{array}$	$ \begin{array}{r} \text{ad} \\ \hline \#\text{it} \\ 1 \\ 1 \\ 2 \\ 1 \\ 3 \\ 1 \\ 2 \\ 2 \\ 2 \\ 4 \\ 1 \\ 5 \\ 4 \\ 4 \\ 3 \\ \end{array} $	$\begin{array}{c} 0.2 \\ \hline \\ \text{Reduct} \\ \hline \\ C_{\text{max}} \\ \hline \\ 33,132 \\ 27,557 \\ 46,806 \\ 24,485 \\ 24,485 \\ 24,2578 \\ 31,597 \\ 36,098 \\ 29,858 \\ 46,939 \\ 33,404 \\ 30,219 \\ 31,284 \\ 41,893 \\ \end{array}$	#it     4     1     3     2     3     1     5     4     2     2     5     4     4     4	$\begin{array}{c} C_{max} \\ \hline \\ 33,697 \\ 25,969 \\ 42,787 \\ 24,017 \\ 24,743 \\ 27,566 \\ 41,737 \\ 30,276 \\ 34,357 \\ 27,547 \\ 29,989 \\ 25,881 \\ 29,989 \\ 25,881 \\ 28,131 \\ 8,187 \end{array}$	$\begin{array}{c} \text{ed} \\ \hline \#\text{it} \\ 1 \\ 1 \\ 3 \\ 1 \\ 1 \\ 1 \\ 2 \\ 2 \\ 1 \\ 2 \\ 1 \\ 5 \\ 3 \\ 6 \\ 3 \\ \end{array}$	$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$	$ \begin{array}{c} \# it \\ 2 \\ 1 \\ 3 \\ 2 \\ 1 \\ 1 \\ 5 \\ 4 \\ 1 \\ 5 \\ 4 \\ 6 \\ 4 \end{array} $
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	miniYFJS01 miniYFJS03 miniYFJS03 miniYFJS04 miniYFJS06 miniYFJS06 miniYFJS00 miniYFJS09 miniYFJS10 miniYFJS11 miniYFJS11 miniYFJS13 miniYFJS15 miniYFJS15	$\begin{array}{c} \hline C_{max} \\ \hline 35,243 \\ 28,688 \\ 53,381 \\ 25,394 \\ 26,371 \\ 30,952 \\ 33,954 \\ 37,049 \\ 29,416 \\ 31,925 \\ 31,826 \\ 31,826 \\ 31,826 \\ 33,965 \\ \end{array}$	$\begin{array}{c} \text{ed} \\ \hline \#\text{it} \\ 1 \\ 1 \\ 2 \\ 1 \\ 2 \\ 1 \\ 2 \\ 2 \\ 5 \\ 1 \\ 4 \\ 5 \\ 6 \\ 3 \\ 3 \end{array}$	$\begin{array}{c} \mbox{Reduce} \\ \hline C_{max} \\ \hline 35,046 \\ 28,688 \\ 52,098 \\ 25,750 \\ 30,952 \\ 46,089 \\ 33,952 \\ 46,089 \\ 33,952 \\ 37,049 \\ 29,416 \\ 51,129 \\ 36,343 \\ 32,792 \\ 31,826 \\ 45,442 \\ 33,791 \\ \end{array}$	$ \begin{array}{c} \# it \\ 2 \\ 1 \\ 3 \\ 1 \\ 4 \\ 3 \\ 2 \\ 5 \\ 2 \\ 4 \\ 5 \\ 6 \\ 4 \\ 7 \\ \end{array} $	$\begin{tabular}{ c c c c c } \hline Croppy \\ \hline C_{max} & 34,443 \\ 27,557 & 49,011 \\ 24,669 & 25,635 \\ 29,080 & 44,137 \\ 31,992 & 36,098 \\ 27,604 & 47,079 \\ 33,404 & 47,079 \\ 33,404 & 47,079 \\ 33,404 & 42,306 \\ 30,219 & 31,284 \\ 42,306 & 32,481 \\ \end{tabular}$	$\begin{array}{c} \text{ed} \\ \hline \#\text{it} \\ 1 \\ 1 \\ 2 \\ 1 \\ 3 \\ 1 \\ 2 \\ 2 \\ 2 \\ 4 \\ 1 \\ 5 \\ 4 \\ 4 \\ 3 \\ 3 \end{array}$	$\begin{array}{c} 0.2 \\ \hline 0.2 \\ \hline Reduct \\ C_{max} \\ 33,132 \\ 27,557 \\ 46,806 \\ 24,485 \\ 24,235 \\ 29,080 \\ 42,578 \\ 31,597 \\ 36,098 \\ 29,858 \\ 46,939 \\ 33,404 \\ 46,893 \\ 33,219 \\ 31,284 \\ 41,893 \\ 32,165 \\ \end{array}$	$ \begin{array}{c} \# it \\ 4 \\ 1 \\ 3 \\ 2 \\ 3 \\ 1 \\ 5 \\ 4 \\ 2 \\ 2 \\ 5 \\ 4 \\ 4 \\ 6 \\ \end{array} $	$\begin{array}{c} C_{max} \\ \hline \\ 33,697 \\ 25,969 \\ 42,787 \\ 24,017 \\ 24,743 \\ 27,666 \\ 41,737 \\ 30,276 \\ 34,357 \\ 27,547 \\ 43,254 \\ 29,989 \\ 25,881 \\ 29,989 \\ 25,881 \\ 29,187 \\ 39,187 \\ 30,483 \end{array}$	$\begin{array}{c} \text{ed} \\ \hline \#\text{it} \\ 1 \\ 1 \\ 3 \\ 1 \\ 1 \\ 1 \\ 2 \\ 2 \\ 1 \\ 2 \\ 1 \\ 5 \\ 3 \\ 6 \\ 3 \\ 2 \\ \end{array}$	$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$	$ \begin{array}{c} \# it \\ 2 \\ 1 \\ 3 \\ 2 \\ 1 \\ 1 \\ 5 \\ 4 \\ 1 \\ 5 \\ 4 \\ 6 \\ 4 \\ 2 \\ \end{array} $
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	miniYFJS01 miniYFJS03 miniYFJS03 miniYFJS06 miniYFJS06 miniYFJS06 miniYFJS08 miniYFJS10 miniYFJS11 miniYFJS13 miniYFJS13 miniYFJS13 miniYFJS15 miniYFJS15 miniYFJS15	$\begin{array}{c} \hline C_{max} \\ 35,243 \\ 28,688 \\ 53,381 \\ 25,394 \\ 26,371 \\ 30,952 \\ 46,782 \\ 33,954 \\ 37,049 \\ 29,416 \\ 51,212 \\ 36,343 \\ 32,915 \\ 31,826 \\ 45,597 \\ 33,965 \\ 33,965 \\ 33,965 \\ 33,965 \\ 34,181 \\ \end{array}$	$ \begin{array}{r} \text{ed} \\ \hline \#\text{it} \\ 1 \\ 1 \\ 2 \\ 1 \\ 2 \\ 2 \\ 2 \\ 2 \\ 5 \\ 1 \\ 4 \\ 5 \\ 6 \\ 3 \\ 3 \\ 5 \\ \end{array} $	$\begin{array}{c} \mbox{Reduce} \\ \hline C_{max} \\ \hline 35,046 \\ 28,688 \\ 52,098 \\ 25,750 \\ 30,952 \\ 46,089 \\ 33,883 \\ 37,049 \\ 29,416 \\ 51,129 \\ 36,343 \\ 32,792 \\ 31,826 \\ 45,442 \\ 33,701 \\ 33,701 \\ 44,044 \\ \end{array}$	$ \begin{array}{r} \#it \\ 2 \\ 1 \\ 3 \\ 1 \\ 3 \\ 1 \\ 4 \\ 3 \\ 2 \\ 5 \\ 2 \\ 4 \\ 5 \\ 6 \\ 4 \\ 7 \\ 7 \end{array} $	$\begin{array}{c} Croppe\\ C_{max}\\ 34,443\\ 27,557\\ 49,111\\ 24,669\\ 25,635\\ 29,080\\ 44,137\\ 31,992\\ 36,098\\ 27,604\\ 47,079\\ 33,404\\ 30,219\\ 31,284\\ 42,306\\ 32,481\\ 41,316\end{array}$	$\begin{array}{c} \text{ed} \\ \hline \#\text{it} \\ 1 \\ 1 \\ 2 \\ 1 \\ 3 \\ 1 \\ 2 \\ 2 \\ 2 \\ 4 \\ 1 \\ 5 \\ 4 \\ 4 \\ 3 \\ 5 \\ \end{array}$	$\begin{array}{c} 0.2 \\ \hline 0.2 \\ \hline 0.2 \\ \hline 0.2 \\ \hline 0.3 \\ \hline$	#it     4     1     3     2     3     1     5     4     2     2     5     4     4     6     5	$\begin{array}{c} C_{\rm max} \\ \hline 33,697 \\ 25,969 \\ 42,787 \\ 24,017 \\ 24,736 \\ 27,366 \\ 41,737 \\ 30,276 \\ 34,357 \\ 43,254 \\ 29,989 \\ 27,547 \\ 43,254 \\ 29,989 \\ 25,881 \\ 28,131 \\ 39,187 \\ 30,483 \\ 30,483 \\ 38,739 \end{array}$	$\begin{array}{c} \text{ed} \\ \hline \#\text{it} \\ 1 \\ 1 \\ 3 \\ 1 \\ 1 \\ 1 \\ 2 \\ 2 \\ 1 \\ 2 \\ 1 \\ 5 \\ 3 \\ 6 \\ 3 \\ 2 \\ 5 \\ \end{array}$	$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$	#it     2     1     3     2     1     1     5     4     1     2     1     5     4     6     4     2     5     5
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	miniYFJS01 miniYFJS03 miniYFJS03 miniYFJS05 miniYFJS05 miniYFJS07 miniYFJS07 miniYFJS07 miniYFJS10 miniYFJS11 miniYFJS12 miniYFJS14 miniYFJS15 miniYFJS15 miniYFJS15 miniYFJS17 miniYFJS17 miniYFJS17	$\begin{tabular}{ c c c c c }\hline \hline $C_{max}$ & $35,243$ \\ $28,688$ & $53,381$ \\ $25,394$ & $26,371$ \\ $30,952$ & $46,782$ \\ $33,954$ & $37,049$ \\ $29,416$ & $51,212$ \\ $36,343$ & $32,915$ & $31,826$ \\ $45,597$ & $33,965$ & $44,181$ \\ $34,133$ & $41,333$ \\ \end{tabular}$	$\begin{array}{r} \text{ed} \\ \hline \#\text{it} \\ 1 \\ 1 \\ 2 \\ 1 \\ 2 \\ 2 \\ 2 \\ 2 \\ 2 \\ 5 \\ 1 \\ 4 \\ 5 \\ 6 \\ 3 \\ 5 \\ 3 \\ 5 \\ 3 \end{array}$	$\begin{tabular}{lllllllllllllllllllllllllllllllllll$	$ \begin{array}{r} \#it \\ 2 \\ 1 \\ 3 \\ 1 \\ 3 \\ 1 \\ 4 \\ 3 \\ 2 \\ 5 \\ 2 \\ 4 \\ 5 \\ 6 \\ 4 \\ 7 \\ 7 \\ 4 \\ \end{array} $	$\begin{array}{c} Croppp\\ C_{max}\\ 34,443\\ 27,557\\ 49,111\\ 24,669\\ 25,635\\ 29,080\\ 44,137\\ 31,992\\ 36,098\\ 27,604\\ 47,079\\ 33,404\\ 30,219\\ 31,284\\ 42,306\\ 32,481\\ 41,316\\ 29,883\\ \end{array}$	$\begin{array}{c} \text{ed} \\ \hline \#\text{it} \\ 1 \\ 1 \\ 2 \\ 1 \\ 3 \\ 1 \\ 2 \\ 2 \\ 2 \\ 4 \\ 1 \\ 5 \\ 4 \\ 4 \\ 3 \\ 5 \\ 2 \end{array}$	$\begin{array}{c} 0.2 \\ \hline 0.2 \\ \hline Reduct \\ C_{max} \\ \hline 27,557 \\ 46,806 \\ 24,485 \\ 24,255 \\ 29,080 \\ 42,578 \\ 31,597 \\ 36,098 \\ 29,858 \\ 33,404 \\ 30,219 \\ 33,404 \\ 41,893 \\ 32,165 \\ 41,199 \\ 29,883 \\ \end{array}$	#it     4     1     3     2     3     1     5     4     2     2     5     4     4     6     5     2     2	$\begin{array}{c} C_{\rm max} \\ \hline \\ 33,697 \\ 25,969 \\ 42,787 \\ 24,017 \\ 24,743 \\ 27,364 \\ 41,737 \\ 30,276 \\ 34,357 \\ 41,737 \\ 43,254 \\ 29,989 \\ 25,811 \\ 39,187 \\ 30,483 \\ 38,739 \\ 27,944 \end{array}$	$\begin{array}{c} \text{ed} \\ \hline \#\text{it} \\ \hline 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 2 \\ 2 \\ 1 \\ 2 \\ 1 \\ 2 \\ 1 \\ 5 \\ 3 \\ 6 \\ 3 \\ 2 \\ 5 \\ 2 \\ \end{array}$	$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$	$ \begin{array}{c} \# it \\ 2 \\ 1 \\ 3 \\ 2 \\ 1 \\ 1 \\ 5 \\ 4 \\ 1 \\ 5 \\ 4 \\ 6 \\ 4 \\ 2 \\ 5 \\ 2 \\ 2 \\ \end{array} $
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	miniYFJS01 miniYFJS03 miniYFJS03 miniYFJS04 miniYFJS06 miniYFJS06 miniYFJS00 miniYFJS00 miniYFJS00 miniYFJS10 miniYFJS11 miniYFJS13 miniYFJS15 miniYFJS15 miniYFJS16 miniYFJS19	$\begin{array}{c} C_{max} \\ 35,243 \\ 28,683 \\ 33,381 \\ 25,334 \\ 26,371 \\ 30,952 \\ 46,782 \\ 33,954 \\ 47,7049 \\ 29,416 \\ 51,212 \\ 36,343 \\ 32,915 \\ 31,826 \\ 45,597 \\ 33,965 \\ 44,181 \\ 34,133 \\ 39,165 \end{array}$	ed #it 1 2 1 2 2 2 5 1 4 5 6 3 3 3 3	$\begin{array}{c} \mbox{Reduce} \\ \hline $C_{max}$ \\ \hline $25,098$ \\ $22,088$ \\ $52,098$ \\ $25,750$ \\ $30,952$ \\ $46,089$ \\ $33,883$ \\ $37,049$ \\ $29,416$ \\ $51,129$ \\ $36,343$ \\ $32,792$ \\ $31,826$ \\ $36,343$ \\ $32,792$ \\ $31,826$ \\ $45,442$ \\ $33,791$ \\ $44,044$ \\ $39,046$ \\ \end{array}$	$ \begin{array}{r} \#it \\ 2 \\ 1 \\ 3 \\ 1 \\ 4 \\ 3 \\ 2 \\ 5 \\ 2 \\ 4 \\ 5 \\ 6 \\ 4 \\ 7 \\ 7 \\ 4 \\ 4 \\ \end{array} $	$\begin{tabular}{ c c c c c } \hline Croppy \\ \hline C_{max} & 34,443 \\ 27,557 & 49,111 \\ 24,669 & 25,635 \\ 29,080 & 44,137 \\ 31,992 & 36,098 \\ 27,604 & 47,079 \\ 33,404 & 47,079 \\ 33,404 & 47,079 \\ 33,404 & 47,079 \\ 33,404 & 47,137 \\ 34,2306 & 632,481 \\ 41,316 & 29,883 \\ 33,965 & 33,965 \\ \hline \end{tabular}$	#it           1           2           1           2           2           4           1           5           4           3           5           2           6	$\begin{array}{c} 0.2 \\ \hline 0.2 \\ \hline Reduct \\ C_{max} \\ 33,132 \\ 27,557 \\ 46,806 \\ 24,485 \\ 24,235 \\ 29,080 \\ 42,578 \\ 31,597 \\ 36,098 \\ 29,858 \\ 46,939 \\ 33,404 \\ 46,939 \\ 33,219 \\ 31,284 \\ 41,893 \\ 32,165 \\ 41,199 \\ 29,883 \\ 33,805 \\ \end{array}$	$ \begin{array}{r} \#it \\ 4 \\ 1 \\ 3 \\ 2 \\ 3 \\ 1 \\ 5 \\ 4 \\ 2 \\ 2 \\ 2 \\ 5 \\ 4 \\ 4 \\ 6 \\ 5 \\ 2 \\ 7 \\ \end{array} $	$\begin{array}{c} C_{\rm max} \\ \hline \\ 33,697 \\ 25,969 \\ 42,787 \\ 24,017 \\ 24,743 \\ 27,366 \\ 41,737 \\ 30,276 \\ 41,737 \\ 30,27547 \\ 43,254 \\ 29,989 \\ 25,881 \\ 28,131 \\ 39,187 \\ 25,881 \\ 28,131 \\ 39,187 \\ 30,483 \\ 38,739 \\ 27,944 \\ 31,743 \end{array}$	#it           #it           1           1           3           1           1           2           1           2           1           2           1           5           3           6           3           2           5           2           6           3           6           3           2           6	$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$	$ \begin{array}{r} \# it \\ 2 \\ 1 \\ 3 \\ 2 \\ 1 \\ 1 \\ 5 \\ 4 \\ 1 \\ 2 \\ 1 \\ 5 \\ 4 \\ 6 \\ 4 \\ 2 \\ 5 \\ 2 \\ 8 \\ \end{array} $
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	miniYFJS01 miniYFJS03 miniYFJS03 miniYFJS04 miniYFJS06 miniYFJS06 miniYFJS06 miniYFJS00 miniYFJS10 miniYFJS10 miniYFJS13 miniYFJS13 miniYFJS13 miniYFJS13 miniYFJS18 miniYFJS18 miniYFJS18 miniYFJS18 miniYFJS18	$\begin{tabular}{ c c c c c }\hline \hline $C_{max}$ & $35,243$ \\ $28,688$ & $53,381$ \\ $25,334$ & $26,371$ \\ $30,952$ & $46,782$ \\ $33,954$ & $37,049$ \\ $29,416$ & $51,212$ \\ $36,343$ & $32,915$ \\ $31,826$ & $44,181$ \\ $34,133$ & $39,165$ \\ $44,181$ & $34,133$ \\ $39,165$ & $30,837$ \\ \hline \end{tabular}$	ed #it 1 1 2 1 2 1 2 2 2 5 1 4 5 6 3 3 5 3 3 6	$\begin{array}{c} \mbox{Reduce} \\ \hline $C_{\rm max}$ \\ \hline $35,046$ \\ $28,688$ \\ $52,098$ \\ $25,750$ \\ $30,952$ \\ $46,089$ \\ $33,883$ \\ $37,049$ \\ $29,416$ \\ $51,129$ \\ $36,843$ \\ $37,792$ \\ $31,826$ \\ $45,442$ \\ $32,792$ \\ $31,826$ \\ $45,442$ \\ $33,791$ \\ $44,044$ \\ $34,044$ \\ $39,046$ \\ $30,837$ \\ \end{array}$	$\begin{array}{c} \# \mathrm{it} \\ 2 \\ 1 \\ 3 \\ 1 \\ 3 \\ 1 \\ 4 \\ 3 \\ 2 \\ 5 \\ 2 \\ 4 \\ 5 \\ 6 \\ 4 \\ 7 \\ 7 \\ 4 \\ 4 \\ 6 \end{array}$	$\begin{tabular}{ c c c c c } \hline Cropp \\ \hline C_{max} & 34,443 \\ 27,557 & 49,111 \\ 24,669 & 25,635 \\ 29,080 & 44,137 \\ 31,992 & 36,098 \\ 27,604 & 47,079 \\ 33,404 & 30,219 \\ 30,219 & 31,284 \\ 42,306 & 30,214 \\ 41,316 & 29,883 \\ 33,965 & 31,304 \\ 51,304 & 51,204 \\ 10,102 & 10,102 \\ 10,1$	$\begin{array}{c} & \\ \#it \\ & \\ 1 \\ 1 \\ 2 \\ 1 \\ 3 \\ 1 \\ 2 \\ 2 \\ 2 \\ 4 \\ 1 \\ 5 \\ 4 \\ 4 \\ 3 \\ 5 \\ 2 \\ 6 \\ 6 \end{array}$	$\begin{array}{c} 0.2\\ \hline 0.2\\ \hline Reduct \\ C_{max}\\ \hline 3,132\\ 27,557\\ 46,806\\ 24,485\\ 24,257\\ 31,597\\ 36,098\\ 29,858\\ 46,939\\ 33,404\\ 30,219\\ 31,284\\ 41,893\\ 32,165\\ 31,304\\ 1,199\\ 29,883\\ 33,805\\ 31,304\\ \end{array}$	$\frac{\# it}{4} \\ 1 \\ 3 \\ 2 \\ 3 \\ 1 \\ 5 \\ 4 \\ 2 \\ 2 \\ 2 \\ 5 \\ 4 \\ 4 \\ 4 \\ 6 \\ 5 \\ 2 \\ 7 \\ 6 \\ \end{bmatrix}$	$\begin{array}{c} C_{\rm max} \\ \hline \\ 33,697 \\ 25,969 \\ 42,787 \\ 24,017 \\ 24,743 \\ 27,366 \\ 41,737 \\ 30,276 \\ 34,357 \\ 43,254 \\ 29,588 \\ 27,547 \\ 43,254 \\ 29,881 \\ 28,131 \\ 39,187 \\ 30,483 \\ 38,739 \\ 27,944 \\ 31,743 \\ 29,559 \end{array}$	$\begin{array}{c} \text{#it} \\ \text{#it} \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 2 \\ 2 \\ 1 \\ 1$	$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$	$ \begin{array}{c} \# it \\ 2 \\ 1 \\ 3 \\ 2 \\ 1 \\ 1 \\ 5 \\ 4 \\ 1 \\ 5 \\ 4 \\ 6 \\ 4 \\ 2 \\ 5 \\ 2 \\ 8 \\ 4 \\ 4 \\ 1 \end{array} $
miniYFJS25         43,592         3         43,555         3         40,933         1         40,425         3         34,388         3         34,388         3           miniYFJS26         54,739         2         54,675         3         49,412         1         49,412         1         44,633         3         44,207         6           miniYFJS27         36,765         4         36,765         4         34,125         4         34,225         6         31,749         4         31,571         6           miniYFJS28         41,951         2         41,838         3         38,640         2         38,450         3         34,388         44,207         6           miniYFJS28         41,951         2         41,838         3         38,640         2         38,456         4         34,304         4         34,604         3           miniYFJS29         44,930         5         38,903         3         38,586         4         34,903         7         31,093         7           miniYFJS30         44,938         3         38,576         4         41,209         3         40,744         4         31,093         7         31,093	miniYFJS01 miniYFJS03 miniYFJS03 miniYFJS05 miniYFJS05 miniYFJS05 miniYFJS07 miniYFJS07 miniYFJS10 miniYFJS11 miniYFJS13 miniYFJS13 miniYFJS15 miniYFJS15 miniYFJS15 miniYFJS17 miniYFJS18 miniYFJS17 miniYFJS18 miniYFJS19 miniYFJS19 miniYFJS20 miniYFJS20	$\begin{tabular}{ c c c c c }\hline \hline $C_{max}$ & $35,243$ \\ $28,688$ & $53,381$ \\ $25,394$ & $26,371$ \\ $30,952$ & $30,952$ \\ $30,952$ & $30,954$ \\ $37,049$ & $29,416$ \\ $51,212$ & $36,343$ \\ $32,915$ & $44,181$ \\ $34,133$ & $39,165$ \\ $44,181$ & $30,837$ \\ $40,523$ & $40,523$ \\ \end{tabular}$	#it           1           2           1           2           1           2           1           2           1           2           5           1           4           5           3           5           3           6           6           6           6	$\begin{tabular}{lllllllllllllllllllllllllllllllllll$	$\begin{array}{c} \# \mathrm{it} \\ 2 \\ 1 \\ 3 \\ 1 \\ 3 \\ 1 \\ 4 \\ 3 \\ 2 \\ 5 \\ 2 \\ 4 \\ 5 \\ 6 \\ 4 \\ 7 \\ 7 \\ 4 \\ 4 \\ 6 \\ 6 \end{array}$	$\begin{tabular}{ c c c c c } \hline $C$ roppy $C$ max $$ $$ $$ $$ $$ $$ $$ $$ $$ $$ $$ $$ $$$	$\begin{array}{c} & \\ & \\ \#it \\ & \\ 1 \\ 1 \\ 2 \\ 1 \\ 3 \\ 1 \\ 2 \\ 2 \\ 2 \\ 2 \\ 4 \\ 1 \\ 5 \\ 4 \\ 4 \\ 3 \\ 3 \\ 5 \\ 2 \\ 6 \\ 6 \\ 9 \end{array}$	$\begin{array}{c c} 0.2 \\\hline \hline 0.2 \\\hline \hline Reduct \\ \hline C_{max} \\\hline 27,557 \\\hline 46,806 \\\hline 24,485 \\\hline 24,485 \\\hline 24,257 \\\hline 31,597 \\\hline 36,098 \\\hline 29,858 \\\hline 31,597 \\\hline 33,404 \\\hline 30,219 \\\hline 31,284 \\\hline 41,893 \\\hline 32,165 \\\hline 41,199 \\\hline 29,883 \\\hline 33,805 \\\hline 31,304 \\\hline 55,570 \\\hline \end{array}$	$\begin{array}{c} \# \mathrm{it} \\ 4 \\ 1 \\ 3 \\ 2 \\ 3 \\ 1 \\ 5 \\ 4 \\ 2 \\ 2 \\ 2 \\ 2 \\ 5 \\ 4 \\ 4 \\ 6 \\ 5 \\ 2 \\ 7 \\ 6 \\ 9 \end{array}$	$\begin{array}{c} C_{\rm max} \\ \hline \\ 33,697 \\ 25,969 \\ 42,787 \\ 24,017 \\ 24,743 \\ 27,366 \\ 41,737 \\ 30,276 \\ 34,357 \\ 43,254 \\ 29,989 \\ 25,881 \\ 39,187 \\ 30,483 \\ 38,739 \\ 27,944 \\ 31,743 \\ 29,599 \\ 25,585 \\ 83,355 \\ \end{array}$	$\begin{array}{c} \text{#it} \\ \hline \\ \text{#it} \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 2 \\ 2 \\ 1 \\ 1 \\ 2 \\ 2$	$\begin{tabular}{ c c c c c c c } \hline Reduct \\ \hline $C_{max}$ \\ \hline $2,196$ \\ \hline $2,969$ \\ $42,787$ \\ $23,774$ \\ $24,743$ \\ $24,743$ \\ $27,366$ \\ $39,229$ \\ $29,631$ \\ $39,229$ \\ $29,632$ \\ $29,589$ \\ $25,619$ \\ $28,131$ \\ $38,554$ \\ $27,944$ \\ $31,082$ \\ $29,599$ \\ $33,355$ \\ \hline \end{tabular}$	$ \begin{array}{c} \# it \\ 2 \\ 1 \\ 3 \\ 2 \\ 1 \\ 1 \\ 5 \\ 4 \\ 1 \\ 5 \\ 4 \\ 2 \\ 5 \\ 2 \\ 8 \\ 4 \\ 5 \\ \end{array} $
miniYFJS26         54,739         2         54,675         3         49,412         1         49,412         1         44,633         3         44,207         6           miniYFJS27         36,765         4         36,765         4         36,765         4         34,215         4         34,225         6         31,749         4         31,571         6           miniYFJS28         41,951         2         41,838         3         38,640         2         38,450         3         35,729         2         35,729         2         35,729         2         36,765         4         44,930         5         38,640         2         38,450         3         34,330         44         34,020         2         38,450         3         34,330         44         34,020         2         38,450         3         34,330         44,930         5         44,930         5         38,586         40,744         4         31,093         7         31,093         7           miniYFJS28         44,938         3         43,725         4         41,290         3         40,744         4         31,093         7         31,093         7         31,093         7 <t< td=""><td>miniYFJS01 miniYFJS03 miniYFJS03 miniYFJS04 miniYFJS06 miniYFJS06 miniYFJS00 miniYFJS00 miniYFJS00 miniYFJS10 miniYFJS12 miniYFJS11 miniYFJS13 miniYFJS15 miniYFJS15 miniYFJS16 miniYFJS18 miniYFJS18 miniYFJS18 miniYFJS20 miniYFJS20</td><td><math display="block">\begin{array}{c} \hline C_{max} \\ 35,243 \\ 28,688 \\ 28,683 \\ 33,81 \\ 25,334 \\ 26,371 \\ 30,952 \\ 46,782 \\ 33,954 \\ 47,704 \\ 92,416 \\ 51,212 \\ 36,343 \\ 32,915 \\ 31,826 \\ 32,915 \\ 31,826 \\ 44,181 \\ 32,915 \\ 33,965 \\ 44,181 \\ 39,165 \\ 30,837 \\ 40,523 \\ 35,019 \\ \end{array}</math></td><td><math display="block">\begin{array}{c} \text{#it} \\ \text{#it} \\ 1 \\ 2 \\ 1 \\ 2 \\ 1 \\ 2 \\ 2 \\ 2 \\ 5 \\ 1 \\ 4 \\ 5 \\ 6 \\ 3 \\ 3 \\ 6 \\ 6 \\ 4 \end{array}</math></td><td><math display="block">\begin{array}{c} \mbox{Reduce} \\ \hline \$C_{max}\$ \\ \hline \$C_{max}\$ \\ \hline \$25,max\$ \\ \hline \$28,688\$ \\ \hline \$52,098\$ \\ \hline \$25,750\$ \\ \hline \$30,952\$ \\ \hline \$46,089\$ \\ \hline \$33,883\$ \\ \hline \$37,049\$ \\ \hline \$29,166\$ \\ \hline \$51,129\$ \\ \hline \$33,883\$ \\ \hline \$37,049\$ \\ \hline \$29,416\$ \\ \hline \$51,129\$ \\ \hline \$36,343\$ \\ \hline \$32,792\$ \\ \hline \$31,826\$ \\ \hline \$45,442\$ \\ \hline \$36,711\$ \\ \hline \$45,442\$ \\ \hline \$37,711\$ \\ \hline \$45,442\$ \\ \hline \$37,711\$ \\ \hline \$40,444\$ \\ \hline \$30,046\$ \\ \hline \$30,837\$ \\ \hline \$40,523\$ \\ \hline \$35,019\$ \\ \hline \end{tabular}</math></td><td><math display="block">\begin{array}{c} \# \mathrm{it} \\ 2 \\ 1 \\ 3 \\ 1 \\ 3 \\ 1 \\ 4 \\ 3 \\ 2 \\ 5 \\ 2 \\ 4 \\ 5 \\ 6 \\ 4 \\ 7 \\ 7 \\ 4 \\ 4 \\ 6 \\ 6 \\ 4 \\ \end{array}</math></td><td><math display="block">\begin{tabular}{ c c c c c } \hline Croppy \\ \hline C_{max} &amp; 34,443 \\ 27,557 &amp; 49,111 \\ 24,669 &amp; 25,635 \\ 29,080 &amp; 44,137 \\ 31,992 &amp; 36,098 \\ 27,604 &amp; 47,079 \\ 33,404 &amp; 30,219 \\ 33,404 &amp; 30,219 \\ 33,404 &amp; 30,219 \\ 31,284 &amp; 42,306 \\ 32,481 &amp; 41,316 \\ 29,883 &amp; 33,965 \\ 31,304 &amp; 35,570 \\ 32,485 &amp; 32,485 \\ \hline \end{tabular}</math></td><td><math display="block">\begin{array}{c} \text{d} \\ \hline \#\text{it} \\ 1 \\ 1 \\ 2 \\ 1 \\ 3 \\ 1 \\ 2 \\ 2 \\ 4 \\ 1 \\ 5 \\ 4 \\ 3 \\ 5 \\ 2 \\ 6 \\ 6 \\ 9 \\ 1 \\ \end{array}</math></td><td><math display="block">\begin{array}{c} 0.2 \\ \hline 0.2 \\ \hline Reduct \\ C_{max} \\ \hline 27,557 \\ 46,806 \\ 24,485 \\ 24,235 \\ 29,080 \\ 42,578 \\ 31,597 \\ 36,098 \\ 29,858 \\ 46,939 \\ 33,404 \\ 46,939 \\ 33,404 \\ 41,893 \\ 32,165 \\ 41,199 \\ 29,883 \\ 32,165 \\ 41,199 \\ 29,883 \\ 33,805 \\ 31,304 \\ 35,570 \\ 31,946 \\ \end{array}</math></td><td><math display="block">\begin{array}{c} \#\mathrm{it} \\ 4 \\ 1 \\ 3 \\ 2 \\ 3 \\ 1 \\ 5 \\ 4 \\ 2 \\ 2 \\ 2 \\ 5 \\ 4 \\ 4 \\ 4 \\ 6 \\ 5 \\ 2 \\ 7 \\ 6 \\ 9 \\ 2 \end{array}</math></td><td><math display="block">\begin{array}{c} C_{\rm max} \\ \hline \\ 33,697 \\ 25,969 \\ 42,787 \\ 24,017 \\ 24,743 \\ 27,366 \\ 41,737 \\ 30,276 \\ 41,737 \\ 30,27547 \\ 43,254 \\ 29,989 \\ 25,881 \\ 28,131 \\ 39,187 \\ 29,589 \\ 25,881 \\ 28,131 \\ 39,187 \\ 30,483 \\ 38,739 \\ 27,944 \\ 31,743 \\ 29,599 \\ 33,355 \\ 50,212 \\ \end{array}</math></td><td><math display="block">\begin{array}{c} \operatorname{ad} \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\</math></td><td><math display="block">\begin{tabular}{ c c c c c c c c c c c c c c c c c c c</math></td><td>#it           2           1           3           2           1           5           4           2           1           5           4           6           4           5           2           8           4           5           2           8           4           5           2           8           5           2</td></t<>	miniYFJS01 miniYFJS03 miniYFJS03 miniYFJS04 miniYFJS06 miniYFJS06 miniYFJS00 miniYFJS00 miniYFJS00 miniYFJS10 miniYFJS12 miniYFJS11 miniYFJS13 miniYFJS15 miniYFJS15 miniYFJS16 miniYFJS18 miniYFJS18 miniYFJS18 miniYFJS20 miniYFJS20	$\begin{array}{c} \hline C_{max} \\ 35,243 \\ 28,688 \\ 28,683 \\ 33,81 \\ 25,334 \\ 26,371 \\ 30,952 \\ 46,782 \\ 33,954 \\ 47,704 \\ 92,416 \\ 51,212 \\ 36,343 \\ 32,915 \\ 31,826 \\ 32,915 \\ 31,826 \\ 44,181 \\ 32,915 \\ 33,965 \\ 44,181 \\ 39,165 \\ 30,837 \\ 40,523 \\ 35,019 \\ \end{array}$	$\begin{array}{c} \text{#it} \\ \text{#it} \\ 1 \\ 2 \\ 1 \\ 2 \\ 1 \\ 2 \\ 2 \\ 2 \\ 5 \\ 1 \\ 4 \\ 5 \\ 6 \\ 3 \\ 3 \\ 6 \\ 6 \\ 4 \end{array}$	$\begin{array}{c} \mbox{Reduce} \\ \hline $C_{max}$ \\ \hline $C_{max}$ \\ \hline $25,max$ \\ \hline $28,688$ \\ \hline $52,098$ \\ \hline $25,750$ \\ \hline $30,952$ \\ \hline $46,089$ \\ \hline $33,883$ \\ \hline $37,049$ \\ \hline $29,166$ \\ \hline $51,129$ \\ \hline $33,883$ \\ \hline $37,049$ \\ \hline $29,416$ \\ \hline $51,129$ \\ \hline $36,343$ \\ \hline $32,792$ \\ \hline $31,826$ \\ \hline $45,442$ \\ \hline $36,711$ \\ \hline $45,442$ \\ \hline $37,711$ \\ \hline $45,442$ \\ \hline $37,711$ \\ \hline $40,444$ \\ \hline $30,046$ \\ \hline $30,837$ \\ \hline $40,523$ \\ \hline $35,019$ \\ \hline \end{tabular}$	$\begin{array}{c} \# \mathrm{it} \\ 2 \\ 1 \\ 3 \\ 1 \\ 3 \\ 1 \\ 4 \\ 3 \\ 2 \\ 5 \\ 2 \\ 4 \\ 5 \\ 6 \\ 4 \\ 7 \\ 7 \\ 4 \\ 4 \\ 6 \\ 6 \\ 4 \\ \end{array}$	$\begin{tabular}{ c c c c c } \hline Croppy \\ \hline C_{max} & 34,443 \\ 27,557 & 49,111 \\ 24,669 & 25,635 \\ 29,080 & 44,137 \\ 31,992 & 36,098 \\ 27,604 & 47,079 \\ 33,404 & 30,219 \\ 33,404 & 30,219 \\ 33,404 & 30,219 \\ 31,284 & 42,306 \\ 32,481 & 41,316 \\ 29,883 & 33,965 \\ 31,304 & 35,570 \\ 32,485 & 32,485 \\ \hline \end{tabular}$	$\begin{array}{c} \text{d} \\ \hline \#\text{it} \\ 1 \\ 1 \\ 2 \\ 1 \\ 3 \\ 1 \\ 2 \\ 2 \\ 4 \\ 1 \\ 5 \\ 4 \\ 3 \\ 5 \\ 2 \\ 6 \\ 6 \\ 9 \\ 1 \\ \end{array}$	$\begin{array}{c} 0.2 \\ \hline 0.2 \\ \hline Reduct \\ C_{max} \\ \hline 27,557 \\ 46,806 \\ 24,485 \\ 24,235 \\ 29,080 \\ 42,578 \\ 31,597 \\ 36,098 \\ 29,858 \\ 46,939 \\ 33,404 \\ 46,939 \\ 33,404 \\ 41,893 \\ 32,165 \\ 41,199 \\ 29,883 \\ 32,165 \\ 41,199 \\ 29,883 \\ 33,805 \\ 31,304 \\ 35,570 \\ 31,946 \\ \end{array}$	$\begin{array}{c} \#\mathrm{it} \\ 4 \\ 1 \\ 3 \\ 2 \\ 3 \\ 1 \\ 5 \\ 4 \\ 2 \\ 2 \\ 2 \\ 5 \\ 4 \\ 4 \\ 4 \\ 6 \\ 5 \\ 2 \\ 7 \\ 6 \\ 9 \\ 2 \end{array}$	$\begin{array}{c} C_{\rm max} \\ \hline \\ 33,697 \\ 25,969 \\ 42,787 \\ 24,017 \\ 24,743 \\ 27,366 \\ 41,737 \\ 30,276 \\ 41,737 \\ 30,27547 \\ 43,254 \\ 29,989 \\ 25,881 \\ 28,131 \\ 39,187 \\ 29,589 \\ 25,881 \\ 28,131 \\ 39,187 \\ 30,483 \\ 38,739 \\ 27,944 \\ 31,743 \\ 29,599 \\ 33,355 \\ 50,212 \\ \end{array}$	$\begin{array}{c} \operatorname{ad} \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\$	$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$	#it           2           1           3           2           1           5           4           2           1           5           4           6           4           5           2           8           4           5           2           8           4           5           2           8           5           2
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	miniYFJS01 miniYFJS03 miniYFJS03 miniYFJS06 miniYFJS06 miniYFJS06 miniYFJS07 miniYFJS09 miniYFJS10 miniYFJS11 miniYFJS13 miniYFJS13 miniYFJS14 miniYFJS16 miniYFJS16 miniYFJS19 miniYFJS19 miniYFJS19 miniYFJS19 miniYFJS19 miniYFJS19 miniYFJS19 miniYFJS20 miniYFJS21	$\begin{array}{c} \hline C_{max} \\ \hline 35,243 \\ 28,688 \\ 53,381 \\ 25,334 \\ 26,371 \\ 30,952 \\ 46,782 \\ 33,954 \\ 37,049 \\ 29,416 \\ 51,212 \\ 36,343 \\ 32,915 \\ 31,826 \\ 45,595 \\ 44,181 \\ 34,133 \\ 39,165 \\ 30,837 \\ 40,523 \\ 35,019 \\ 55,25 \\ \end{array}$	$\begin{array}{c} \text{#it} \\ \text{#it} \\ 1 \\ 2 \\ 1 \\ 2 \\ 1 \\ 2 \\ 2 \\ 2 \\ 5 \\ 1 \\ 4 \\ 5 \\ 6 \\ 3 \\ 3 \\ 5 \\ 3 \\ 3 \\ 6 \\ 6 \\ 4 \\ 4 \end{array}$	$\begin{array}{r} \mbox{Reduce} \\ \hline $C_{max}$ \\ \hline $35,046$ \\ $28,688$ \\ $52,098$ \\ $25,750$ \\ $30,952$ \\ $46,089$ \\ $33,883$ \\ $37,049$ \\ $29,416$ \\ $51,129$ \\ $36,343$ \\ $32,792$ \\ $31,826$ \\ $45,442$ \\ $33,791$ \\ $44,044$ \\ $30,946$ \\ $30,837$ \\ $40,623$ \\ $30,837$ \\ $40,523$ \\ $35,019$ \\ $45,725$ \\ \end{array}$	$\begin{array}{c} \# \mathrm{it} \\ 2 \\ 1 \\ 3 \\ 1 \\ 4 \\ 3 \\ 2 \\ 5 \\ 2 \\ 4 \\ 5 \\ 6 \\ 4 \\ 4 \\ 6 \\ 6 \\ 4 \\ 4 \\ \end{array}$	$\begin{tabular}{ c c c c c } \hline Cropp \\ \hline C_{max} & 34,443 \\ 27,557 & 49,111 \\ 24,669 & 25,635 \\ 29,080 & 44,137 \\ 31,992 & 36,038 \\ 27,604 & 47,079 \\ 33,604 & 47,079 \\ 33,604 & 47,079 \\ 33,044 & 30,219 \\ 30,219 & 31,284 \\ 41,316 & 29,883 \\ 32,481 & 41,316 \\ 29,883 & 33,965 \\ 31,304 & 35,570 \\ 32,485 & 31,304 \\ 35,570 & 32,485 \\ \hline \end{tabular}$	$\frac{\#it}{\#it}$ 1 1 2 1 3 1 2 2 2 4 1 5 4 4 3 5 2 6 6 9 1 2	$\begin{array}{c} 0.2 \\ \hline 0.2 \\ \hline Reduce \\ C_{max} \\ \hline 3,132 \\ 27,557 \\ 46,806 \\ 24,485 \\ 24,255 \\ 29,080 \\ 42,578 \\ 31,597 \\ 36,098 \\ 29,858 \\ 46,939 \\ 33,404 \\ 30,219 \\ 31,284 \\ 41,893 \\ 32,165 \\ 41,199 \\ 29,883 \\ 33,805 \\ 31,304 \\ 35,570 \\ 31,946 \\ 42,016 \\ \end{array}$	$\begin{array}{c} \#\mathrm{it} \\ 4 \\ 1 \\ 3 \\ 2 \\ 3 \\ 1 \\ 5 \\ 4 \\ 2 \\ 2 \\ 5 \\ 4 \\ 4 \\ 4 \\ 6 \\ 5 \\ 2 \\ 7 \\ 6 \\ 9 \\ 2 \\ 3 \end{array}$	$\begin{array}{c} C_{\rm max} \\ \hline \\ 33,697 \\ 25,969 \\ 42,787 \\ 24,017 \\ 24,743 \\ 27,366 \\ 41,737 \\ 30,276 \\ 41,737 \\ 30,27547 \\ 43,254 \\ 29,598 \\ 25,881 \\ 28,131 \\ 39,187 \\ 25,881 \\ 28,131 \\ 39,187 \\ 30,483 \\ 38,739 \\ 27,944 \\ 31,743 \\ 29,599 \\ 33,355 \\ 30,212 \\ 29,599 \\ 33,355 \\ 30,212 \\ 29,599 \\ 33,355 \\ 30,212 \\ 29,599 \\ 33,355 \\ 30,212 \\ 29,599 \\ 33,355 \\ 30,212 \\ 38,777 \\ 38,777 \\ 38,777 \\ 38,777 \\ 38,777 \\ 38,777 \\ 38,777 \\ 38,777 \\ 33,355 \\ 30,212 \\ 38,777 \\ 38,777 \\ 38,777 \\ 38,777 \\ 33,355 \\ 30,212 \\ 38,777 \\ 38,777 \\ 38,777 \\ 38,777 \\ 33,355 \\ 30,212 \\ 38,777 \\ 38,77$	ad #it 1 3 1 1 2 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2	$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$	$\begin{array}{c} \#\mathrm{it} \\ 2 \\ 1 \\ 3 \\ 2 \\ 1 \\ 1 \\ 5 \\ 4 \\ 1 \\ 2 \\ 1 \\ 5 \\ 4 \\ 6 \\ 4 \\ 2 \\ 5 \\ 2 \\ 8 \\ 4 \\ 5 \\ 2 \\ 5 \\ 5 \\ \end{array}$
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	miniYFJS01 miniYFJS03 miniYFJS03 miniYFJS05 miniYFJS05 miniYFJS05 miniYFJS07 miniYFJS07 miniYFJS10 miniYFJS10 miniYFJS13 miniYFJS13 miniYFJS15 miniYFJS15 miniYFJS17 miniYFJS18 miniYFJS17 miniYFJS21 miniYFJS22 miniYFJS22	$\begin{tabular}{ c c c c c }\hline \hline $C_{max}$ & $35,243$ \\ $28,688$ & $53,381$ \\ $25,394$ & $26,371$ \\ $30,952$ & $30,952$ \\ $31,954$ & $37,049$ \\ $29,416$ & $1,212$ & $36,433$ \\ $32,915$ & $31,826$ & $45,597$ \\ $33,965$ & $31,826$ & $44,181$ \\ $34,133$ & $39,165$ & $30,837$ \\ $40,523$ & $30,837$ & $40,523$ \\ $35,019$ & $45,725$ & $35,019$ \\ $45,725$ & $40,291$ & $40,291$ \\ \hline \end{tabular}$	$\begin{array}{c} \#it\\ \#it\\ 1\\ 1\\ 2\\ 1\\ 2\\ 2\\ 2\\ 2\\ 5\\ 1\\ 4\\ 5\\ 6\\ 3\\ 3\\ 5\\ 3\\ 3\\ 6\\ 6\\ 4\\ 4\\ 5\end{array}$	$\begin{tabular}{ c c c c c c c } \hline Reduct \\ \hline C_{max} \\ \hline $C_{max}$ \\ \hline $25,max$ \\ $28,688$ \\ $52,098$ \\ $25,394$ \\ $25,394$ \\ $30,952$ \\ $30,952$ \\ $30,952$ \\ $30,952$ \\ $33,883$ \\ $37,049$ \\ $29,416$ \\ $51,129$ \\ $33,7049$ \\ $29,416$ \\ $51,129$ \\ $33,7049$ \\ $35,129$ \\ $35,019$ \\ $45,442$ \\ $30,837$ \\ $40,523$ \\ $35,019$ \\ $45,725$ \\ $40,221$ \\ $35,019$ \\ $45,725$ \\ $40,221$ \\ $35,019$ \\ $45,725$ \\ $40,221$ \\ $35,019$ \\ $45,725$ \\ $40,221$ \\ $35,019$ \\ $45,725$ \\ $40,221$ \\ $$	$\begin{array}{c} \#\mathrm{it} \\ 2 \\ 1 \\ 3 \\ 1 \\ 3 \\ 1 \\ 4 \\ 3 \\ 2 \\ 5 \\ 2 \\ 4 \\ 5 \\ 6 \\ 4 \\ 7 \\ 7 \\ 4 \\ 4 \\ 6 \\ 6 \\ 4 \\ 4 \\ 6 \end{array}$	$\begin{tabular}{ c c c c c } \hline $Cropp$\\ \hline $C_{max}$ & $34,443$ \\ $27,557$ & $49,111$ \\ $24,669$ & $25,635$ \\ $29,080$ & $44,137$ \\ $31,992$ & $36,098$ \\ $27,604$ & $47,079$ \\ $33,404$ & $30,219$ \\ $27,604$ & $47,079$ \\ $33,404$ & $30,219$ \\ $30,219$ & $31,284$ \\ $42,306$ & $32,481$ \\ $42,306$ & $32,481$ \\ $41,316$ & $29,883$ \\ $33,965$ & $31,304$ \\ $41,336$ & $35,570$ \\ $32,485$ & $42,446$ \\ $38,144$ \\ $42,466$ \\ $38,144$ \\ \end{tabular}$	$\begin{array}{c} \text{#it} \\ \hline \\ \text{#it} \\ 1 \\ 2 \\ 1 \\ 3 \\ 1 \\ 2 \\ 2 \\ 2 \\ 4 \\ 1 \\ 5 \\ 4 \\ 4 \\ 3 \\ 5 \\ 2 \\ 6 \\ 6 \\ 9 \\ 1 \\ 2 \\ 2 \\ 2 \\ \end{array}$	$\begin{array}{c c} 0.2 \\\hline \hline 0.2 \\\hline \hline 0.2 \\\hline \hline 0.3 \\\hline 0$	$\begin{array}{c} \# it \\ 4 \\ 1 \\ 3 \\ 2 \\ 3 \\ 1 \\ 5 \\ 4 \\ 2 \\ 2 \\ 2 \\ 5 \\ 4 \\ 4 \\ 6 \\ 5 \\ 2 \\ 7 \\ 6 \\ 9 \\ 2 \\ 3 \\ 2 \end{array}$	$\begin{array}{c} C_{\rm max} \\ \hline \\ 33,697 \\ 25,969 \\ 42,787 \\ 24,017 \\ 24,736 \\ 27,366 \\ 41,737 \\ 30,276 \\ 34,357 \\ 43,254 \\ 29,989 \\ 27,547 \\ 43,254 \\ 29,889 \\ 25,881 \\ 28,131 \\ 39,187 \\ 30,483 \\ 38,739 \\ 27,944 \\ 31,743 \\ 29,599 \\ 33,355 \\ 30,212 \\ 38,775 \\ 30,173 \\ \end{array}$	$\begin{array}{c} \text{ad} \\ \frac{\#\text{it}}{1} \\ 1 \\ 1 \\ 3 \\ 1 \\ 1 \\ 2 \\ 2 \\ 1 \\ 2 \\ 1 \\ 2 \\ 1 \\ 2 \\ 1 \\ 5 \\ 3 \\ 6 \\ 3 \\ 2 \\ 5 \\ 2 \\ 6 \\ 4 \\ 5 \\ 1 \\ 4 \\ 7 \end{array}$	$\begin{tabular}{ c c c c c } \hline Reduct \\ \hline $C_{max}$ \\ \hline $2, new \\ $2, 969$ \\ $42, 787$ \\ $23, 787$ \\ $24, 743$ \\ $24, 743$ \\ $24, 743$ \\ $29, 631$ \\ $39, 229$ \\ $29, 639$ \\ $29, 619$ \\ $29, 883$ \\ $21, 4325$ \\ $29, 989$ \\ $25, 619$ \\ $28, 131$ \\ $38, 619$ \\ $30, 483$ \\ $38, 584$ \\ $27, 944$ \\ $31, 682$ \\ $29, 599$ \\ $29, 599$ \\ $33, 355$ \\ $29, 498$ \\ $37, 963$ \\ $31, 572$ \\ \hline \end{tabular}$	$\begin{array}{c} \#\mathrm{it} \\ 2 \\ 1 \\ 3 \\ 2 \\ 1 \\ 1 \\ 5 \\ 4 \\ 1 \\ 2 \\ 1 \\ 5 \\ 4 \\ 6 \\ 4 \\ 2 \\ 5 \\ 2 \\ 8 \\ 4 \\ 5 \\ 2 \\ 5 \\ 9 \end{array}$
miniYFJS28         41,951         2         41,838         3         38,640         2         38,450         3         35,729         2         35,729         2           miniYFJS29         44,930         5         44,930         5         38,993         3         38,586         4         34,303         4         34,604         3           miniYFJS30         44,038         3         43,725         4         41,290         3         40,744         4         31,093         7         31,093         7           mean         38,499.23         3.20         38,356.83         3.87         35,853.05         2.87         35,676.97         3.63         32,729.50         3.07         32,492.13         3.70	miniYFJS01 miniYFJS03 miniYFJS03 miniYFJS06 miniYFJS06 miniYFJS06 miniYFJS00 miniYFJS00 miniYFJS00 miniYFJS10 miniYFJS12 miniYFJS12 miniYFJS13 miniYFJS15 miniYFJS16 miniYFJS16 miniYFJS18 miniYFJS18 miniYFJS23 miniYFJS23 miniYFJS23 miniYFJS23	$\begin{tabular}{ c c c c c }\hline \hline $C_{max}$ & $$3,5243$ \\ $28,688$ & $$2,3341$ \\ $25,3341$ \\ $26,371$ & $$3,955$ \\ $46,782$ & $$3,955$ \\ $47,049$ & $$29,416$ \\ $51,212$ & $$36,343$ \\ $32,915$ & $$31,826$ \\ $32,915$ & $$31,826$ \\ $32,915$ & $$31,826$ \\ $45,597$ & $$3,965$ \\ $44,181$ & $$34,133$ \\ $39,165$ & $$30,837$ \\ $40,523$ & $$35,019$ \\ $45,725$ & $$40,521$ \\ $43,592$ \\ \end{tabular}$	$\begin{array}{c} \#it\\ \#it\\ 1\\ 1\\ 2\\ 1\\ 2\\ 2\\ 2\\ 2\\ 5\\ 1\\ 4\\ 5\\ 6\\ 3\\ 3\\ 5\\ 3\\ 3\\ 6\\ 6\\ 4\\ 4\\ 4\\ 5\\ 3\end{array}$	$\begin{array}{r} \mbox{Reduce} \\ \hline $C_{max}$ \\ \hline $C_{max}$ \\ \hline $25,max$ \\ \hline $28,688$ \\ \hline $52,098$ \\ \hline $25,750$ \\ \hline $30,952$ \\ \hline $46,089$ \\ \hline $33,883$ \\ \hline $37,049$ \\ \hline $29,416$ \\ \hline $51,129$ \\ \hline $33,883$ \\ \hline $37,049$ \\ \hline $29,416$ \\ \hline $51,129$ \\ \hline $36,343$ \\ \hline $32,792$ \\ \hline $36,343$ \\ \hline $36,371$ \\ \hline $40,424$ \\ \hline $30,046$ \\ \hline $30,837$ \\ \hline $40,523$ \\ \hline $35,019$ \\ \hline $45,725$ \\ \hline $40,291$ \\ \hline $43,555$ \\ \hline $43,555$ \\ \hline \ \ \ $43,555$ \\ \hline \ \ \ $43,555$ \\ \hline \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \$	$\begin{array}{c} \#\mathrm{it} \\ 2 \\ 1 \\ 3 \\ 1 \\ 3 \\ 1 \\ 4 \\ 3 \\ 2 \\ 5 \\ 2 \\ 4 \\ 5 \\ 6 \\ 4 \\ 7 \\ 7 \\ 4 \\ 4 \\ 6 \\ 6 \\ 4 \\ 4 \\ 6 \\ 3 \end{array}$	$\begin{tabular}{ c c c c c } \hline Croppy \\ \hline C_{max} & 34,443 \\ 27,557 & 49,111 \\ 24,669 & 25,635 \\ 29,080 & 44,137 \\ 31,992 & 36,098 \\ 27,604 & 41,377 \\ 33,404 & 30,219 \\ 33,404 & 30,219 \\ 33,404 & 30,219 \\ 33,248 & 33,042 \\ 33,2481 & 41,316 \\ 32,481 & 41,316 \\ 32,481 & 41,316 \\ 33,965 & 31,304 \\ 35,570 & 32,485 \\ 32,485 & 42,446 \\ 38,144 & 40,933 \\ \hline \end{tabular}$	$\begin{array}{c} \overset{\text{ded}}{\#\mathrm{it}} \\ 1 \\ 1 \\ 2 \\ 1 \\ 3 \\ 1 \\ 2 \\ 2 \\ 2 \\ 4 \\ 1 \\ 5 \\ 4 \\ 4 \\ 3 \\ 5 \\ 2 \\ 6 \\ 6 \\ 9 \\ 1 \\ 2 \\ 2 \\ 1 \end{array}$	$\begin{array}{c} 0.2 \\ \hline 0.2 \\ \hline Reduct \\ C_{max} \\ \hline 27,557 \\ 46,806 \\ 24,485 \\ 24,235 \\ 29,080 \\ 42,578 \\ 31,597 \\ 36,098 \\ 29,858 \\ 46,939 \\ 33,404 \\ 41,893 \\ 30,219 \\ 31,284 \\ 41,893 \\ 32,165 \\ 41,199 \\ 29,883 \\ 33,805 \\ 31,304 \\ 35,570 \\ 31,946 \\ 38,144 \\ 40,425 \\ \end{array}$	$\begin{array}{c} \#\mathrm{it} \\ 4 \\ 1 \\ 3 \\ 2 \\ 3 \\ 1 \\ 5 \\ 4 \\ 2 \\ 2 \\ 2 \\ 2 \\ 5 \\ 4 \\ 4 \\ 4 \\ 6 \\ 5 \\ 2 \\ 7 \\ 6 \\ 9 \\ 2 \\ 3 \\ 2 \\ 3 \end{array}$	$\begin{array}{c} C_{\rm max} \\ \hline \\ 33,697 \\ 25,969 \\ 42,787 \\ 24,017 \\ 24,743 \\ 27,366 \\ 41,737 \\ 30,276 \\ 41,737 \\ 30,27547 \\ 43,254 \\ 29,989 \\ 25,881 \\ 28,131 \\ 39,187 \\ 29,589 \\ 25,881 \\ 28,131 \\ 39,187 \\ 30,483 \\ 38,739 \\ 27,944 \\ 31,743 \\ 29,599 \\ 33,355 \\ 30,212 \\ 38,777 \\ 30,173 \\ 30,212 \\ 38,777 \\ 30,173 \\ 30,212 \\ 38,777 \\ 30,173 \\ 34,388 \\ \end{array}$	$\begin{array}{c} \text{ad} \\ \frac{\#\text{it}}{1} \\ 1 \\ 1 \\ 3 \\ 1 \\ 1 \\ 1 \\ 2 \\ 2 \\ 1 \\ 2 \\ 1 \\ 2 \\ 1 \\ 5 \\ 3 \\ 6 \\ 3 \\ 2 \\ 5 \\ 2 \\ 6 \\ 4 \\ 5 \\ 1 \\ 4 \\ 7 \\ 3 \end{array}$	$\begin{tabular}{ c c c c c c c } \hline Reduct \\ \hline $C_{max}$ & $32,109$ \\ $25,969$ & $42,787$ \\ $23,774$ & $24,743$ \\ $24,743$ & $27,366$ \\ $39,229$ & $29,631$ \\ $34,357$ & $27,425$ & $43,254$ \\ $43,254$ & $43,254$ \\ $29,989$ & $25,619$ \\ $29,989$ & $25,619$ \\ $29,989$ & $25,619$ \\ $29,989$ & $25,619$ \\ $29,989$ & $25,619$ \\ $29,989$ & $25,619$ \\ $29,989$ & $36,419$ \\ $30,483$ & $38,555$ \\ $29,498$ & $37,963$ \\ $31,572$ & $34,388$ \\ \hline \end{tabular}$	#it           2           1           3           2           1           5           4           1           5           4           6           4           5           2           5           2           5           2           5           2           5           2           5           2           5           9           3
miniYFJS29         44,930         5         44,930         5         38,993         3         38,586         4         34,303         4         34,604         3           miniYFJS30         44,038         3         43,725         4         41,200         3         40,744         4         31,093         7         31,093         7           mean         38,499.23         3.20         38,356.83         3.87         35,853.50         2.87         35,567.97         3.63         32,729.50         3.07         32,492.13         3.70	miniYFJS01 miniYFJS03 miniYFJS03 miniYFJS06 miniYFJS06 miniYFJS06 miniYFJS07 miniYFJS09 miniYFJS10 miniYFJS10 miniYFJS13 miniYFJS13 miniYFJS13 miniYFJS16 miniYFJS16 miniYFJS16 miniYFJS19 miniYFJS19 miniYFJS20 miniYFJS23 miniYFJS24 miniYFJS24 miniYFJS26	$\begin{tabular}{ c c c c c }\hline \hline $C_{max}$ & $$3,243$ \\ $28,688$ & $$5,384$ \\ $25,334$ & $$26,371$ \\ $26,371$ & $$26,33954$ \\ $37,049$ & $$29,416$ \\ $51,212$ & $$36,354$ \\ $37,049$ & $$29,416$ \\ $51,212$ & $$36,354$ \\ $32,915$ & $$31,826$ \\ $45,925$ & $$30,837$ \\ $40,523$ & $$30,837$ \\ $40,523$ & $$30,837$ \\ $40,523$ & $$30,837$ \\ $40,523$ & $$30,837$ \\ $40,523$ & $$30,837$ \\ $40,523$ & $$30,837$ \\ $40,523$ & $$30,837$ \\ $40,524$ & $$30,837$ \\ $40,523$ & $$30,837$ \\ $40,524$ & $$40,739$ \\ $40,525$ & $$40,739$ \\ $40,525$ & $$40,739$ \\ $40,525$ & $$40,739$ \\ $40,525$ & $$40,739$ \\ $40,525$ & $$40,739$ \\ $40,525$ & $$40,739$ \\ $40,525$ & $$40,739$ \\ $40,525$ & $$40,739$ \\ $40,525$ & $$40,739$ \\ $40,525$ & $$40,739$ \\ $40,525$ & $$40,739$ \\ $40,525$ & $$40,739$ \\ $40,525$ & $$40,739$ \\ $40,525$ & $$40,739$ \\ $40,555$ & $$40,739$ \\ $40,555$ & $$40,739$ \\ $40,555$ & $$40,739$ \\ $40,555$ & $$40,739$ \\ $40,555$ & $40,755$ \\ $40,755$ & $40,755$ \\ $40,755$ & $$	$\begin{array}{c} \text{ded} \\ \frac{\#\text{it}}{1} \\ 1 \\ 2 \\ 1 \\ 2 \\ 2 \\ 2 \\ 2 \\ 2 \\ 2 \\ 2$	$\begin{array}{r} \mbox{Reduce} \\ \hline $C_{max}$ \\ \hline $35,046$ \\ $28,688$ \\ $52,098$ \\ $25,950$ \\ $30,952$ \\ $46,089$ \\ $33,952$ \\ $46,089$ \\ $37,049$ \\ $29,416$ \\ $51,129$ \\ $36,343$ \\ $32,792$ \\ $31,826$ \\ $36,343$ \\ $32,792$ \\ $31,826$ \\ $36,343$ \\ $32,792$ \\ $34,542$ \\ $37,91$ \\ $44,044$ \\ $30,046$ \\ $30,837$ \\ $40,623$ \\ $30,837$ \\ $40,523$ \\ $35,019$ \\ $45,725$ \\ $40,291$ \\ $43,552$ \\ $40,291$ \\ $43,554$ \\ $54,675$ \\ \hline \end{array}$	$\begin{array}{c} \#\mathrm{it} \\ 2 \\ 1 \\ 3 \\ 1 \\ 3 \\ 1 \\ 4 \\ 3 \\ 2 \\ 5 \\ 2 \\ 4 \\ 5 \\ 6 \\ 4 \\ 4 \\ 6 \\ 6 \\ 4 \\ 4 \\ 6 \\ 3 \\ 3 \end{array}$	$\begin{tabular}{ c c c c } \hline Croppy \\ \hline C_{max} & 34,443 \\ 27,557 & 49,111 \\ 24,669 \\ 25,635 & 29,080 \\ 44,137 & 31,992 \\ 36,098 & 27,604 \\ 47,079 & 33,404 \\ 36,098 & 27,604 \\ 47,079 & 33,404 \\ 30,219 & 31,284 \\ 42,360 & 30,219 \\ 31,284 & 42,364 \\ 41,316 & 29,883 \\ 33,965 & 31,304 \\ 33,965 & 31,304 \\ 33,965 & 31,304 \\ 35,570 & 32,485 \\ 31,304 & 35,570 \\ 32,485 & 31,304 \\ 35,570 & 32,485 \\ 31,304 & 35,570 \\ 32,481 & 44,413 \\ 33,965 & 31,304 \\ 35,570 & 32,485 \\ 34,444 & 38,144 \\ 40,931 & 49,412 \\ \hline \end{tabular}$	$\begin{array}{c} \text{#it} \\ \hline \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ $	$\begin{array}{c} 0.2 \\ \hline 0.2 \\ \hline Reduct \\ C_{max} \\ \hline 3,132 \\ 27,557 \\ 46,806 \\ 24,485 \\ 24,255 \\ 29,080 \\ 42,578 \\ 31,597 \\ 36,098 \\ 29,858 \\ 46,939 \\ 33,404 \\ 30,219 \\ 31,284 \\ 41,893 \\ 32,165 \\ 41,199 \\ 29,883 \\ 33,805 \\ 41,199 \\ 29,883 \\ 33,805 \\ 31,304 \\ 35,570 \\ 31,946 \\ 42,016 \\ 38,144 \\ 40,412 \\ 49,412 \\ \end{array}$	$\begin{array}{c} \#\mathrm{it} \\ 4 \\ 1 \\ 3 \\ 2 \\ 3 \\ 1 \\ 5 \\ 4 \\ 2 \\ 2 \\ 2 \\ 2 \\ 5 \\ 4 \\ 4 \\ 4 \\ 6 \\ 5 \\ 2 \\ 7 \\ 6 \\ 9 \\ 2 \\ 3 \\ 2 \\ 3 \\ 1 \\ \end{array}$	$\begin{array}{c} C_{\rm max} \\ \hline \\ 33,697 \\ 25,969 \\ 42,787 \\ 24,017 \\ 24,743 \\ 27,366 \\ 41,737 \\ 30,276 \\ 41,737 \\ 30,27547 \\ 43,254 \\ 29,599 \\ 25,881 \\ 28,131 \\ 39,187 \\ 25,881 \\ 28,131 \\ 39,187 \\ 30,483 \\ 38,739 \\ 27,944 \\ 31,743 \\ 29,599 \\ 33,355 \\ 30,212 \\ 38,777 \\ 30,173 \\ 34,388 \\ 44,633 \\ \end{array}$	#it           1           3           1           2           1           2           1           2           1           2           1           2           1           2           1           2           1           2           1           5           3           6           3           2           6           4           7           3           3	$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$	$\begin{array}{c} \#\mathrm{it} \\ 2 \\ 1 \\ 3 \\ 2 \\ 1 \\ 1 \\ 5 \\ 4 \\ 1 \\ 2 \\ 1 \\ 5 \\ 4 \\ 2 \\ 5 \\ 2 \\ 8 \\ 4 \\ 5 \\ 2 \\ 5 \\ 9 \\ 3 \\ 6 \end{array}$
miniYFJS30         44,038         3         43,725         4         41,290         3         40,744         4         31,093         7         31,093         7           mean         38,499.23         3.20         38,356.83         3.87         35,853.50         2.87         35,567.97         3.63         32,729.50         3.07         32,492.13         3.70	miniYFJS01 miniYFJS03 miniYFJS03 miniYFJS05 miniYFJS06 miniYFJS06 miniYFJS07 miniYFJS08 miniYFJS10 miniYFJS11 miniYFJS13 miniYFJS13 miniYFJS13 miniYFJS15 miniYFJS15 miniYFJS18 miniYFJS18 miniYFJS18 miniYFJS18 miniYFJS20 miniYFJS20 miniYFJS22 miniYFJS23 miniYFJS24 miniYFJS26 miniYFJS26 miniYFJS26 miniYFJS26 miniYFJS26 miniYFJS26 miniYFJS26 miniYFJS26 miniYFJS26 miniYFJS26 miniYFJS27	$\begin{tabular}{ c c c c c }\hline \hline $C_{max}$ & $35,243$ \\ $28,688$ & $53,381$ \\ $25,334$ & $26,371$ \\ $30,952$ & $46,782$ \\ $33,954$ & $37,049$ \\ $29,416$ & $51,212$ \\ $36,343$ & $32,915$ \\ $31,826$ & $45,597$ \\ $33,965$ & $31,826$ \\ $44,181$ & $34,133$ \\ $39,165$ & $30,837$ \\ $40,523$ & $30,837$ \\ $40,523$ & $30,837$ \\ $40,523$ & $30,837$ \\ $40,523$ & $30,837$ \\ $40,523$ & $30,837$ \\ $40,523$ & $30,837$ \\ $40,291$ & $43,592$ \\ $54,739$ & $54,739$ \\ $54,759$ \\ $54,759$ \\ $56,765$ \\ \end{tabular}$	$\begin{array}{c} \# it \\ \# it \\ 1 \\ 1 \\ 2 \\ 1 \\ 2 \\ 1 \\ 2 \\ 2 \\ 2 \\ 5 \\ 1 \\ 4 \\ 5 \\ 6 \\ 3 \\ 3 \\ 5 \\ 3 \\ 3 \\ 6 \\ 6 \\ 4 \\ 4 \\ 5 \\ 3 \\ 2 \\ 4 \end{array}$	$\begin{tabular}{ c c c c c } \hline Reduct \\ \hline C_{max} \\ \hline 35,046 \\ \hline 35,046 \\ \hline 28,688 \\ \hline 52,098 \\ \hline 25,394 \\ \hline 30,952 \\ \hline$	$\begin{array}{c} \#\mathrm{it} \\ 2 \\ 1 \\ 3 \\ 1 \\ 3 \\ 1 \\ 4 \\ 3 \\ 2 \\ 5 \\ 2 \\ 4 \\ 5 \\ 6 \\ 4 \\ 7 \\ 7 \\ 4 \\ 4 \\ 6 \\ 6 \\ 4 \\ 4 \\ 6 \\ 3 \\ 3 \\ 4 \end{array}$	$\begin{tabular}{ c c c c c } \hline Cropp \\ \hline C_{max} & 34,443 \\ \hline 27,557 & 49,111 \\ 24,669 & 25,635 \\ 29,080 & 44,137 \\ 31,992 & 36,098 \\ 27,604 & 47,079 \\ 33,404 & 30,219 \\ 31,284 & 42,306 \\ 32,481 & 41,316 \\ 29,883 & 33,965 \\ 31,304 & 35,570 \\ 32,485 & 42,446 \\ 38,144 & 40,933 \\ 49,412 & 54,125 \\ \hline \end{tabular}$	$\begin{array}{c} \text{#it} \\ \hline \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ $	$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	$\begin{array}{c} \#\mathrm{it} \\ 4 \\ 1 \\ 3 \\ 2 \\ 3 \\ 1 \\ 5 \\ 4 \\ 2 \\ 2 \\ 5 \\ 4 \\ 4 \\ 4 \\ 6 \\ 5 \\ 2 \\ 7 \\ 6 \\ 9 \\ 2 \\ 3 \\ 2 \\ 3 \\ 1 \\ 6 \end{array}$	$\begin{array}{c} C_{\rm max} \\ \hline \\ 33,697 \\ 25,969 \\ 42,787 \\ 24,017 \\ 24,737 \\ 30,276 \\ 34,357 \\ 30,276 \\ 34,357 \\ 43,254 \\ 29,989 \\ 27,547 \\ 43,254 \\ 29,598 \\ 28,131 \\ 39,187 \\ 30,483 \\ 38,739 \\ 27,944 \\ 31,743 \\ 29,599 \\ 33,355 \\ 30,212 \\ 38,777 \\ 34,388 \\ 44,633 \\ 31,749 \\ \end{array}$	#it           1           3           1           3           1           2           1           2           1           2           1           2           1           2           1           2           1           2           1           2           1           2           1           2           1           2           1           2           1           2           1           2           1           2           1           2           3           4	$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$	$\begin{array}{c} \#\mathrm{it} \\ 2 \\ 1 \\ 3 \\ 2 \\ 1 \\ 1 \\ 5 \\ 4 \\ 1 \\ 5 \\ 4 \\ 1 \\ 5 \\ 4 \\ 2 \\ 5 \\ 2 \\ 8 \\ 4 \\ 5 \\ 2 \\ 5 \\ 9 \\ 3 \\ 6 \\ 6 \end{array}$
mean 38,499.23 3.20 38,356.83 3.87 35,853.50 2.87 35,567.97 3.63 32,729.50 3.07 32,492.13 3.70	miniYFJS01 miniYFJS03 miniYFJS03 miniYFJS05 miniYFJS05 miniYFJS05 miniYFJS07 miniYFJS07 miniYFJS10 miniYFJS10 miniYFJS11 miniYFJS12 miniYFJS15 miniYFJS15 miniYFJS15 miniYFJS18 miniYFJS17 miniYFJS18 miniYFJS18 miniYFJS20 miniYFJS21 miniYFJS22 miniYFJS22 miniYFJS22 miniYFJS23 miniYFJS23 miniYFJS24 miniYFJS25 miniYFJS27 miniYFJS27 miniYFJS27 miniYFJS28	$\begin{array}{c} C_{\max} \\ \hline \\ 35,243 \\ 28,688 \\ 28,683 \\ 33,81 \\ 25,334 \\ 26,371 \\ 30,952 \\ 46,782 \\ 33,954 \\ 47,724 \\ 37,049 \\ 29,416 \\ 51,212 \\ 36,343 \\ 32,915 \\ 31,826 \\ 45,597 \\ 33,965 \\ 44,181 \\ 39,165 \\ 30,837 \\ 40,523 \\ 35,019 \\ 45,725 \\ 40,291 \\ 43,592 \\ 54,739 \\ 36,765 \\ 54,739 \\ 36,765 \\ 41,951 \\ \end{array}$	$\begin{array}{c} \text{#d} \\ \text{#it} \\ 1 \\ 1 \\ 2 \\ 1 \\ 2 \\ 2 \\ 2 \\ 5 \\ 1 \\ 4 \\ 5 \\ 6 \\ 3 \\ 3 \\ 5 \\ 3 \\ 3 \\ 6 \\ 6 \\ 4 \\ 4 \\ 5 \\ 3 \\ 2 \\ 4 \\ 2 \end{array}$	$\begin{tabular}{ c c c c c } \hline Reduct \\ \hline C_{max} \\ \hline C_{max} \\ \hline 35,046 \\ \hline 52,098 \\ 25,394 \\ 46,089 \\ 33,883 \\ 37,049 \\ 29,416 \\ 51,129 \\ 36,343 \\ 32,792 \\ 31,826 \\ 45,442 \\ 33,701 \\ 45,442 \\ 33,701 \\ 45,442 \\ 34,044 \\ 30,837 \\ 701 \\ 34,044 \\ 30,837 \\ 35,019 \\ 45,725 \\ 40,523 \\ 35,019 \\ 45,725 \\ 40,231 \\ 35,019 \\ 45,725 \\ 54,675 \\ 54,675 \\ 54,675 \\ 54,675 \\ 54,675 \\ 54,675 \\ 54,675 \\ 54,675 \\ 54,675 \\ 54,675 \\ 54,675 \\ 54,675 \\ 54,675 \\ 54,675 \\ 54,675 \\ 54,675 \\ 54,675 \\ 54,675 \\ 54,675 \\ 54,838 \\ \hline \end{tabular}$	$\begin{array}{c} \# \mathrm{it} \\ & 2 \\ 1 \\ 3 \\ 1 \\ 3 \\ 1 \\ 4 \\ 3 \\ 2 \\ 5 \\ 2 \\ 4 \\ 5 \\ 6 \\ 4 \\ 5 \\ 6 \\ 4 \\ 4 \\ 6 \\ 6 \\ 4 \\ 4 \\ 6 \\ 3 \\ 3 \\ 4 \\ 3 \end{array}$	$\begin{tabular}{ c c c c c } \hline Croppy \\ \hline C_{max} & 34,443 \\ 27,557 & 49,111 \\ 24,669 & 25,635 \\ 29,080 & 44,137 \\ 31,992 & 36,098 \\ 27,604 & 47,079 \\ 33,404 & 30,219 \\ 33,404 & 30,219 \\ 33,404 & 30,219 \\ 33,404 & 30,219 \\ 33,404 & 33,442 \\ 33,965 & 33,965 \\ 31,304 & 35,570 \\ 32,485 & 42,446 \\ 38,144 & 40,933 \\ 49,412 & 34,125 \\ 38,640 & 38,640 \\ \hline \end{tabular}$	$ \begin{array}{c} \mathrm{d} \\ \frac{\mathrm{\#it}}{\mathrm{1}} \\ 1 \\ 1 \\ 2 \\ 1 \\ 3 \\ 1 \\ 2 \\ 2 \\ 4 \\ 1 \\ 5 \\ 4 \\ 4 \\ 3 \\ 3 \\ 5 \\ 2 \\ 6 \\ 6 \\ 9 \\ 1 \\ 2 \\ 2 \\ 1 \\ 1 \\ 4 \\ 2 \end{array} $	$\begin{array}{c c} 0.2 \\\hline \hline 0.2 \\\hline \hline 0.2 \\\hline \hline 0.3 \\\hline 0.3 \hline\hline 0.3 \\\hline 0$	$\begin{array}{c} \#\mathrm{it} \\ 4 \\ 1 \\ 3 \\ 2 \\ 3 \\ 1 \\ 5 \\ 4 \\ 2 \\ 2 \\ 2 \\ 2 \\ 4 \\ 4 \\ 4 \\ 6 \\ 5 \\ 2 \\ 7 \\ 6 \\ 9 \\ 2 \\ 3 \\ 1 \\ 6 \\ 3 \\ \end{array}$	$\begin{array}{c} C_{\rm max} \\ \hline \\ 33,697 \\ 25,969 \\ 42,787 \\ 24,017 \\ 24,743 \\ 27,366 \\ 41,737 \\ 30,276 \\ 41,737 \\ 30,27547 \\ 43,257 \\ 27,547 \\ 43,257 \\ 29,989 \\ 25,881 \\ 28,131 \\ 39,187 \\ 30,483 \\ 38,739 \\ 27,944 \\ 31,743 \\ 29,599 \\ 33,355 \\ 30,212 \\ 38,777 \\ 30,173 \\ 30,212 \\ 38,777 \\ 30,174 \\ 31,743 \\ 29,599 \\ 33,355 \\ 31,749 \\ 31,743 \\ 34,388 \\ 44,633 \\ 31,749 \\ 35,729 \\ \end{array}$	#it 1 1 3 1 1 2 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 3 6 3 2 5 2 6 4 4 5 2 6 4 4 5 5 2 6 4 5 5 2 6 6 4 5 5 5 5 6 6 6 7 7 7 7 7 7 7 7 7 7 7 7 7	$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$	$\begin{array}{c} \#\mathrm{it} \\ 2 \\ 1 \\ 3 \\ 2 \\ 1 \\ 1 \\ 5 \\ 4 \\ 1 \\ 2 \\ 1 \\ 5 \\ 4 \\ 1 \\ 2 \\ 1 \\ 5 \\ 4 \\ 6 \\ 4 \\ 2 \\ 5 \\ 2 \\ 8 \\ 4 \\ 5 \\ 2 \\ 5 \\ 9 \\ 3 \\ 6 \\ 6 \\ 2 \end{array}$
wins 14 30 13 28 17 18	miniYFJS01 miniYFJS03 miniYFJS03 miniYFJS06 miniYFJS06 miniYFJS06 miniYFJS07 miniYFJS09 miniYFJS10 miniYFJS11 miniYFJS13 miniYFJS13 miniYFJS14 miniYFJS16 miniYFJS16 miniYFJS16 miniYFJS19 miniYFJS20 miniYFJS22 miniYFJS23 miniYFJS25 miniYFJS25 miniYFJS26 miniYFJS26 miniYFJS28	$\begin{array}{c} \hline C_{max} \\ \hline 35,243 \\ 28,688 \\ 28,688 \\ 53,381 \\ 25,334 \\ 26,371 \\ 30,952 \\ 46,782 \\ 33,954 \\ 47,704 \\ 92,416 \\ 51,212 \\ 36,343 \\ 32,915 \\ 31,826 \\ 45,597 \\ 33,965 \\ 44,181 \\ 34,133 \\ 39,165 \\ 30,837 \\ 40,523 \\ 35,019 \\ 45,725 \\ 40,291 \\ 45,725 \\ 40,291 \\ 45,725 \\ 54,739 \\ 36,765 \\ 41,951 \\ 44,930 \\ \end{array}$	$\begin{array}{c} \frac{\#\mathrm{it}}{\#\mathrm{it}} \\ \frac{\#\mathrm{it}}{1} \\ 1 \\ 2 \\ 1 \\ 2 \\ 1 \\ 2 \\ 2 \\ 2 \\ 2 \\ 5 \\ 1 \\ 4 \\ 5 \\ 6 \\ 3 \\ 3 \\ 6 \\ 6 \\ 4 \\ 4 \\ 5 \\ 3 \\ 2 \\ 4 \\ 2 \\ 5 \\ \end{array}$	$\begin{array}{r} \mbox{Reduct}\\ \hline $C_{max}$ \\ \hline $35,046$ \\ $28,688$ \\ $52,098$ \\ $25,790$ \\ $30,952$ \\ $46,089$ \\ $33,883$ \\ $37,049$ \\ $29,416$ \\ $51,129$ \\ $36,343$ \\ $32,792$ \\ $36,343$ \\ $32,792$ \\ $36,343$ \\ $32,792$ \\ $36,343$ \\ $36,355$ \\ $36,75$	$\begin{array}{c} \#\mathrm{it} \\ 2 \\ 1 \\ 3 \\ 1 \\ 3 \\ 1 \\ 4 \\ 3 \\ 2 \\ 5 \\ 2 \\ 4 \\ 5 \\ 6 \\ 4 \\ 4 \\ 6 \\ 6 \\ 4 \\ 4 \\ 6 \\ 6 \\ 4 \\ 4$	$\begin{tabular}{ c c c c } \hline $Croppy $C_{max}$ & $Croppy $C_{max}$ & $34,443$ & $27,557$ & $49,111$ & $24,669$ & $25,635$ & $29,080$ & $44,137$ & $31,992$ & $36,098$ & $27,604$ & $47,079$ & $33,096$ & $27,604$ & $47,079$ & $33,096$ & $27,604$ & $47,079$ & $33,095$ & $27,604$ & $47,079$ & $33,095$ & $27,604$ & $47,079$ & $30,219$ & $30,219$ & $30,219$ & $30,219$ & $30,219$ & $30,219$ & $30,219$ & $30,219$ & $31,284$ & $42,346$ & $32,485$ & $31,304$ & $35,570$ & $32,485$ & $42,446$ & $38,143$ & $40,933$ & $42,446$ & $38,144$ & $40,933$ & $42,446$ & $38,144$ & $40,933$ & $42,446$ & $38,144$ & $40,933$ & $42,4125$ & $38,640$ & $38,993$ & $38,993$ & $38,993$ & $38,993$ & $38,993$ & $38,993$ & $38,993$ & $38,993$ & $38,993$ & $30,910$ & $30,9$	$\begin{array}{c} \text{dd} \\ \frac{\#\text{it}}{1} \\ 1 \\ 2 \\ 1 \\ 3 \\ 1 \\ 2 \\ 2 \\ 2 \\ 4 \\ 1 \\ 5 \\ 4 \\ 4 \\ 3 \\ 3 \\ 5 \\ 2 \\ 6 \\ 6 \\ 9 \\ 1 \\ 2 \\ 2 \\ 1 \\ 1 \\ 4 \\ 2 \\ 3 \end{array}$	$\begin{array}{c} 0.2 \\ \hline 0.2 \\ \hline 0.2 \\ \hline 0.2 \\ \hline 0.3 \\ \hline$	$\begin{array}{c} \#\mathrm{it} \\ 4 \\ 1 \\ 3 \\ 2 \\ 3 \\ 1 \\ 5 \\ 4 \\ 2 \\ 2 \\ 5 \\ 4 \\ 4 \\ 4 \\ 6 \\ 5 \\ 2 \\ 7 \\ 6 \\ 9 \\ 2 \\ 3 \\ 2 \\ 3 \\ 1 \\ 6 \\ 3 \\ 4 \end{array}$	$\begin{array}{c} C_{\rm max} \\ \hline \\ 33,697 \\ 25,969 \\ 42,787 \\ 24,017 \\ 24,743 \\ 27,366 \\ 41,737 \\ 30,276 \\ 41,737 \\ 30,276 \\ 41,737 \\ 32,7547 \\ 43,254 \\ 29,989 \\ 25,881 \\ 28,131 \\ 39,187 \\ 25,881 \\ 28,131 \\ 39,187 \\ 30,483 \\ 38,739 \\ 27,944 \\ 30,483 \\ 30,483 \\ 30,483 \\ 30,483 \\ 30,483 \\ 30,483 \\ 30,483 \\ 30,483 \\ 30,483 \\ 30,483 \\ 30,483 \\ 30,483 \\ 30,483 \\ 30,483 \\ 30,483 \\ 30,483 \\ 31,744 \\ 33,575 \\ 30,173 \\ 30,212 \\ 38,777 \\ 30,173 \\ 30,212 \\ 38,777 \\ 30,173 \\ 30,212 \\ 38,777 \\ 30,173 \\ 34,380 \\ 34,330 \\ \end{array}$	$\begin{array}{c} \text{#it} \\ \text{#it} \\ 1 \\ 1 \\ 3 \\ 1 \\ 1 \\ 2 \\ 2 \\ 1 \\ 2 \\ 1 \\ 2 \\ 1 \\ 2 \\ 1 \\ 5 \\ 3 \\ 6 \\ 3 \\ 2 \\ 5 \\ 2 \\ 6 \\ 4 \\ 5 \\ 1 \\ 4 \\ 7 \\ 3 \\ 3 \\ 4 \\ 2 \\ 4 \end{array}$	$\begin{tabular}{ c c c c c c c } \hline Reduct \\ \hline $C_{max}$ & $32,199$ \\ $25,969$ & $42,787$ \\ $23,774$ & $24,743$ \\ $24,743$ & $24,743$ \\ $24,743$ & $24,743$ \\ $29,631$ & $29,631$ \\ $29,631$ & $29,5619$ \\ $29,989$ & $25,619$ \\ $29,999$ & $25,619$ \\ $29,998$ & $25,6$	$\begin{array}{c} \#\mathrm{it} \\ 2 \\ 1 \\ 3 \\ 2 \\ 1 \\ 1 \\ 5 \\ 4 \\ 1 \\ 2 \\ 1 \\ 5 \\ 4 \\ 6 \\ 4 \\ 2 \\ 5 \\ 2 \\ 8 \\ 4 \\ 5 \\ 2 \\ 8 \\ 4 \\ 5 \\ 2 \\ 5 \\ 9 \\ 3 \\ 6 \\ 6 \\ 2 \\ 3 \\ \end{array}$
	miniYFJS01 miniYFJS03 miniYFJS03 miniYFJS06 miniYFJS06 miniYFJS06 miniYFJS07 miniYFJS08 miniYFJS10 miniYFJS11 miniYFJS13 miniYFJS13 miniYFJS16 miniYFJS16 miniYFJS17 miniYFJS18 miniYFJS19 miniYFJS20 miniYFJS23 miniYFJS23 miniYFJS24 miniYFJS23 miniYFJS227 miniYFJS29	$\begin{tabular}{ c c c c c }\hline \hline $C_{max}$ & $$3,243$ \\ $28,688$ & $$3,381$ \\ $25,334$ & $$2,334$ \\ $26,371$ & $$30,952$ \\ $46,782$ & $$33,954$ \\ $37,049$ & $$29,416$ \\ $51,212$ & $$29,416$ \\ $51,212$ & $$29,416$ \\ $51,212$ & $$36,343$ \\ $32,915$ & $$31,826$ \\ $45,915$ & $$31,826$ \\ $44,181$ & $$34,133$ \\ $39,165$ & $$31,826$ \\ $44,181$ & $$34,133$ \\ $39,165$ & $$30,837$ \\ $40,523$ & $$40,523$ \\ $40,523$ & $$40,523$ \\ $40,523$ & $$40,523$ \\ $40,523$ & $$40,523$ \\ $40,523$ & $$40,523$ \\ $40,523$ & $$40,523$ \\ $40,523$ & $$40,523$ \\ $40,523$ & $$40,523$ \\ $40,523$ & $$40,525$ \\ $40,525$ & $$40,525$ \\ $40,525$ & $$40,525$ \\ $40,525$ & $$40,525$ \\ $40,525$ & $$40,525$ \\ $40,525$ & $$40,525$ \\ $40,525$ & $$40,525$ \\ $40,525$ & $$40,525$ \\ $40,525$ & $$40,525$ \\ $40,525$ & $$40,525$ \\ $40,525$ & $$40,525$ \\ $40,525$ & $$40,525$ \\ $40,525$ & $$40,525$ \\ $40,525$ & $$40,525$ \\ $40,525$ & $4$	$ \frac{\text{ded}}{\#\text{it}} \\ \frac{1}{2} \\ 1 \\ 2 \\ 1 \\ 2 \\ 2 \\ 2 \\ 2 \\ 5 \\ 1 \\ 4 \\ 5 \\ 6 \\ 3 \\ 3 \\ 6 \\ 6 \\ 4 \\ 4 \\ 5 \\ 3 \\ 2 \\ 4 \\ 2 \\ 5 \\ 3 \\ 2 \\ 4 \\ 2 \\ 5 \\ 3 \\ 3 \\ 3 \\ 4 \\ 2 \\ 5 \\ 3 \\ 3 \\ 4 \\ 2 \\ 5 \\ 3 \\ 3 \\ 4 \\ 2 \\ 5 \\ 3 \\ 3 \\ 3 \\ 4 \\ 2 \\ 5 \\ 3 \\ 3 \\ 3 \\ 4 \\ 2 \\ 5 \\ 3 \\ 3 \\ 3 \\ 4 \\ 2 \\ 5 \\ 3 \\ 3 \\ 4 \\ 2 \\ 5 \\ 3 \\ 3 \\ 4 \\ 2 \\ 5 \\ 3 \\ 3 \\ 4 \\ 2 \\ 5 \\ 3 \\ 4 \\ 2 \\ 5 \\ 3 \\ 3 \\ 4 \\ 2 \\ 5 \\ 3 \\ 3 \\ 4 \\ 2 \\ 5 \\ 3 \\ 3 \\ 4 \\ 2 \\ 5 \\ 3 \\ 3 \\ 4 \\ 4 \\ 2 \\ 5 \\ 3 \\ 3 \\ 4 \\ 4 \\ 2 \\ 5 \\ 3 \\ 3 \\ 4 \\ 4 \\ 2 \\ 5 \\ 3 \\ 3 \\ 4 \\ 4 \\ 2 \\ 5 \\ 3 \\ 3 \\ 4 \\ 4 \\ 4 \\ 4 \\ 5 \\ 3 \\ 3 \\ 4 \\ 4 \\ 4 \\ 4 \\ 4 \\ 5 \\ 3 \\ 3 \\ 4 \\ 4 \\ 4 \\ 4 \\ 5 \\ 3 \\ 3 \\ 4 \\ 4 \\ 4 \\ 4 \\ 5 \\ 5 \\ 4 \\ 4 \\ 4 \\ 4$	$\begin{tabular}{ c c c c c } \hline Reduct \\ \hline C_{max} \\ \hline State \\ \hline $	$\begin{array}{c} \#\mathrm{it} \\ 2 \\ 1 \\ 3 \\ 1 \\ 3 \\ 1 \\ 4 \\ 3 \\ 2 \\ 5 \\ 2 \\ 4 \\ 5 \\ 6 \\ 4 \\ 4 \\ 6 \\ 6 \\ 4 \\ 4 \\ 6 \\ 3 \\ 3 \\ 4 \\ 3 \\ 5 \\ 4 \end{array}$	$\begin{tabular}{ c c c c } \hline Cropp \\ \hline C_{max} & 34,443 \\ \hline 27,557 & 49,111 \\ \hline 24,669 & 25,635 \\ \hline 29,080 & 44,137 \\ \hline 31,992 & 36,098 \\ \hline 27,604 & 47,079 \\ \hline 33,404 & 30,219 \\ \hline 30,219 & 31,284 \\ \hline 42,306 & 32,481 \\ \hline 44,316 & 29,883 \\ \hline 33,964 & 32,481 \\ \hline 41,316 & 29,883 \\ \hline 33,304 & 35,570 \\ \hline 32,485 & 42,446 \\ \hline 38,144 & 40,933 \\ \hline 49,412 & 34,125 \\ \hline 38,640 & 38,993 \\ \hline 38,993 & 38,993 \\ \hline 38,9$	$ \begin{array}{c} \mathrm{d} \\ \#\mathrm{it} \\ 1 \\ 1 \\ 2 \\ 1 \\ 2 \\ 2 \\ 4 \\ 1 \\ 2 \\ 2 \\ 4 \\ 1 \\ 5 \\ 4 \\ 4 \\ 3 \\ 5 \\ 2 \\ 6 \\ 6 \\ 9 \\ 1 \\ 2 \\ 2 \\ 1 \\ 1 \\ 4 \\ 2 \\ 3 \\ 3 \end{array} $	$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	$\begin{array}{c} \#\mathrm{it} \\ 4 \\ 1 \\ 3 \\ 2 \\ 3 \\ 1 \\ 5 \\ 4 \\ 2 \\ 2 \\ 2 \\ 5 \\ 4 \\ 4 \\ 4 \\ 6 \\ 5 \\ 2 \\ 7 \\ 6 \\ 9 \\ 2 \\ 3 \\ 2 \\ 3 \\ 1 \\ 6 \\ 3 \\ 4 \\ 4 \\ \end{array}$	$\begin{array}{c} C_{\rm max} \\ \hline \\ 33,697 \\ 25,969 \\ 42,787 \\ 24,017 \\ 24,743 \\ 27,366 \\ 41,737 \\ 30,276 \\ 41,737 \\ 30,276 \\ 41,737 \\ 30,275 \\ 27,547 \\ 43,254 \\ 29,881 \\ 28,131 \\ 39,187 \\ 30,483 \\ 38,739 \\ 27,944 \\ 31,743 \\ 32,599 \\ 33,355 \\ 30,212 \\ 38,777 \\ 30,173 \\ 34,385 \\ 31,749 \\ 35,729 \\ 34,330 \\ 31,093 \\ \end{array}$	$\begin{array}{c} \text{ad} \\ \#\text{it} \\ 1 \\ 1 \\ 1 \\ 3 \\ 1 \\ 1 \\ 2 \\ 2 \\ 1 \\ 2 \\ 1 \\ 2 \\ 1 \\ 2 \\ 1 \\ 2 \\ 1 \\ 2 \\ 1 \\ 2 \\ 1 \\ 2 \\ 1 \\ 2 \\ 1 \\ 3 \\ 4 \\ 2 \\ 4 \\ 7 \\ 3 \\ 4 \\ 2 \\ 4 \\ 7 \\ \end{array}$	$\begin{tabular}{ c c c c c } \hline Reduct \\ \hline $C_{max}$ \\ \hline $2,199$ \\ \hline $2,969$ \\ $42,787$ \\ $23,774$ \\ $24,743$ \\ $27,366$ \\ $39,229$ \\ $29,631$ \\ $29,531$ \\ $27,425$ \\ $43,254$ \\ $29,589$ \\ $25,619$ \\ $28,131$ \\ $38,584$ \\ $29,589$ \\ $26,619$ \\ $28,131$ \\ $38,584$ \\ $27,944$ \\ $31,082$ \\ $29,599$ \\ $33,355$ \\ $29,498$ \\ $37,963$ \\ $31,572$ \\ $34,388$ \\ $44,207$ \\ $31,571$ \\ $35,729$ \\ $34,604$ \\ $42,093$ \\ $31,093$ \\ $31,093$ \\ $31,093$ \\ \end{tabular}$	$\begin{array}{c} \#\mathrm{it} \\ 2 \\ 1 \\ 3 \\ 2 \\ 1 \\ 1 \\ 5 \\ 4 \\ 1 \\ 2 \\ 1 \\ 5 \\ 4 \\ 6 \\ 4 \\ 2 \\ 5 \\ 2 \\ 8 \\ 4 \\ 5 \\ 2 \\ 8 \\ 4 \\ 5 \\ 2 \\ 8 \\ 6 \\ 6 \\ 2 \\ 3 \\ 7 \end{array}$

Table 3: Local search results with the best-improvement strategy using the reduced neighborhood and the cropped neighborhood, applied to the small-sized instances with learning rate  $\alpha \in \{0.1, 0.2, 0.3\}$ .

			$\alpha =$	0.1					$\alpha =$	0.2					α =	= 0.3		
instance	Cr	opped		Re	educed		Cr	opped		Re	educed		Cr	opped		Re	educed	
	$C_{\text{max}}$	#it	Time	$C_{\text{max}}$	#it	Time	$C_{\text{max}}$	#it	Time	$C_{\text{max}}$	#it	Time	$C_{\text{max}}$	#it	Time	C <sub>max</sub>	#it	Time
DAFJS01	26,465	4	0.000	26,203	7	0.004	26,371	3	0.000	24,993	8	0.001	21,685	3	0.000	21,685	3	0.000
DAFJS02	28,098	3	0.000	28,098	3	0.001	27,949	2	0.000	27,727	4	0.000	23,021	3	0.000	23,021	3	0.000
DAFJS03	53,688	1	0.000	51,580	14	0.009	47,879	2	0.000	45,916	15	0.011	43,509	2	0.000	42,258	8	0.006
DAFJS04	54,082	1	0.000	52,494	11	0.004	47,571	4	0.000	46,502	7	0.003	41,899	2	0.000	41,533	4	0.001
DAFJS05	40,723	10	0.006	40,723	12	0.005	37,118	15	0.002	38,484	12	0.005	33,331	12	0.001	33,813	7	0.003
DAFJS06	45,234	11	0.007	44,877	15	0.009	41,995	6	0.001	41,909	9	0.005	33,956	5	0.001	30,556	20	0.011
DAFJS07	54,937	5	0.006	53,651	15	0.032	44,414	16	0.009	44,147	21	0.046	40,442	5	0.002	40,057	13	0.027
DAFJS08	58,941	10	0.009	56,561	14	0.031	52,803	3	0.001	51,128	16	0.038	44,590	4	0.001	43,737	16	0.034
DAFJS09	43,032	9	0.003	45,796	5	0.002	38,062	12	0.002	37,876	12	0.007	36,488	5	0.001	36,303	10	0.008
DAFJS10	54,858	5	0.002	51,277	24	0.025	45,971	4	0.001	45,868	3	0.002	35,273	8	0.002	35,023	9	0.009
DAFJS11	63,795	8	0.010	64,796	20	0.066	53,770	7	0.007	52,845	17	0.061	44,701	7	0.005	44,599	11	0.035
DAFJS12	62,433	15	0.024	61,533	28	0.128	54,073	5	0.007	52,355	17	0.080	44,051	5	0.004	43,449	11	0.045
DAFJS13	58,902	6	0.004	56,453	22	0.027	48,838	13	0.007	49,179	10	0.011	41,717	4	0.001	41,717	4	0.005
DAFJS14	62,637	42	0.029	70,357	8	0.014	55,503	19	0.012	54,609	25	0.040	44,777	16	0.008	44,646	23	0.042
DAFJS15	64,527	21	0.032	62,030	39	0.205	52,115	9	0.011	53,677	7	0.035	46,921	12	0.012	47,268	15	0.071
DAFJS16	69,300	21	0.029	66,153	71	0.358	61,676	8	0.011	60,010	20	0.093	54,072	15	0.015	49,031	46	0.260
DAFJS17	70,803	9	0.011	69,975	22	0.054	55,294	6	0.006	54,456	18	0.045	45,667	17	0.016	47,550	28	0.103
DAFJS18	67,984	27	0.022	71,052	10	0.031	57,965	16	0.012	57,274	25	0.042	48,351	7	0.004	49,753	5	0.013
DAFJS19	57,786	16	0.014	57,471	22	0.046	51,065	8	0.004	51,065	8	0.019	43,998	9	0.003	40,678	26	0.053
DAFJS20	67,045	22	0.021	66,674	30	0.115	57,271	27	0.027	55,355	47	0.180	45,160	23	0.024	49,481	14	0.055
DAFJS21	72,979	17	0.025	71,913	23	0.103	58,044	14	0.018	57,787	20	0.070	48,693	16	0.023	48,912	16	0.064
DAFJS22	60,238	46	0.068	62,189	29	0.196	54,147	11	0.017	53,728	15	0.088	41,480	28	0.040	42,035	25	0.156
DAFJS23	47,719	9	0.004	47,520	15	0.022	42,480	8	0.003	42,943	11	0.014	39,105	3	0.001	38,185	8	0.011
DAFJS24	54,427	13	0.009	55,115	12	0.033	46,797	15	0.012	46,985	12	0.024	41,832	4	0.005	39,979	21	0.063
DAFJS25	74,359	37	0.049	73,353	48	0.301	58,767	31	0.043	61,465	29	0.165	49,919	9	0.013	49,527	14	0.059
DAFJS26	68,577	50	0.076	76,328	12	0.080	63,243	36	0.049	68,469	18	0.142	51,544	16	0.021	50,829	31	0.219
DAFJS27	79,254	2	0.004	78,967	6	0.036	62,520	12	0.020	62,359	18	0.120	51,382	29	0.041	53,010	23	0.168
DAFJS28	58,564	4	0.004	53,505	41	0.100	48,593	12	0.012	48,941	9	0.029	41,206	4	0.004	40,923	7	0.019
DAFJS29	70,450	6	0.005	65,758	36	0.120	56,387	20	0.014	57,708	14	0.054	49,906	5	0.005	48,412	18	0.074
DAFJS30	57,326	6	0.004	56,839	13	0.032	49,649	17	0.012	49,312	30	0.092	42,819	2	0.002	42,592	4	0.011
mean	58,305.43	14.53	0.016	57,974.70	20.90	0.073	49,944.33	12.03	0.011	49,835.73	15.90	0.051	42,383.17	9.33	0.009	42,018.73	14.77	0.054
wins	9			23			10			21			11			13		

			$\alpha =$	0.1					$\alpha =$	0.2					α =	= 0.3		
instance	Cr	opped		Re	educed		Cr	opped		Re	duced		Cr	opped		Re	educed	
	$C_{\text{max}}$	#it	Time	$C_{\text{max}}$	#it	Time	$C_{\text{max}}$	#it	Time	$C_{\text{max}}$	#it	Time	$C_{\text{max}}$	#it	Time	$C_{\text{max}}$	#it	Time
YFJS01	80,167	6	0.000	79,657	8	0.002	71,592	9	0.001	68,822	14	0.004	66,246	6	0.000	60,208	15	0.005
YFJS02	76,529	3	0.000	76,529	3	0.000	66,853	1	0.000	66,853	1	0.000	59,001	2	0.000	59,001	2	0.000
YFJS03	34,166	5	0.000	36,409	4	0.000	32,864	5	0.000	32,864	5	0.000	30,995	3	0.000	31,407	2	0.000
YFJS04	45,683	3	0.000	45,533	4	0.000	42,553	4	0.000	42,553	4	0.000	38,092	3	0.000	38,092	3	0.000
YFJS05	45,421	3	0.000	45,421	3	0.000	40,738	2	0.000	40,738	2	0.000	38,324	4	0.000	38,324	8	0.001
YFJS06	44,936	10	0.001	44,936	10	0.002	40,272	9	0.000	43,744	6	0.001	43,123	6	0.000	43,099	7	0.001
YFJS07	48,491	9	0.000	48,355	10	0.002	40,941	12	0.001	40,941	12	0.002	38,453	2	0.000	38,453	2	0.000
YFJS08	47,429	3	0.000	41,754	9	0.001	41,994	3	0.000	37,681	10	0.001	35,429	2	0.000	33,392	5	0.000
YFJS09	24,413	2	0.000	23,944	4	0.000	23,059	2	0.000	22,211	4	0.000	20,916	7	0.000	20,916	7	0.001
YFJS10	42,583	1	0.000	42,278	2	0.000	39,126	4	0.000	39,361	4	0.000	34,487	7	0.000	34,487	10	0.001
YFJS11	52,815	4	0.000	52,196	8	0.002	49,781	2	0.000	49,206	4	0.001	45,051	1	0.000	44,729	2	0.000
YFJS12	53,094	11	0.001	52,650	12	0.004	56,022	7	0.000	54,186	12	0.004	46,471	5	0.000	43,150	9	0.003
YFJS13	47,064	4	0.000	46,578	9	0.003	41,618	5	0.000	41,498	6	0.002	36,962	4	0.000	35,800	11	0.003
YFJS14	119,792	13	0.016	118,731	27	0.202	97,201	18	0.022	100,177	23	0.161	89,371	6	0.008	87,518	21	0.162
YFJS15	121,960	14	0.020	125,754	66	0.553	110,858	8	0.011	109,314	33	0.284	90,041	15	0.019	88,664	28	0.220
YFJS16	116,033	19	0.024	115,312	31	0.204	101,073	7	0.008	98,976	34	0.238	88,521	5	0.006	85,252	27	0.176
YFJS17	104,862	9	0.025	104,466	18	0.396	83,240	14	0.042	82,167	42	0.895	71,114	9	0.027	70,851	46	1.004
YFJS18	124,738	13	0.043	119,224	84	1.872	97,366	9	0.027	94,472	45	1.123	83,681	9	0.030	82,795	27	0.639
YFJS19	98,795	24	0.072	100,158	38	0.847	86,289	9	0.031	83,530	48	1.159	70,454	22	0.061	68,592	69	1.435
YFJS20	95,573	10	0.030	94,201	42	0.764	79,653	24	0.062	79,638	35	0.630	70,928	9	0.028	70,253	19	0.365
mean	71,227.20	8.30	0.012	70,704.30	19.60	0.243	62,154.65	7.70	0.010	61,446.60	17.20	0.225	54,883.00	6.35	0.009	53,749.15	16.00	0.201
wins	6			17			8			17			7			19		

Table 4: Local search results with the best-improvement strategy using the reduced neighborhood and the cropped neighborhood, applied to the large-sized instances proposed in [8] with learning rate  $\alpha \in \{0.1, 0.2, 0.3\}$ .

tables, additional lines show some statistics. The line named  $\bar{C}_{max}$  shows the average of the makespans found by each method (for each instance, the average considers the best over the five runs, when applicable). The line named #best shows, for each method, the number of instances in which the method found the best solution among the solutions found by the seven methods being considered. The line named gap(%), shows, for each method, the average gap

when, for each instance, the solution found is compared with the best solution found by the seven methods. If the seven methods applied to the same instance found makespans  $c_1, \ldots, c_7$ , the gap of method i in the considered instance corresponds to  $100\% \times (c_i - c_{\min})/c_{\min}$ , where  $c_{\min} = \min\{c_1, \ldots, c_7\}$ . The gap reported in line gap(%) for each method corresponds to the average over all instances in the table. In the previous sentence, if a method i is run five times per instance, the value  $c_i$  made reference to the best over the five runs. So the value reported in line gap(%) does not refer to what happened in "the other four runs". In these other cases, does each method find something close to its best makespan or something much worse? To answer this question, let us now consider that the values  $\bar{c}_1, \ldots, \bar{c}_7$  correspond to the average of the makespans found in the five runs. The line  $\overline{gap}(\%)$  shows the same as line gap(%) but considering  $\bar{c}_1, \ldots, \bar{c}_7$  instead of  $c_1, \ldots, c_7$ . Both lines coincide for the case of TS-RN and TS-CN which have no random components and are therefore only executed once per instance. Thus, when TS-RN or TS-CN is compared with other method, it is the value of  $\overline{\text{gap}}(\%)$  that must be compared. Otherwise, we would be comparing a method that is run only once against a method that is run five times and keeps the best solution found only. Statistics, consolidating the individual statistics for the DA-type and Y-type instances and the learning rates  $\alpha \in \{0.1, 0.2, 0.3\}$ , appear at the top of Table 13.

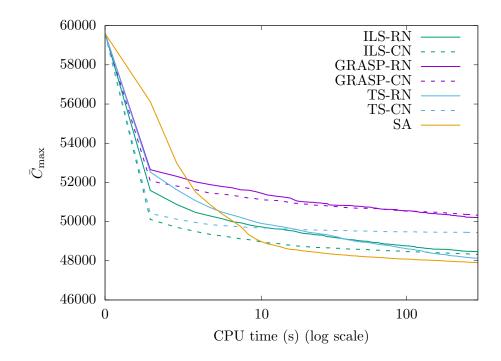


Figure 3: This figure shows the value of  $\overline{C}_{max}$  as a function of the CPU time for each of the seven methods applied to the large-sized instances. The average makespan shown in the graphic is the average of the different values shown in Tables 5, 6, and 7, that separate the instances by DA type, Y type and learning rates  $\alpha \in \{0.1, 0.2, 0.3\}$ .

Figure 3 shows, for each method, the average value of  $C_{\text{max}}$  as a function of the CPU time. As mentioned above, the considered average is the average of the makespans shown in Tables 5,

	ILS-1	RN	ILS-	CN	GRAS	P-RN	GRAS	P-CN	TS-I	RN	TS-	CN	SA	A
instance	$C_{\text{max}}$	Time	$C_{\text{max}}$	Time	$C_{\text{max}}$	Time	$C_{\text{max}}$	Time	$C_{\text{max}}$	Time	$C_{\text{max}}$	Time	C <sub>max</sub>	Time
DAFJS01	23,460	12.29	23,460	3.39	24,172	90.48	23,961	131.52	24,424	0.05	24,661	0.01	23,992	46.48
DAFJS02	26,432	60.95	26,432	25.84	26,989	0.01	26,869	0.28	26,432	0.32	27,620	0.00	27,577	0.55
DAFJS03	50,343	164.37	50,462	34.55	50,424	241.44	51,028	156.99	50,343	7.20	51,612	0.26	50,458	261.30
DAFJS04	51,872	62.24	51,992	181.28	51,927	30.24	52,358	275.80	52,291	0.11	53,348	0.00	51,927	151.36
DAFJS05	34,660	167.91	34,660	45.10	37,081	35.04	36,883	80.14	35,278	1.96	36,009	0.26	36,141	139.08
DAFJS06	35,435	111.76	35,302	176.69	37,023	122.84	36,338	98.55	$35,\!636$	15.04	37,854	0.05	35,697	256.36
DAFJS07	45,805	240.68	45,306	72.33	46,624	107.20	46,791	57.95	44,281	158.67	45,060	297.79	44,219	241.82
DAFJS08	53,202	52.07	53,463	41.54	53,575	174.57	54,129	129.70	53,002	261.88	54,018	0.69	53,292	276.00
DAFJS09	40,573	145.06	40,537	166.88	41,066	119.76	40,759	184.35	41,123	4.34	42,241	0.09	41,265	4.00
DAFJS10	44,523	99.32	44,058	254.61	44,917	217.73	44,735	277.52	45,820	10.28	47,438	0.32	44,851	70.25
DAFJS11	55,180	121.71	55,393	151.06	58,257	219.22	58,527	228.89	$54,\!351$	260.24	55,337	158.73	54,708	264.50
DAFJS12	54,035	227.92	53,175	20.54	$56,\!670$	237.70	56,495	79.61	51,432	238.43	51,794	224.88	51,067	234.61
DAFJS13	$54,\!654$	35.35	54,371	0.05	54,392	277.63	54,583	107.84	53,340	233.35	53,792	0.10	54,502	93.52
DAFJS14	61,500	133.79	60,882	169.24	$61,\!487$	185.43	$61,\!641$	265.85	59,668	196.33	61,524	0.74	59,573	254.00
DAFJS15	57,552	111.67	57,554	216.92	59,362	201.70	59,997	220.71	55,086	253.37	55,381	115.31	55,164	197.01
DAFJS16	58,828	213.11	58,327	98.92	63,365	189.53	62,494	242.24	55,927	242.72	56,758	115.48	55,868	208.74
DAFJS17	65,252	138.93	65,121	1.17	64,804	269.21	$65,\!643$	74.78	64,262	283.76	65,525	1.33	65,602	55.29
DAFJS18	66,429	288.91	65,889	271.51	66,633	179.15	66,419	214.60	64,916	134.40	67,040	0.23	64,820	219.02
DAFJS19	45,416	136.34	44,744	95.28	46,757	147.62	46,301	76.22	44,633	121.09	45,602	1.30	44,086	144.96
DAFJS20	59,190	298.29	58,137	241.93	59,670	43.48	59,323	79.25	56,432	155.97	57,141	9.73	57,245	290.79
DAFJS21	65,432	83.75	66,006	217.22	66,547	87.71	66,752	277.45	64,563	264.94	64,902	13.37	64,059	124.80
DAFJS22	58,025	2.64	57,426	227.59	59,477	62.55	59,086	30.34	55,246	269.80	55,038	24.67	55,624	283.70
DAFJS23	42,818	226.75	42,255	149.85	43,565	66.68	43,426	150.96	41,941	57.87	42,426	1.56	41,286	227.89
DAFJS24	48,266	207.07	48,911	123.21	51,313	127.05	51,532	43.92	47,443	139.28	47,365	281.95	46,945	217.47
DAFJS25	62,813	127.68	63,039	16.33	65,321	147.01	65,866	65.19	60,824	205.95	60,308	248.14	60,187	270.84
DAFJS26	62,389	131.50	61,645	158.57	65,982	299.75	65,951	196.11	58,995	185.68	58,749	67.28	59,450	297.29
DAFJS27	69,386 48,001	73.63	68,795	254.71	70,375	231.60	70,762	6.13	66,539	245.31	66,003	148.50	66,070	204.00
DAFJS28	48,091	133.90	47,738	187.43	48,669	164.03	49,309	294.79	47,428	164.05	47,551	75.18	46,569	268.66
DAFJS29 DAFJS30	57,824 48,572	58.01 292.30	57,384 48,329	259.73 137.76	59,825 50,395	$173.11 \\ 59.47$	59,564 50,593	234.87 18.06	55,820 47,140	$10.14 \\ 237.35$	56,122 47,307	$37.45 \\ 76.44$	54,686 46,344	296.94 232.86
C <sub>max</sub>	,		,				,		,				,	
		8 57	L 51.35	9 77	52.88	88 80	52.93	7 17	50.48	7.20	51.18	34 20	50 44	2.47
		8.57	51,35		52,88		52,93		50,48 8	7.20	51,18		50,44	
#best	5		6	;	Ć	)	Ó	)	8		3	3	1:	3
#best gap(%)		9		5 33	/	) 46	· · · · ·	) 18		1		8 45	,	3 34
#best	5 2.7	9	6 2.3	5 33	0 5.4	) 46	( 5.4	) 18	8 0.9	1	3 2.4	8 45	1: 0.8 1.8	3 34 37
$\frac{\text{\#best}}{\text{gap}(\%)}$ $\frac{1}{\text{gap}(\%)}$	5 2.7 3.4 ILS-1	9 3 RN	6 2.5 2.9 ILS-	6 33 94 •CN	0 5.4 6.5 GRAS	) 46 23 P-RN	0 5.4 6.1 GRAS	9 48 14 P-CN	8 0.9 0.9 TS-I	1 1 RN	3 2.4 2.4 TS-	8 45 45 CN	1: 0.8 1.8	3 34 37 A
#best gap(%)	5 2.7 3.4	9 3	6 2.3 2.9	6 33 94 -CN -Time	0 5.4 6.5	) 46 23	0 5.4 6.1	) 18 14	8 0.9 0.9	1	3 2.4 2.4	8 45 45	1: 0.8 1.8	3 34 37
$\frac{\text{\#best}}{\text{gap}(\%)}$ $\frac{1}{\text{gap}(\%)}$	5 2.7 3.4 ILS-1	9 3 RN	6 2.5 2.9 ILS-	6 33 94 •CN	0 5.4 6.5 GRAS	) 46 23 P-RN	0 5.4 6.1 GRAS	9 48 14 P-CN	8 0.9 0.9 TS-I	1 1 RN	3 2.4 2.4 TS-	8 45 45 CN	1: 0.8 1.8	3 34 37 A
$\frac{\text{\#best}}{\text{gap}(\%)}$ $\frac{\text{gap}(\%)}{\text{instance}}$ $\frac{\text{YFJS01}}{\text{YFJS02}}$	5 2.7 3.4 ILS-1 <i>C</i> <sub>max</sub> <b>68,714</b> <b>72,465</b>	9 3 RN <u>Time</u> 0.51 1.40	6 2.: 2.9 <u>ILS- C<sub>max</sub></u> 68,714 72,465	5 33 34 CN Time 0.80 2.82	( 5.4 6.2 GRAS C <sub>max</sub> <b>68,714</b> 73,053	) 46 23 3P-RN Time 0.12 0.12	$\begin{array}{c} & ( \\ 5.4 \\ 6.1 \\ \\ \hline \\ GRAS \\ \hline \\ C_{max} \\ 69,189 \\ \hline \\ 73,149 \end{array}$	48 14 P-CN Time 0.02 0.44	8 0.9 0.9 TS-I C <sub>max</sub> 68,714 72,465	1 1 RN Time 0.34 0.02	$\begin{array}{c} & 3 \\ 2.4 \\ 2.4 \\ \hline \\ \hline \\ C_{max} \\ \hline \\ 75,595 \\ 73,053 \end{array}$	3 45 45 CN Time 0.03 0.04	1: 0.8 1.8 C <sub>max</sub> 68,714 72,465	3 34 37 A Time 0.81 1.79
#best gap(%) gap(%) instance YFJS01 YFJS02 YFJS03	5 2.7 3.4 ILS-I <i>C</i> <sub>max</sub> 68,714 72,465 32,538	9 3 RN <u>Time</u> 0.51 1.40 0.03	$\begin{array}{c} & 6\\ 2.3\\ \hline 2.6\\ \hline \\ C_{\max} \end{array}$	5 33 34 CN Time 0.80 2.82 0.02	GRAS <i>C</i> max <b>68,714</b> 73,053 <b>32,538</b>	) 46 23 BP-RN Time 0.12 0.12 254.14	$\begin{array}{c} & ( \\ 5.4 \\ 6.7 \\ \hline \\ \hline \\ C_{max} \\ \hline \\ 69,189 \\ \hline \\ 73,149 \\ \textbf{32,538} \end{array}$	148 14 P-CN Time 0.02 0.44 0.08	8 0.9 0.9 TS-1 C <sub>max</sub> 68,714 72,465 32,538	1 1 <u>RN</u> <u>Time</u> 0.34 0.02 0.10	$\begin{array}{c} & 3\\ 2.4\\ \hline \\ \hline \\ C_{max}\\ \hline \\ \hline \\ 75,595\\ 73,053\\ 33,174\\ \end{array}$	3 45 45 CN Time 0.03 0.04 0.00	1; 0.8 1.8 <i>C</i> <sub>max</sub> 68,714 72,465 32,538	3 34 37 A Time 0.81 1.79 0.47
#best gap(%) gap(%) instance YFJS01 YFJS02 YFJS03 YFJS04	5 2.7 3.4 ILS-I <i>C</i> <sub>max</sub> <b>68,714</b> <b>72,465</b> <b>32,538</b> <b>35,883</b>	9 3 <u>RN</u> <u>Time</u> 0.51 1.40 0.03 1.73	6           2.2           ILS-           Cmax           68,714           72,465           32,538           35,883	6 33 94 CN Time 0.80 2.82 0.02 0.17	GRAS C <sub>max</sub> 68,714 73,053 32,538 36,946	) 46 23 <u>BP-RN</u> <u>Time</u> 0.12 0.12 254.14 0.15	$\begin{array}{c} & ( \\ 5.4 \\ 6.7 \\ \hline \\ \hline \\ C_{max} \\ \hline \\ 69,189 \\ 73,149 \\ \textbf{32,538} \\ \textbf{35,883} \\ \end{array}$	P-CN Time 0.02 0.44 0.08 0.10	8 0.9 0.9 TS-1 C <sub>max</sub> 68,714 72,465 32,538 35,883	1 1 <u>Time</u> 0.34 0.02 0.10 1.25	$\begin{array}{c} & 3\\ 2.4\\ \hline \\ 2.4\\ \hline \\ \hline$	3 45 45 <u>CN</u> <u>Time</u> 0.03 0.04 0.00 0.02	1: 0.8 1.8 <i>C</i> <sub>max</sub> 68,714 72,465 32,538 35,883	3 34 37 A Time 0.81 1.79 0.47 0.59
#best gap(%) gap(%) instance YFJS01 YFJS02 YFJS03 YFJS03 YFJS04 YFJS05	5 2.7 3.4 <u>ILS-1</u> C <sub>max</sub> 68,714 72,465 32,538 35,883 40,186	9 3 <u>RN</u> <u>Time</u> 0.51 1.40 0.03 1.73 9.99	66 2.3 2.9 <i>C</i> <sub>max</sub> 68,714 72,465 32,538 35,883 40,186	6 33 94 CN Time 0.80 2.82 0.02 0.17 1.76	$\begin{array}{c} & 0 \\ & 5.4 \\ & 6.2 \end{array}$ $\begin{array}{c} & GRAS \\ \hline C_{max} \\ \hline {\bf 68,714} \\ 73,053 \\ {\bf 32,538} \\ 36,946 \\ 41,034 \end{array}$	) 46 23 <u>BP-RN</u> Time 0.12 0.12 0.12 254.14 0.15 160.74	GRAS <i>C</i> <sub>max</sub> 69,189 73,149 <b>32,538</b> <b>35,883</b> 41,034	P-CN Time 0.02 0.44 0.08 0.10 0.52	8 0.9 0.9 TS-1 C <sub>max</sub> 68,714 72,465 32,538 35,883 40,186	1 1 <u>RN</u> <u>Time</u> 0.34 0.02 0.10 1.25 4.42	$\begin{array}{c} & 3\\ 2.4\\ \hline 2.4\\ \hline \\ \hline$	3 45 45 <u>CN</u> <u>Time</u> 0.03 0.04 0.00 0.02 0.03	1; 0.8 1.8 <i>C</i> <sub>max</sub> 68,714 72,465 32,538 35,883 41,034	3 34 37 A Time 0.81 1.79 0.47 0.59 0.74
#best gap(%) gap(%) instance YFJS01 YFJS02 YFJS03 YFJS04 YFJS05 YFJS06	$5 \\ 2.7 \\ 3.4 \\ \hline ILS - 1 \\ \hline C_{max} \\ 68,714 \\ 72,465 \\ 32,538 \\ 35,883 \\ 40,186 \\ 40,441 \\ \hline \end{array}$	9 3 Time 0.51 1.40 0.03 1.73 9.99 218.75	$\begin{array}{c} 6\\ 2.3\\ 2.9\\ \hline \\ C_{\max} \end{array}$	5 33 94 Time 0.80 2.82 0.02 0.17 1.76 122.67	$\begin{array}{c} & 0 \\ & 5.4 \\ & 6.2 \end{array}$ GRAS $C_{\max}$ <b>68,714 73,053 32,538 36,946 41,034 41,123</b>	) 46 23 <u>BP-RN</u> <u>Time</u> 0.12 0.12 254.14 0.15 160.74 3.28	$\begin{array}{c} & 0 \\ & 5.4 \\ & 6.7 \\ \hline \\ & GRAS \\ \hline \\ & C_{max} \\ \hline \\ & 69,189 \\ \hline \\ & 73,149 \\ \hline \\ & 32,538 \\ \hline \\ & 32,538 \\ \hline \\ & 35,883 \\ \hline \\ & 41,034 \\ \hline \\ & 41,174 \\ \end{array}$	P-CN Time 0.02 0.44 0.08 0.10 0.52 59.04	8 0.9 0.9 TS-I <i>C</i> <sub>max</sub> 68,714 72,465 32,538 35,883 40,186 40,522	1 <u>RN</u> <u>Time</u> 0.34 0.02 0.10 1.25 4.42 13.18	$\begin{array}{c} & 3\\ & 2.4\\ & 2.4\\ \hline & \\ \hline \\ \hline$	3 45 45 <u>CN</u> <u>Time</u> 0.03 0.04 0.00 0.02 0.03 0.61	1; 0.8 1.8 <i>C</i> <sub>max</sub> 68,714 72,465 32,538 35,883 41,034 40,784	3 34 37 <u>Time</u> 0.81 1.79 0.47 0.59 0.74 0.76
#best gap(%) gap(%) instance - YFJS01 YFJS02 YFJS03 YFJS05 YFJS05 YFJS06 YFJS07	$\begin{array}{c} 5\\ 2.7\\ 3.4\\ \hline \\ ILS^{-1}\\ \hline \\ C_{max}\\ 68,714\\ 72,465\\ 32,538\\ 35,883\\ 40,186\\ 40,441\\ 40,887\\ \end{array}$	9 3 Time 0.51 1.40 0.03 1.73 9.99 218.75 131.61	$\begin{array}{c} 6\\ 2.3\\ 2.5\\ \hline \\ C_{max}\\ \hline \\ 68,714\\ 72,465\\ 32,538\\ 35,883\\ 40,186\\ 40,441\\ 40,887\\ \end{array}$	5 33 04 Time 0.80 2.82 0.02 0.17 1.76 122.67 37.21	$\begin{array}{c} & ()\\ & 5.,\\ & 6.,\\ \hline \\ & GRAS\\ \hline \\ & C_{max}\\ \hline \\ & 68,714\\ & 73,053\\ & 32,538\\ & 36,946\\ & 41,034\\ & 41,024\\ & 41,024\\ \hline \\ & 41,025\\ \end{array}$	) 46 23 Time 0.12 0.12 0.12 254.14 0.15 160.74 3.28 54.84	$\begin{array}{c} & 0 \\ & 5.4 \\ & 6.7 \\ \hline \\ & GRAS \\ \hline \\ & C_{max} \\ \hline \\ & 69,189 \\ \hline \\ & 73,149 \\ \hline \\ & 32,538 \\ & 35,883 \\ \hline \\ & 41,034 \\ & 41,174 \\ & 41,354 \\ \end{array}$	P-CN Time 0.02 0.44 0.08 0.10 0.52 59.04 11.63	8 0.9 0.9 TS-I <i>C</i> max 68,714 72,465 32,538 35,883 40,186 40,522 40,887	1 1 Time 0.34 0.02 0.10 1.25 4.42 13.18 38.15	$\begin{array}{c} & 3\\ 2.4\\ 2.4\\ \hline \\ \hline$	3 45 45 15 <u>Time</u> 0.03 0.04 0.00 0.02 0.03 0.61 0.17	$\begin{array}{c} 1;\\ 0.8\\ 1.8\end{array}$	3 34 37 <u>Time</u> 0.81 1.79 0.47 0.59 0.74 0.76 16.55
#best gap(%)           gap(%)           instance           YFJS01           YFJS02           YFJS03           YFJS03           YFJS05           YFJS06           YFJS08	5 2.7 3.4 ILS-1 C <sub>max</sub> 68,714 72,465 32,538 35,883 40,441 40,887 32,573	9 3 Time 0.51 1.40 0.03 1.73 9.99 218.75 131.61 0.69	$\begin{array}{c} 6\\ 2.3\\ 2.3\\ \hline \\ C_{max}\\ \hline \\ 68,714\\ 72,465\\ 32,538\\ 35,883\\ 35,883\\ 40,186\\ 40,441\\ 40,887\\ 32,573\\ \end{array}$	5 33 34 Time 0.80 2.82 0.02 0.17 1.76 122.67 37.21 0.88	$\begin{array}{c} & ()\\ & 5.4\\ & 6.7\\ \hline \\ & 6.7\\ \hline \\ & 68,714\\ \hline \\ & 73,053\\ \hline \\ & 32,538\\ & 36,946\\ & 41,034\\ & 41,123\\ & 41,625\\ & 32,623\\ \end{array}$	) 46 23 3 3 9 7 8 7 8 7 8 9 7 9 7	$\begin{array}{c} & ()\\ & 5\\ & 6\\ & GRAS\\ \hline \\ & C_{max}\\ \hline \\ & 69.189\\ \hline \\ & 73,149\\ \hline \\ & 32,588\\ \hline \\ & 35,883\\ \hline \\ & 35,883\\ \hline \\ & 35,883\\ \hline \\ & 41,034\\ \hline \\ & 41,174\\ \hline \\ & 41,354\\ \hline \\ & 32,655\\ \end{array}$	18           14           P-CN           Time           0.02           0.44           0.08           0.10           0.52           59.04           11.63           29.50	8 0.9 0.9 <u>Cmax</u> 68,714 72,465 32,538 35,883 40,186 40,522 40,887 32,573	1 1 Time 0.34 0.02 0.10 1.25 4.42 13.18 38.15 0.91	$\begin{array}{c} & 3\\ 2.4\\ \hline \\ 2.4\\ \hline \\ \hline$	3 45 45 7 7 8 0.03 0.04 0.00 0.02 0.03 0.61 0.17 0.00	1: 0.8 1.8 C <sub>max</sub> 68,714 72,465 32,583 35,883 35,883 41,034 40,784 40,887 32,573	3 34 37 Time 0.81 1.79 0.47 0.59 0.74 0.76 16.55 63.60
#best gap(%)           gap(%)           instance           YFJS01           YFJS02           YFJS03           YFJS04           YFJS05           YFJS07           YFJS08           YFJS09	5 2.7 3.4 <u>ILS-1</u> <u>C<sub>max</sub></u> 68,714 72,465 32,538 35,883 40,186 40,481 40,887 32,573 22,681	9 3 Time 0.51 1.40 0.03 1.73 9.99 218.75 131.61 0.69 2.68	$\begin{array}{c} 6\\ 2.3\\ 2.6\\ \hline \\ \hline$	5 33 34 <u>CN</u> <u>Time</u> 0.80 2.82 0.02 0.17 1.76 122.67 37.21 0.88 0.54	$\begin{array}{c} & ( \\ 5.4 \\ 6.7 \\ \hline \\ 6.7 \\ \hline \\ 6.7 \\ \hline \\ 6.7 \\ 6.7 \\ \hline \\ 6.7 \\ 7.0 \\ 5.3 \\ 3.5 \\ 3.5 \\ 3.5 \\ 3.5 \\ 3.5 \\ 3.5 \\ 3.5 \\ 2.5 \\ 3.5 \\ 2.5 \\ 3.5 \\ 2.5 \\ 3$	) 46 23 Time 0.12 0.12 0.12 254.14 0.15 160.74 3.28 54.84 0.09 6.30	$\begin{array}{c} & (, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,$	P-CN Time 0.02 0.44 0.08 0.10 0.52 59.04 11.63 29.50 56.94	8 0.9 0.9 TS-1 <i>C</i> <sub>max</sub> 68,714 72,465 32,538 35,883 40,186 40,522 40,887 32,573 22,681	1 1 Time 0.34 0.02 0.10 1.25 4.42 13.18 38.15 0.91 0.01	$\begin{array}{c} & 3\\ 2.4\\ \hline \\ 2.4\\ \hline \\ \hline$	3 45 45 7 7 1 0.03 0.04 0.00 0.02 0.03 0.61 0.17 0.00 0.24	1; 0.8 1.8 C <sub>max</sub> 68,714 72,465 32,538 35,883 41,034 40,787 32,573 22,681	3 34 37 Time 0.81 1.79 0.47 0.59 0.74 0.76 16.55 63.60 2.03
#best gap(%) gap(%) instance YFJS01 YFJS02 YFJS03 YFJS03 YFJS04 YFJS05 YFJS06 YFJS06 YFJS06 YFJS08 YFJS09 YFJS10	5 2.7 3.4 <u>ILS-1</u> 68,714 72,465 32,583 40,186 40,441 40,887 32,578 22,681 37,372	9 3 Time 0.51 1.40 0.03 1.73 9.99 218.75 131.61 0.69 2.68 11.63	6 2.3 2.6 <i>C</i> max 68,714 72,465 32,538 35,883 40,186 40,441 40,887 32,573 22,681 37,372	5 33 34 <u>Time</u> 0.80 2.82 0.02 0.17 1.76 122.67 37.21 0.88 0.54 19.65	$\begin{array}{c} & ( \\ 5.4 \\ 6.5 \\ \hline \\ $	) 46 23 Time 0.12 0.12 0.12 254.14 0.15 160.74 3.28 54.84 0.09 6.30 1.92	$\begin{array}{c} & ( \\ 5 \\ 6 \\ \hline \\ GRAS \\ \hline \\ C_{max} \\ 69,189 \\ 32,538 \\ 35,883 \\ 41,034 \\ 41,174 \\ 41,354 \\ 32,655 \\ 22,681 \\ 37,685 \end{array}$	I8           18           Image: Constraint of the second se	$\begin{array}{c} 8\\ 0.9\\ 0.9\\ \hline \\ \hline \\ C_{max}\\ \hline \\ 68,714\\ \hline \\ 72,465\\ 32,538\\ 35,883\\ 40,186\\ 40,522\\ 40,887\\ 32,573\\ 32,573\\ 32,681\\ 39,621\\ \end{array}$	1 Time 0.34 0.02 0.10 1.25 4.42 13.18 38.15 0.91 0.01 0.03	$\begin{array}{c} & 3\\ 2.4\\ \hline \\ 2.4\\ \hline \\ \hline$	3 45 45 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	1; 0.8 1.8 <i>C</i> max <b>68</b> ,714 <b>72</b> ,465 <b>32</b> ,538 <b>35</b> ,883 41,034 40,784 40,784 <b>40</b> ,887 <b>32</b> ,573 <b>32</b> ,573 <b>32</b> ,573 <b>32</b> ,573	$\begin{array}{c} 3\\ 34\\ 37\\ \hline \\ \hline$
#best gap(%) gap(%) instance YFJS01 YFJS02 YFJS03 YFJS04 YFJS05 YFJS06 YFJS05 YFJS06 YFJS07 YFJS08 YFJS09 YFJS10 YFJS11	$5 \\ 2.7 \\ 3.4 \\ 1 \\ ILS-1 \\ \hline C_{max} \\ 68,714 \\ 72,465 \\ 32,538 \\ 35,883 \\ 35,883 \\ 35,883 \\ 40,186 \\ 40,441 \\ 40,887 \\ 32,573 \\ 22,681 \\ 37,372 \\ 47,800 \\ \hline \end{cases}$	9 3 Time 0.51 1.40 0.03 1.73 9.99 218.75 131.61 0.69 2.68 11.63 12.50	$\begin{array}{c} 6\\ 2.3\\ 2.9\\ \hline\\ C_{max}\\ \hline\\ 68,714\\ 72,465\\ 33,538\\ 35,883\\ 40,186\\ 40,186\\ 40,184\\ 40,887\\ 33,573\\ 22,681\\ 37,372\\ 47,800\\ \end{array}$	S         S	GRAS GRAS Cmax 68,714 73,053 32,538 36,946 41,034 41,034 41,025 32,623 22,681 37,685 49,493	) 46 23 P-RN Time 0.12 0.12 254.14 0.15 160.74 3.28 54.84 0.09 6.30 1.92 174.55	$\begin{array}{c} GRAS\\ \hline GRAS\\ \hline Grax\\ \hline 69,189\\ \hline 73,149\\ \textbf{32,538}\\ \textbf{35,883}\\ \textbf{41,034}\\ 41,174\\ 41,354\\ \textbf{32,655}\\ \textbf{22,681}\\ \textbf{37,685}\\ 49,208 \end{array}$	I8           I8           I4           Time           0.02           0.44           0.02           0.44           0.52           59.04           11.63           29.50           56.94           0.62           41.96	8 0.9 0.9 TS-I C <sub>max</sub> 68,714 72,465 32,538 35,883 40,186 40,522 40,887 32,573 22,681 39,621 48,195	1 Time 0.34 0.02 0.10 1.25 4.42 13.18 38.15 0.91 0.03 4.95	$\begin{array}{c} & 3\\ 2.4\\ \hline \\ 2.4\\ \hline \\ \hline$	B         3           45         45           CN         Time           0.03         0.04           0.00         0.02           0.03         0.61           0.17         0.00           0.00         0.02           0.00         0.04	1; 0.8 1.8 2; 2; 2; 4; 4; 4; 4; 4; 4; 4; 4; 4; 4; 4; 4; 4;	$\begin{array}{c} 3\\ 34\\ 37\\ \hline \\ \hline$
#best gap(%) gap(%) instance YFJS01 YFJS02 YFJS03 YFJS03 YFJS05 YFJS05 YFJS05 YFJS06 YFJS07 YFJS08 YFJS09 YFJS10 YFJS11 YFJS12	5 2.7 3.4 <u>ILS-</u> 68,714 72,465 32,538 35,883 40,186 40,441 40,487 32,573 22,681 37,372 47,800 46,728	9 3 Time 0.51 1.40 0.03 1.73 9.99 218.75 131.61 0.69 2.68 11.63 12.50 26.81	$\begin{array}{c} 6\\ 2.3\\ 2.9\\ \hline \\ \hline \\ C_{max}\\ \hline \\ 68,714\\ 72,465\\ 32,538\\ 35,883\\ 40,186\\ 40,487\\ 32,573\\ 32,573\\ 22,681\\ 37,372\\ 47,800\\ 46,728\\ \end{array}$	CN Time 0.80 2.82 0.02 0.17 1.76 122.67 37.21 0.88 0.54 19.65 94.06 15.79	$\begin{array}{c} GRAS\\ \hline GRAS\\ \hline C_{max}\\ \hline 68,714\\ 73,053\\ \textbf{32,538}\\ 36,946\\ 41,034\\ 41,123\\ 41,625\\ 32,623\\ \textbf{22,681}\\ 37,685\\ \textbf{49,493}\\ 49,411\\ \end{array}$	) 46 23 P-RN Time 0.12 0.12 254.14 0.15 160.74 3.28 54.84 0.09 6.30 1.92 1.74.55 13.84	$\begin{array}{c} GRAS\\ \hline GRAS\\ \hline Grax\\ \hline 69,189\\ \hline 73,149\\ \textbf{32,538}\\ \textbf{35,883}\\ 41,034\\ 41,174\\ 41,354\\ 32,655\\ \textbf{22,681}\\ 37,685\\ \textbf{49,208}\\ 49,208\\ 48,774\\ \end{array}$	Is           IS           IS           P-CN           Time           0.02           0.44           0.08           0.10           0.52           59.04           11.63           29.50           56.94           0.62           41.96           92.81	8 0.9 0.9 TS-I C <sub>max</sub> 68,714 72,465 32,538 35,883 40,186 40,522 40,887 32,573 22,681 39,621 48,195 46,728	1 Time 0.34 0.02 0.10 1.25 4.42 13.18 38.15 0.91 0.01 0.03 4.95 149.42	$\begin{array}{c} & 3\\ 2.4\\ \hline \\ 2.4\\ \hline \\ \hline$	B           45           15           CN           Time           0.03           0.04           0.00           0.03           0.61           0.17           0.00           0.24           0.00           0.04           0.00           0.04	1; 0.8 1.8 2,538 35,883 41,034 40,784 40,784 40,784 40,784 32,573 32,573 37,372 47,800 46,728	3 34 37 Time 0.81 1.79 0.47 0.59 0.74 0.76 16.55 63.60 2.03 3.04 85.90 63.09
#best gap(%) gap(%) instance YFJS01 YFJS02 YFJS03 YFJS05 YFJS05 YFJS06 YFJS07 YFJS06 YFJS07 YFJS08 YFJS09 YFJS10 YFJS11 YFJS12 YFJS13	5 2.7 3.4 <u>ILS-1</u> 68,714 72,465 32,538 35,883 40,186 40,487 32,573 22,681 37,372 47,800 46,728 36,911	9 3 Time 0.51 1.40 0.03 1.73 9.99 218.75 131.61 0.69 2.68 11.63 12.50 26.81 12.30	$\begin{array}{c} 6\\ 2.3\\ 2.9\\ \hline \\ C_{max}\\ \hline \\ 68,714\\ 72,465\\ 32,538\\ 35,883\\ 40,186\\ 40,441\\ 40,887\\ 32,573\\ 22,681\\ 37,372\\ 47,800\\ 46,728\\ 36,911\\ \end{array}$	CN Time 0.80 2.82 0.02 0.17 1.76 122.67 37.21 0.88 0.54 19.65 94.06 15.79 13.38	$\begin{array}{c} & 0 \\ & 5.4 \\ & 6.5 \\ \hline \\ & 6.714 \\ & 73,053 \\ & 32,538 \\ & 36,946 \\ & 41,034 \\ & 41,023 \\ & 41,625 \\ & 32,623 \\ & 22,681 \\ & 37,685 \\ & 49,493 \\ & 37,685 \\ & 49,491 \\ & 38,042 \end{array}$	) 46 23 Time 0.12 0.12 254.14 0.15 160.74 3.28 54.84 0.09 6.30 1.925 13.84 2.35	$\begin{array}{c} GRAS\\ \hline GRAS\\ \hline C_{max}\\ \hline 69,189\\ 73,149\\ \textbf{32,538}\\ \textbf{35,883}\\ 41,034\\ 41,174\\ 41,354\\ 32,655\\ \textbf{22,681}\\ 37,685\\ 49,208\\ 48,774\\ 37,361\\ \end{array}$	I8           I8           I8           I4           P-CN           Time           0.02           0.44           0.08           0.10           0.52           59.04           11.63           29.50           56.94           0.62           41.96           92.81           108.86	8 0.9 0.9 TS-I C <sub>max</sub> 68,714 72,465 32,538 35,883 40,186 40,522 40,887 32,573 22,681 39,621 48,195 46,728 36,926	1 Time 0.34 0.02 0.10 1.25 4.42 13.18 38.15 0.91 0.01 0.03 4.95 149.42 33.80	$\begin{array}{c} & 3\\ 2.4\\ \hline \\ 2.4\\ \hline \\ \hline$	3 45 45 5 5 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	1; 0.8 1.8 2; 2; 3; 3; 3; 3; 3; 3; 3; 3; 3; 3; 3; 3; 3;	3 34 37 Time 0.81 1.79 0.47 0.59 0.74 0.76 16.55 63.60 2.03 3.04 85.90 63.09 76.79
#best gap(%) gap(%) instance YFJS01 YFJS02 YFJS03 YFJS05 YFJS05 YFJS05 YFJS05 YFJS06 YFJS07 YFJS08 YFJS09 YFJS10 YFJS11 YFJS11 YFJS12 YFJS13 YFJS14	$5\\2.7\\3.4\\\hline\\C_{max}$	9 3 Time 0.51 1.40 0.03 1.73 9.99 218.75 131.61 0.69 2.68 11.63 12.50 26.81 12.30 216.19	$\begin{array}{c} 6\\ 6\\ 2.3\\ 2.6\\ \hline\\ \hline\\ C_{max}\\ \hline\\ 68,714\\ 72,465\\ 32,538\\ 33,883\\ 40,186\\ 40,481\\ 32,573\\ 22,681\\ 37,372\\ 47,800\\ 46,728\\ 36,911\\ 110,558\\ \end{array}$	CN Time 0.80 2.82 0.02 0.17 1.76 122.67 37.21 0.88 0.54 19.65 94.06 15.79 13.38 269.22	$\begin{array}{c} & ( \\ 5.4 \\ 6.5 \\ \hline \\ 6.7 \\ \hline \\ 6.7 \\ \hline \\ 6.7 \\ \hline \\ 73,053 \\ \textbf{32,538} \\ \textbf{36,946} \\ 41,034 \\ 41,123 \\ \textbf{32,623} \\ \textbf{22,681} \\ \textbf{37,685} \\ \textbf{32,623} \\ \textbf{22,681} \\ \textbf{37,685} \\ \textbf{49,411} \\ \textbf{38,042} \\ 112,062 \end{array}$	) 46 23 Time 0.12 0.12 254.14 0.15 160.74 3.28 54.84 0.09 6.30 1.92 174.55 13.84 2.35 221.06	$\begin{array}{c} GRAS\\ \hline GRAS\\ \hline C_{max}\\ \hline 69,189\\ \hline 73,149\\ \textbf{32,538}\\ \textbf{35,883}\\ \textbf{41,034}\\ 41,174\\ 41,354\\ 41,354\\ \textbf{32,655}\\ \textbf{22,681}\\ \textbf{37,685}\\ \textbf{49,208}\\ 48,774\\ \textbf{47,361}\\ 113,009\\ \end{array}$	18           18           14           P-CN           Time           0.02           0.44           0.08           0.10           0.52           59.04           11.63           29.50           56.94           0.62           41.96           92.81           108.86           59.06	8 0.9 0.9 TS-I C <sub>max</sub> 68,714 72,465 32,538 35,883 40,186 40,522 40,887 32,573 22,681 39,621 48,195 46,728 36,926 110,625	1           1           Time           0.34           0.02           0.10           1.25           4.42           13.18           38.15           0.91           0.03           4.92           33.80           9.33	$\begin{array}{c} & 3\\ 2.4\\ \hline \\ 2.4\\ \hline \\ \hline$	3 45 45 45 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	1;           0.8           1.8           Cmax           68,714           72,465           32,538           35,883           41,034           40,784           40,887           32,573           22,681           37,372           47,800           46,728           36,911           111,282	3 34 37 Time 0.81 1.79 0.47 0.59 0.76 16.55 63.60 2.03 3.04 85.90 63.09 76.79 147.69
#best gap(%) gap(%) instance YFJS01 YFJS02 YFJS03 YFJS04 YFJS05 YFJS06 YFJS06 YFJS06 YFJS07 YFJS08 YFJS09 YFJS10 YFJS11 YFJS13 YFJS14 YFJS15	5 2.7 3.4 <u>ILS-1</u> <b>68,714</b> 72,465 32,588 35,883 40,186 40,441 40,887 32,573 22,681 37,372 47,800 46,728 36,911 110,185 105,935	9 3 Time 0.51 1.40 0.03 1.73 9.99 218.75 131.61 0.69 2.68 11.63 12.50 26.81 12.30 216.19 192.42	6           2.3           2.4           11           68,714           72,465           32,538           35,883           35,883           40,186           40,441           40,887           32,573           22,681           37,372           47,800           46,728           36,911           110,558           106,221	CN Time 0.80 2.82 0.02 0.17 1.76 122.67 37.21 0.88 0.54 19.65 94.06 15.79 13.38 269.22 189.75	$\begin{array}{c} & 0 \\ 5.4 \\ 6.5 \\ \hline \\ 6.7 \\ 6.7 \\ 6.7 \\ 6.7 \\ 6.7 \\ 1.0 \\ 1$	) 46 23 Time 0.12 0.12 254.14 0.15 160.74 3.28 54.84 0.09 6.30 1.92 174.55 13.84 2.35 221.06 17.04	$\begin{array}{c} \textbf{GRAS}\\ \hline \textbf{GRAS}\\ \hline \textbf{Grax}\\ \hline \textbf{G9,189}\\ \textbf{73,149}\\ \textbf{32,538}\\ \textbf{35,883}\\ \textbf{35,883}\\ \textbf{41,034}\\ \textbf{41,174}\\ \textbf{41,354}\\ \textbf{32,655}\\ \textbf{22,681}\\ \textbf{43,756}\\ \textbf{49,208}\\ \textbf{48,774}\\ \textbf{37,661}\\ \textbf{13,009}\\ \textbf{113,304}\\ \textbf{113,374} \end{array}$	I8           I4           P-CN           0.02           0.44           0.08           0.10           0.52           59.04           11.63           29.504           11.63           29.61           0.62           41.96           92.81           108.86           59.06           226.73	$\begin{array}{r} 8\\ 0.9\\ 0.9\\ \hline \\ 0.9\\ \hline \\ \hline \\ C_{max}\\ \hline \\ 68,714\\ \hline \\ 72,465\\ 32,538\\ 35,883\\ 40,186\\ 40,522\\ 40,887\\ \hline \\ 32,573\\ 22,681\\ 39,621\\ 48,195\\ 46,728\\ 36,926\\ 110,625\\ 105,837\\ \hline \end{array}$	1           1           Time           0.34           0.02           0.125           4.42           13.18           38.15           0.91           0.03           4.95           149.42           33.80           9.33           259.22	$\begin{array}{c} 3\\ 2.4\\ \hline TS-\\ \hline C_{max} \\ \hline 75,595\\ 73,053\\ 33,174\\ 37,340\\ 41,034\\ 41,123\\ 41,394\\ 34,452\\ \textbf{22,681}\\ 37,482\\ 49,721\\ 48,608\\ 39,207\\ 117,667\\ 116,525\\ \end{array}$	B           45           45           CN           0.03           0.04           0.00           0.03           0.61           0.17           0.00           0.24           0.00           0.02           0.04           0.02           0.03           0.61           0.17           0.00           0.24           0.00           0.02           0.03           0.19	1; 0.8 1.8 2, 2, 465, 32, 538 35, 883 35, 883 41,034 40,784 40,887 32,573 22,681 37,372 47,800 46,728 36,911 111,282 106,892	3 34 37 <b>A</b> <b>Time</b> 0.81 1.79 0.47 0.47 0.74 0.76 16.55 63.60 2.03 3.04 85.90 63.09 76.79 147.69 149.18
#best gap(%) gap(%) YFJS01 YFJS02 YFJS03 YFJS03 YFJS05 YFJS06 YFJS06 YFJS07 YFJS06 YFJS07 YFJS09 YFJS10 YFJS10 YFJS11 YFJS12 YFJS15 YFJS16	$5\\2.7\\3.4\\ \hline ILS-1\\68,714\\72,465\\32,538\\35,883\\40,186\\40,441\\40,887\\32,573\\22,681\\37,372\\47,800\\46,728\\36,911\\110,185\\36,911\\110,185\\105,903\\105,003$	9 3 Time 0.51 1.40 0.03 1.73 9.99 218.75 131.61 0.69 2.68 11.63 12.50 26.81 12.30 216.19 216.29 192.42 256.50	$\begin{array}{c} 6\\ 6\\ 2.3\\ 2.9\\ \hline \\ C_{max} \end{array}$	S         S	GRAS GRAS Cmax 68,714 73,053 32,538 36,946 41,034 41,034 41,025 32,623 22,681 37,685 49,493 49,411 38,042 112,062 108,296 111,439	) 46 23 P-RN Time 0.12 0.12 254.14 0.15 160.74 3.28 54.84 0.09 6.30 1.92 174.55 13.84 2.35 221.06 17.04 107.53	$\begin{array}{c} GRAS\\ \hline \\ GRAS\\ \hline \\ C_{max}\\ \hline \\ 69,189\\ \hline \\ 73,149\\ \hline \\ 33,588\\ \hline \\ 35,883\\ 41,034\\ \hline \\ 41,174\\ \hline \\ 41,354\\ \hline \\ 32,655\\ \hline \\ 22,681\\ \hline \\ 37,685\\ \hline \\ 49,208\\ \hline \\ 48,774\\ \hline \\ 37,681\\ \hline \\ 37,681\\ \hline \\ 113,009\\ \hline \\ 111,374\\ \hline \\ 111,432\\ \end{array}$	Image: 18           Image: 18           P-CN           Time           0.02           0.44           0.08           0.10           0.52           59.04           11.63           29.50           56.94           0.62           41.96           92.81           108.86           59.06           226.73           284.88	$\begin{array}{r} 8\\ 0.9\\ 0.9\\ \hline\\ \hline\\ C_{max}\\ \hline\\ 68,714\\ 72,465\\ 32,538\\ 35,883\\ 40,186\\ 40,522\\ 40,887\\ 32,573\\ 22,681\\ 39,621\\ 48,195\\ 46,728\\ 36,926\\ 110,625\\ 110,625\\ 105,837\\ 105,905\\ \end{array}$	I           Time           0.34           0.02           0.10           1.25           4.42           13.18           38.15           0.91           0.03           4.95           149.42           33.80           259.22           197.45	$\begin{array}{c} 3\\ 2.4\\ \hline \\ \hline \\ C_{max} \end{array}$	B           45           45           Time           0.03           0.04           0.00           0.03           0.61           0.17           0.00           0.23           0.61           0.17           0.00           0.24           0.00           0.04           0.02           0.03           0.17           0.00           0.04           0.02           0.03           0.19           0.07	$\begin{array}{c} 1;\\ 0.8\\ 5.7\\ \hline \\ C_{max} \end{array} \\ \hline \\ 68,714\\ 72,465\\ 32,538\\ 35,838\\ 35,838\\ 41,034\\ 40,784\\ 40,784\\ 40,887\\ 32,573\\ 22,681\\ 37,372\\ 47,800\\ 46,728\\ 36,911\\ 111,282\\ 106,892\\ 105,112\\ \end{array}$	3 34 37 Time 0.81 1.79 0.47 0.59 0.74 0.76 16.55 63.60 2.03 3.04 85.90 63.09 76.79 149.18 56.87
#best gap(%) gap(%) YFJS01 YFJS02 YFJS03 YFJS05 YFJS05 YFJS05 YFJS05 YFJS05 YFJS07 YFJS08 YFJS09 YFJS10 YFJS10 YFJS11 YFJS12 YFJS13 YFJS15 YFJS16 YFJS17	5 2.7 3.4 <u>ILS-1</u> <b>68,714</b> <b>72,465</b> 32,538 35,883 40,186 40,441 40,887 32,573 22,681 37,372 47,800 46,728 36,911 110,185 105,935 105,903 93,469	9 3 Time 0.51 1.40 0.03 1.73 9.99 218.75 131.61 0.69 2.68 11.63 12.50 26.81 12.30 216.19 192.42 56.50 198.07	$\begin{array}{c} 6\\ 6\\ 2.3\\ 2.9\\ \hline \\ \hline \\ C_{max}\\ \hline \\ 68,714\\ 72,465\\ 32,538\\ 35,883\\ 40,186\\ 40,441\\ 40,487\\ 32,573\\ 22,681\\ 37,372\\ 47,800\\ 46,728\\ 36,911\\ 110,558\\ 106,221\\ 105,423\\ 94,558\\ \end{array}$	CN           Time           0.80           2.82           0.02           0.17           1.76           122.67           37.21           0.88           0.54           19.65           94.06           15.79           13.38           269.22           189.75           119.50           174.10	$\begin{array}{c} GRAS\\ \hline GRAS\\ \hline C_{max}\\ \hline 68,714\\ 73,053\\ \textbf{32,538}\\ 36,946\\ 41,034\\ 41,123\\ 41,625\\ 32,623\\ \textbf{22,681}\\ 37,685\\ 49,493\\ 49,411\\ 38,042\\ 112,062\\ 108,296\\ 108,296\\ 111,439\\ 99,912\\ \end{array}$	) 46 23 Time 0.12 0.12 254.14 0.15 160.74 3.28 54.84 0.09 6.30 1.92 174.55 13.84 2.35 221.06 17.04 107.53 159.01	$\begin{array}{c} GRAS\\ \hline GRAS\\ \hline Gmax\\ \hline 69,189\\ \hline 73,149\\ \textbf{32,538}\\ \textbf{35,883}\\ 41,034\\ 41,174\\ 41,354\\ 32,655\\ \textbf{22,681}\\ 37,685\\ \textbf{49,208}\\ 48,774\\ \textbf{37,361}\\ 113,009\\ 111,374\\ 111,432\\ 101,069\\ \end{array}$	I8           IS           IS           P-CN           Time           0.02           0.44           0.08           0.10           59.04           11.63           29.50           56.94           0.62           41.96           92.81           108.86           59.06           226.73           284.88           107.68	$\begin{array}{r} 8\\ 0.9\\ 0.9\\ \hline \\ 0.9\\ \hline \\ \hline$	1           Time           0.34           0.02           0.10           1.25           4.42           13.18           38.15           0.91           0.01           0.03           4.95           149.42           33.80           9.33           259.22           197.45           226.68	$\begin{array}{c} 3\\ 2.4\\ \hline \\ 2.4\\ \hline \\ \hline$	B           45           15           CN           0.03           0.04           0.00           0.03           0.61           0.17           0.00           0.24           0.00           0.04           0.00           0.04           0.02           0.03           0.04           0.02           0.03           0.04           0.02           0.03           0.04           0.02           0.03           0.04           0.02           0.03           0.17           0.03           0.19           0.07           0.99	1; 0.8 1.8 2,538 32,538 35,883 41,034 40,784 40,784 40,784 40,784 40,784 40,784 40,784 40,784 40,784 40,784 40,784 40,784 36,911 111,282 106,892 105,112 94,950	3 3 3 3 7 7 7 7 7 7 7 7 7 7 7 7 7
#best gap(%) gap(%) gap(%) YFJS01 YFJS02 YFJS03 YFJS03 YFJS05 YFJS05 YFJS06 YFJS07 YFJS06 YFJS07 YFJS08 YFJS09 YFJS10 YFJS11 YFJS12 YFJS13 YFJS14 YFJS16 YFJS17 YFJS18	5 2.7 3.4 <u>ILS-</u> ] 68,714 72,465 32,538 35,883 40,186 40,487 32,573 22,681 37,372 47,800 46,728 36,911 110,185 105,003 93,469 101,013	9 3 Time 0.51 1.40 0.03 1.73 9.99 218.75 131.61 0.69 2.68 11.63 2.68 11.63 2.68 11.2.30 216.19 192.42 56.50 198.07 215.24	$\begin{array}{c} 6\\ 6\\ 2.3\\ 2.9\\ \hline \\ \hline \\ C_{max} \\ \hline \\ 68,714\\ 72,465\\ 32,538\\ 35,883\\ 40,186\\ 40,441\\ 40,887\\ 32,573\\ 22,681\\ 37,372\\ 47,800\\ 46,728\\ 36,911\\ 110,558\\ 106,221\\ 105,423\\ 94,558\\ 101,517\\ \end{array}$	CN Time 0.80 2.82 0.02 0.17 1.76 122.67 37.21 0.88 0.54 19.65 94.06 94.06 15.79 13.38 269.22 189.75 119.50 174.10 63.58	$\begin{array}{c} & 0 \\ 5.4 \\ 6.5 \\ \hline \\ 6.7 \\ \hline \\ 68,714 \\ 73,053 \\ \textbf{32,538} \\ 36,946 \\ 41,034 \\ 41,034 \\ 41,023 \\ 41,625 \\ 32,623 \\ \textbf{22,681} \\ 37,685 \\ 49,493 \\ \textbf{33,042} \\ 112,062 \\ 108,296 \\ 111,439 \\ 99,912 \\ 109,763 \end{array}$	) 46 23 Time 0.12 0.12 254.14 0.15 160.74 3.28 54.84 0.09 6.30 1.92 174.55 13.84 2.35 221.06 17.04 107.53 159.01 247.62	$\begin{array}{c} GRAS\\ \hline GRAS\\ \hline C_{max}\\ \hline 69,189\\ \hline 73,149\\ \textbf{32,538}\\ \textbf{35,883}\\ 41,034\\ 41,174\\ 41,354\\ 32,655\\ \textbf{22,681}\\ 37,685\\ 49,208\\ 48,774\\ 37,361\\ 113,009\\ 101,374\\ 111,432\\ 101,069\\ 107,336\end{array}$	I8           I8           I8           I8           P-CN           Time           0.02           0.44           0.08           0.10           0.52           59.04           11.63           29.50           56.94           0.62           41.96           92.81           108.86           59.06           226.73           284.88           107.68           230.38	$\begin{array}{r} 8\\ 0.9\\ 0.9\\ \hline 0.9\\ \hline \\ \hline \\ C_{max}\\ \hline \\ \hline \\ 68,714\\ \hline \\ 72,465\\ 32,538\\ 33,883\\ 40,186\\ 40,522\\ 40,887\\ 32,573\\ 22,681\\ 39,621\\ 48,195\\ 46,728\\ 36,926\\ 110,625\\ 105,837\\ 105,905\\ 96,737\\ 103,359\\ \end{array}$	1 Time 0.34 0.02 0.10 1.25 4.42 13.18 38.15 0.91 0.01 0.03 4.95 149.42 33.80 9.33 259.22 197.45 226.68 239.97	$\begin{array}{c} 3\\ 2.4\\ \hline \\ 2.4\\ \hline \\ \hline$	B           45           15           CN           Time           0.03           0.04           0.002           0.03           0.61           0.17           0.000           0.24           0.00           0.04           0.02           0.03           0.17           0.00           0.04           0.02           0.03           0.19           0.07           0.99           0.48	$\begin{array}{c} 1;\\ 0.8\\ 1.8\\ \hline \\ C_{max}\\ \hline \\ 68,714\\ 72,465\\ 32,538\\ 35,883\\ 41,034\\ 40,784\\ 40,784\\ 40,784\\ 40,784\\ 40,784\\ 32,573\\ 22,681\\ 37,372\\ 47,800\\ 46,728\\ 36,911\\ 111,282\\ 106,892\\ 105,112\\ 94,950\\ 102,477\\ \end{array}$	3 34 37 Time 0.81 1.79 0.47 0.59 0.76 16.55 63.60 2.03 3.04 85.90 63.09 76.79 147.69 149.18 56.87 112.29 184.95
#best gap(%) gap(%) gap(%) YFJS01 YFJS02 YFJS03 YFJS05 YFJS05 YFJS06 YFJS07 YFJS06 YFJS07 YFJS08 YFJS09 YFJS10 YFJS11 YFJS11 YFJS12 YFJS13 YFJS14 YFJS15 YFJS16 YFJS17 YFJS18 YFJS19	5 2.7 3.4 Cmax 68,714 72,465 32,538 35,883 40,186 40,441 40,887 32,573 22,681 37,372 47,800 46,728 36,911 110,185 105,903 93,469 93,469 93,469	9 3 Time 0.51 1.40 0.03 1.73 9.99 218.75 131.61 0.69 2.68 11.63 12.50 26.81 12.30 216.19 192.42 56.50 198.07 215.24 221.94	$\begin{array}{c} 6\\ 6\\ 2.3\\ 2.9\\ \hline \\ \hline \\ C_{max} \\ \hline \\ 68,714\\ 72,465\\ 32,538\\ 33,883\\ 40,186\\ 40,441\\ 40,887\\ 32,573\\ 22,681\\ 37,372\\ 47,800\\ 46,728\\ 36,911\\ 110,558\\ 106,221\\ 105,423\\ 94,558\\ 106,1517\\ 81,172\\ \end{array}$	CN Time 0.80 2.82 0.02 0.17 1.76 122.67 37.21 0.88 0.54 19.65 94.06 15.79 13.38 269.22 189.75 119.50 174.10 63.58 115.47	$\begin{array}{c} & 0 \\ 5.4 \\ 6.5 \\ \hline \\ 6.7 \\ \hline \\ 6.8 \\ \hline \\ 714 \\ 73,053 \\ \textbf{32,538} \\ \textbf{33,538} \\ \textbf{33,538} \\ \textbf{33,538} \\ \textbf{41,034} \\ 41,023 \\ \textbf{41,025} \\ \textbf{32,623} \\ \textbf{22,681} \\ \textbf{37,685} \\ \textbf{49,411} \\ \textbf{38,042} \\ 112,062 \\ 108,296 \\ 111,439 \\ \textbf{99,912} \\ \textbf{109,763} \\ \textbf{94,020} \end{array}$	) 46 23 Time 0.12 0.12 254.14 0.15 160.74 3.28 54.84 0.09 6.30 1.92 174.55 13.84 2.35 221.06 17.04 107.53 159.01 247.62 109.95	$\begin{array}{c} GRAS\\ \hline GRAS\\ \hline C_{max}\\ \hline 69,189\\ 73,149\\ \textbf{32,538}\\ \textbf{33,5883}\\ 41,034\\ 41,174\\ 41,354\\ 32,655\\ \textbf{22,681}\\ 37,685\\ \textbf{49,208}\\ 48,774\\ 37,361\\ 113,009\\ 111,374\\ 111,432\\ 101,069\\ 107,336\\ 92,172\\ \end{array}$	I8           I8           I8           I8           P-CN           Time           0.02           0.44           0.08           0.10           0.59.04           11.63           29.50           56.94           0.62           41.96           92.81           108.86           59.06           226.73           284.88           107.68           230.38           67.18	$\begin{array}{r} 8\\ 0.9\\ 0.9\\ 0.9\\ \hline\\ \hline\\ C_{max}\\ \hline\\ 68,714\\ 72,465\\ 32,538\\ 35,883\\ 40,186\\ 40,522\\ 40,887\\ 32,573\\ 22,681\\ 39,621\\ 48,195\\ 46,728\\ 36,926\\ 110,625\\ 105,837\\ 105,905\\ 96,737\\ 103,359\\ 86,500\\ \end{array}$	1 Time 0.34 0.02 0.10 1.25 4.42 13.18 38.15 0.91 0.01 0.03 4.95 149.42 33.80 9.33 259.22 197.45 226.68 229.97 242.82	$\begin{array}{c} & 3\\ 2.4\\ \hline \\ 2.4\\ \hline \\ \hline$	B           45           15           CN           Time           0.03           0.04           0.00           0.03           0.61           0.17           0.00           0.24           0.00           0.24           0.00           0.02           0.03           0.17           0.00           0.24           0.00           0.02           0.03           0.19           0.07           0.99           0.48           2.14	1; 0.8 1.8 2 7 32,538 35,883 41,034 40,784 40,784 40,784 40,784 40,784 40,784 40,784 40,784 40,784 40,784 40,728 36,911 111,282 106,892 105,112 94,950 102,477 81,946	3 34 37 Time 0.81 1.79 0.47 0.59 0.74 0.76 16.55 63.60 2.03 3.04 85.90 76.79 147.69 149.18 56.87 112.29 184.95 93.62
#best gap(%) gap(%) instance YFJS01 YFJS02 YFJS03 YFJS03 YFJS04 YFJS05 YFJS06 YFJS07 YFJS07 YFJS07 YFJS09 YFJS10 YFJS10 YFJS11 YFJS12 YFJS14 YFJS15 YFJS16 YFJS19 YFJS19 YFJS19 YFJS19 YFJS19 YFJS19 YFJS19 YFJS19 YFJS19 YFJS20	5 2.7 3.4 ILS-1 68,714 72,465 32,538 35,883 40,186 40,441 40,887 32,573 22,681 37,372 47,800 46,728 36,911 110,185 105,935 105,935 105,935 105,935 101,013 82,879 83,689	9 3 Time 0.51 1.40 0.03 1.73 9.99 218.75 131.61 0.69 2.68 11.63 12.50 26.81 12.30 216.19 192.42 56.50 198.07 215.24 221.94 221.94 223.90	$\begin{array}{c} 6\\ 0\\ 2.3\\ 2.5\\ \hline \\ \hline$	Image: Second state           CN           Time           0.80           2.82           0.017           1.76           122.67           37.21           0.88           0.54           19.65           94.06           15.79           13.38           269.22           189.75           119.50           174.10           63.58           115.47           259.71	$\begin{array}{c} GRAS\\ \hline \\ GRAS\\ \hline \\ C_{max}\\ \hline \\ 68,714\\ \hline \\ 73,053\\ 32,538\\ 36,946\\ 41,034\\ 41,123\\ 41,625\\ 32,623\\ 22,681\\ 49,493\\ 49,411\\ 38,042\\ 112,062\\ 108,296\\ 111,439\\ 99,912\\ 109,763\\ 94,020\\ 94,020\\ 94,228\\ \end{array}$	A6           46           23           Time           0.12           0.12           0.15           160.74           3.28           54.84           0.09           6.30           1.92           174.55           13.84           221.06           170.4           107.53           159.01           247.62           280.03	$\begin{array}{c} GRAS\\ \hline \\ GRAS\\ \hline \\ C_{max}\\ \hline \\ 69,189\\ \hline \\ 73,149\\ \hline \\ 32,538\\ \hline \\ 35,883\\ \hline \\ 35,883\\ \hline \\ 35,883\\ \hline \\ 41,034\\ \hline \\ 41,174\\ \hline \\ 41,354\\ \hline \\ 32,655\\ \hline \\ 22,681\\ \hline \\ 49,208\\ \hline \\ 48,774\\ \hline \\ 37,661\\ \hline \\ 13,009\\ \hline \\ 111,374\\ \hline \\ 111,432\\ \hline \\ 101,069\\ \hline \\ 107,336\\ \hline \\ 92,172\\ \hline \\ 93,689\\ \end{array}$	I8           IA           P-CN           0.02           0.44           0.08           0.10           0.52           59.04           11.63           29.504           11.63           29.81           108.86           59.06           226.73           284.88           107.68           230.38           67.18           13.39	$\begin{array}{r} 8\\ 0.9\\ 0.9\\ \hline \\ 0.9\\ \hline \\ \hline \\ C_{max}\\ \hline \\ 68,714\\ \hline \\ 72,465\\ 32,538\\ 35,883\\ 40,186\\ 40,522\\ 40,887\\ 32,573\\ 22,681\\ 39,621\\ 48,195\\ 46,728\\ 36,926\\ 110,625\\ 105,837\\ 105,905\\ 96,737\\ 103,359\\ 86,500\\ 85,867\\ \end{array}$	1           1           Time           0.34           0.02           0.10           1.25           4.42           13.18           38.15           0.91           0.03           4.95           149.42           33.80           9.33           259.22           197.45           226.68           239.97           242.82           282.07	$\begin{array}{c} 3\\ 2.4\\ \hline \\ 2.4\\ \hline \\ \hline \\ \hline \\ 75,595\\ 73,053\\ 33,174\\ 37,340\\ 41,034\\ 41,123\\ 41,394\\ 41,394\\ 41,123\\ 41,394\\ 43,452\\ \textbf{22,681}\\ 37,482\\ 49,721\\ 48,608\\ 39,207\\ 116,525\\ 115,417\\ 98,329\\ 115,332\\ 88,400\\ 88,516\\ \end{array}$	B           45           45           CN           0.03           0.04           0.00           0.03           0.61           0.17           0.00           0.24           0.00           0.02           0.03           0.61           0.17           0.00           0.24           0.00           0.02           0.03           0.19           0.07           0.99           0.48           2.14           3.63	$\begin{array}{c} 1;\\ 0.8\\ 1.8\\ \hline \\ C_{max} \end{array}$	3 3 3 3 7 7 7 7 7 7 7 7 7 7 7 7 7
#best gap(%) gap(%) instance YFJS01 YFJS02 YFJS03 YFJS04 YFJS05 YFJS06 YFJS06 YFJS07 YFJS07 YFJS07 YFJS07 YFJS07 YFJS10 YFJS10 YFJS11 YFJS12 YFJS15 YFJS15 YFJS16 YFJS17 YFJS19 YFJS19 YFJS19 YFJS19 YFJS19 YFJS19 YFJS19	$\begin{array}{c} 5\\ 2.7\\ 3.4\\ \hline \\ ILS-1\\ \hline \\ \hline \\ 68,714\\ 72,465\\ 32,538\\ 35,883\\ 35,883\\ 35,883\\ 35,883\\ 35,883\\ 35,883\\ 35,883\\ 35,883\\ 32,681\\ 40,186\\ 40,441\\ 40,887\\ 32,573\\ 22,681\\ 37,372\\ 47,800\\ 46,728\\ 37,372\\ 47,800\\ 46,728\\ 36,911\\ 110,185\\ 105,003\\ 93,469\\ 101,013\\ 82,879\\ 83,689\\ 61,866\\ \end{array}$	9 3 Time 0.51 1.40 0.03 1.73 9.99 218.75 131.61 0.69 2.68 11.63 12.50 26.81 12.30 216.19 192.42 56.50 198.07 215.24 221.94 233.90 7.60	$\begin{array}{c} 6\\ 6\\ 2.3\\ 2.5\\ \hline\\ C_{max}\\ \hline\\ 68,714\\ 72,465\\ 33,538\\ 35,883\\ 40,186\\ 40,186\\ 40,184\\ 40,186\\ 40,184\\ 10,573\\ 22,681\\ 37,372\\ 47,800\\ 46,728\\ 37,372\\ 47,800\\ 46,728\\ 36,911\\ 110,558\\ 36,911\\ 105,423\\ 94,558\\ 101,517\\ 81,172\\ 83,731\\ 61,91\\ \hline\end{array}$	Image: Second state           CN           Time           0.80           2.82           0.02           0.17           122.67           37.21           0.88           0.54           19.65           94.06           15.79           13.38           269.25           119.50           174.10           63.58           115.47           259.71           7.95	$\begin{array}{c} & 0 \\ & 5.4 \\ & 6.5 \\ \hline \\ & 6.714 \\ & 73,053 \\ & 32,538 \\ & 36,946 \\ & 41,034 \\ & 41,023 \\ & 41,025 \\ & 32,623 \\ & 22,681 \\ & 37,685 \\ & 49,493 \\ & 49,411 \\ & 38,042 \\ & 112,062 \\ & 108,296 \\ & 111,439 \\ & 99,912 \\ & 109,763 \\ & 94,020 \\ & 94,022 \\ & 64,73 \end{array}$	) 46 23 P-RN Time 0.12 0.12 254.14 0.15 160.74 3.28 54.84 0.09 6.30 1.92 174.55 13.84 2.35 221.06 17.04 107.53 159.01 247.62 109.53 280.05 290.05 28	$\begin{array}{c} GRAS\\ \hline \\ GRAS\\ \hline \\ C_{max}\\ \hline \\ 69,189\\ \hline \\ 73,149\\ \hline \\ 32,538\\ \hline \\ 35,883\\ \hline \\ 41,034\\ \hline \\ 41,174\\ \hline \\ 41,354\\ \hline \\ 32,655\\ \hline \\ 22,681\\ \hline \\ 37,685\\ \hline \\ 49,208\\ \hline \\ 48,774\\ \hline \\ 37,685\\ \hline \\ 49,208\\ \hline \\ 48,774\\ \hline \\ 37,681\\ \hline \\ 113,009\\ \hline \\ 113,000\\ \hline \\ 113,000$	Image: Non-State         Image: Non-State           P-CN         Time           0.02         0.44           0.08         0.10           0.52         59.04           11.63         29.504           56.94         0.62           41.96         92.81           108.86         59.06           226.73         284.88           107.68         230.38           67.18         13.39           18.30         830	$\begin{array}{r} 8\\ 0.9\\ 0.9\\ \hline\\ \hline\\ C_{max}\\ \hline\\ 68,714\\ \hline\\ 72,465\\ 32,538\\ 35,883\\ 40,186\\ 40,522\\ 40,887\\ 32,573\\ 22,681\\ 39,621\\ 48,195\\ 46,728\\ 36,926\\ 110,625\\ 105,837\\ 105,905\\ 96,737\\ 103,359\\ 86,500\\ 85,867\\ \hline\\ 62,63\\ \hline\end{array}$	1           Time           0.34           0.02           0.10           1.25           4.42           13.18           38.15           0.91           0.03           4.95           149.42           33.80           9.33           259.22           197.45           226.68           239.97           242.82           282.07           7.45	$\begin{array}{c} & 3\\ 2.4\\ \hline \\ 2.4\\ \hline \\ \hline$	B           45           45           Time           0.03           0.04           0.00           0.03           0.61           0.17           0.00           0.04           0.00           0.017           0.00           0.04           0.02           0.03           0.17           0.00           0.04           0.02           0.03           0.17           0.09           0.41           3.63           i2.50	$\begin{array}{c} 1;\\ 0.8\\ 1.8\\ \hline \\ C_{max}\\ \hline \\ 68,714\\ 72,465\\ 33,588\\ 35,883\\ 41,034\\ 40,784\\ 40,784\\ 40,784\\ 40,887\\ 32,681\\ 37,372\\ 47,800\\ 46,728\\ 36,911\\ 111,282\\ 105,112\\ 94,950\\ 102,477\\ 81,946\\ 84,707\\ \hline \\ 62,18\\ \end{array}$	3 3 3 4 Time 0.81 1.79 0.47 0.59 0.74 0.76 16.55 63.60 2.03 3.04 85.90 63.09 76.79 149.18 56.87 112.29 184.95 93.62 200.84 66.80
$\begin{array}{c} \# \text{best} \\ \text{gap}(\%) \\ \hline \\ \overline{\text{gap}}(\%) \\ \hline \\ \hline \\ \text{instance} \\ \hline \\ & \text{YFJS01} \\ \text{YFJS02} \\ \text{YFJS02} \\ \text{YFJS03} \\ \text{YFJS05} \\ \text{YFJS05} \\ \text{YFJS06} \\ \text{YFJS06} \\ \text{YFJS07} \\ \text{YFJS07} \\ \text{YFJS09} \\ \text{YFJS09} \\ \text{YFJS09} \\ \text{YFJS10} \\ \text{YFJS11} \\ \text{YFJS11} \\ \text{YFJS11} \\ \text{YFJS11} \\ \text{YFJS15} \\ \text{YFJS15} \\ \text{YFJS16} \\ \text{YFJS16} \\ \text{YFJS16} \\ \text{YFJS19} \\ \text{YFJS19} \\ \text{YFJS19} \\ \text{YFJS19} \\ \text{YFJS19} \\ \text{YFJS20} \\ \hline \\ $	$\begin{array}{c} 5\\ 2.7\\ 3.4\\ \hline \\ ILS-1\\ \hline \\ \hline \\ 68,714\\ 72,465\\ 32,538\\ 35,883\\ 40,186\\ 40,441\\ 40,887\\ 32,573\\ 22,681\\ 37,372\\ 22,681\\ 37,372\\ 37,372\\ 37,372\\ 37,372\\ 46,728\\ 36,911\\ 110,185\\ 105,935\\ 36,911\\ 110,185\\ 105,935\\ 93,469\\ 101,013\\ 82,879\\ 83,689\\ \hline \\ 83,689\\ \hline \\ 61,86\\ 18\end{array}$	9 3 Time 0.51 1.40 0.03 1.73 9.99 218.75 131.61 0.69 2.68 11.63 12.50 26.81 12.30 216.19 192.42 256.50 198.07 215.24 233.90 7.60 3	$\begin{array}{c} 6\\ 6\\ 2.3\\ 2.5\\ \hline \\ \hline \\ C_{max} \\ \hline \\ 68,714\\ 72,465\\ 32,538\\ 35,883\\ 40,186\\ 40,487\\ 32,573\\ 32,573\\ 22,681\\ 37,372\\ 22,681\\ 37,372\\ 22,681\\ 37,372\\ 23,573\\ 105,423\\ 94,558\\ 101,517\\ 81,172\\ 83,731\\ 61,91\\ 1.\\ \end{array}$	CN           Time           0.80           2.82           0.02           0.17           1.76           122.67           37.21           0.88           0.54           19.65           94.06           15.79           13.38           269.22           189.75           119.50           174.10           63.58           115.57           259.71           7.95	$\begin{array}{c} & 0 \\ 5.4 \\ 6.5 \\ \hline \\ 6.7 \\ \hline \\ 68,714 \\ 73,053 \\ \textbf{32,538} \\ \textbf{36,946} \\ 41,034 \\ 41,123 \\ 41,625 \\ \textbf{32,623} \\ \textbf{22,681} \\ 37,685 \\ \textbf{32,623} \\ \textbf{49,493} \\ 49,411 \\ \textbf{38,042} \\ 112,062 \\ 108,296 \\ \textbf{111,439} \\ \textbf{99,912} \\ 109,763 \\ \textbf{99,912} \\ 109,763 \\ \textbf{94,020} \\ \textbf{94,228} \\ \textbf{64,73} \\ \textbf{33,020} \\ \textbf{34,020} \\ \textbf$	) 46 23 P-RN Time 0.12 0.12 254.14 0.15 160.74 3.28 54.84 0.09 6.30 1.92 174.55 13.84 2.35 221.06 1.704 107.53 159.01 247.62 280.03 244.40 3	$\begin{array}{c} GRAS\\ \hline \\ GRAS\\ \hline \\ \hline \\ Gmax\\ \hline \\ 69,189\\ \hline \\ 73,149\\ \hline \\ 32,538\\ \hline \\ 35,883\\ \hline \\ 35,883\\ \hline \\ 41,034\\ \hline \\ 41,174\\ \hline \\ 41,354\\ \hline \\ 32,655\\ \hline \\ 22,681\\ \hline \\ 37,685\\ \hline \\ 22,681\\ \hline \\ 37,685\\ \hline \\ 49,208\\ \hline \\ 48,774\\ \hline \\ 37,361\\ \hline \\ 113,009\\ \hline \\ 111,374\\ \hline \\ 49,208\\ \hline \\ 48,774\\ \hline \\ 37,361\\ \hline \\ 113,009\\ \hline \\ 111,374\\ \hline \\ 49,208\\ \hline$	Is           IS           IS           IS           Time           0.02           0.44           0.08           0.102           0.44           0.08           0.102           0.44           0.08           0.102           0.44           0.08           0.101           59.04           11.63           29.50           56.94           0.62           41.96           92.81           108.86           59.06           226.73           2284.88           107.68           230.38           67.18           13.39           8.30	$\begin{array}{r} 8\\ 0.9\\ 0.9\\ 0.9\\ \hline \\ \hline \\ C_{max}\\ \hline \\ 68,714\\ \hline \\ 72,465\\ 32,538\\ 35,883\\ 35,883\\ 40,186\\ 40,522\\ 40,887\\ 32,573\\ 32,573\\ 22,681\\ 39,621\\ 48,195\\ 46,728\\ 36,926\\ 110,625\\ 105,837\\ 105,905\\ 96,737\\ 103,359\\ 86,500\\ 85,867\\ 62,633\\ 62,633\\ 100\\ 85,867\\ 62,633\\ 100\\ 85,867\\ 100\\ 85,867\\ 100\\ 85,867\\ 100\\ 85,867\\ 100\\ 85,867\\ 100\\ 85,867\\ 100\\ 85,867\\ 100\\ 85,867\\ 100\\ 85,867\\ 100\\ 85,867\\ 100\\ 85,867\\ 100\\ 85,867\\ 100\\ 85,867\\ 100\\ 85,867\\ 100\\ 100\\ 85,867\\ 100\\ 100\\ 100\\ 85,867\\ 100\\ 100\\ 85,867\\ 100\\ 100\\ 85,867\\ 100\\ 100\\ 85,867\\ 100\\ 100\\ 85,867\\ 100\\ 100\\ 85,867\\ 100\\ 100\\ 85,867\\ 100\\ 100\\ 85,867\\ 100\\ 100\\ 85,867\\ 100\\ 100\\ 100\\ 85,867\\ 100\\ 100\\ 100\\ 85,867\\ 100\\ 100\\ 100\\ 100\\ 100\\ 100\\ 100\\ 10$	1           Time           0.34           0.02           0.10           1.25           4.42           13.18           38.15           0.91           0.03           4.95           149.42           33.80           9.33           259.22           197.45           226.68           239.97           242.82           282.07           7.45	$\begin{array}{c} & 3\\ 2.4\\ \hline \\ 2.4\\ \hline \\ \hline$	B           45           15           CN           Time           0.03           0.04           0.00           0.02           0.03           0.61           0.17           0.00           0.24           0.00           0.24           0.02           0.03           0.04           0.02           0.03           0.04           0.02           0.03           0.04           0.02           0.03           0.17           0.99           0.48           2.14           3.63           32.50	1; 0.8 1.8 2, 2, 32, 538 35, 35, 35, 35, 35, 35, 35, 35, 35, 35,	3 3 3 3 7 7 7 7 7 7 7 7 7 7 7 7 7
#best gap(%) gap(%) instance YFJS01 YFJS02 YFJS03 YFJS04 YFJS05 YFJS06 YFJS06 YFJS07 YFJS06 YFJS07 YFJS07 YFJS09 YFJS10 YFJS10 YFJS11 YFJS12 YFJS13 YFJS14 YFJS15 YFJS16 YFJS17 YFJS19 YFJS19 YFJS19 YFJS19 YFJS19 YFJS19 YFJS19	$\begin{array}{c} 5\\ 2.7\\ 3.4\\ \hline \\ ILS-1\\ \hline \\ \hline \\ 68,714\\ 72,465\\ 32,538\\ 35,883\\ 35,883\\ 35,883\\ 35,883\\ 35,883\\ 35,883\\ 35,883\\ 35,883\\ 32,681\\ 40,186\\ 40,441\\ 40,887\\ 32,573\\ 22,681\\ 37,372\\ 47,800\\ 46,728\\ 37,372\\ 47,800\\ 46,728\\ 36,911\\ 110,185\\ 105,003\\ 93,469\\ 101,013\\ 82,879\\ 83,689\\ 61,866\\ \end{array}$	9 3 Time 0.51 1.40 0.03 1.73 9.99 218.75 131.61 0.69 2.68 11.63 12.50 26.81 12.30 216.19 192.42 56.50 198.07 215.24 221.94 223.90 7.60 5 1	$\begin{array}{c} 6\\ 6\\ 2.3\\ 2.5\\ \hline\\ C_{max}\\ \hline\\ 68,714\\ 72,465\\ 33,538\\ 35,883\\ 40,186\\ 40,186\\ 40,184\\ 40,186\\ 40,184\\ 10,573\\ 22,681\\ 37,372\\ 47,800\\ 46,728\\ 37,372\\ 47,800\\ 46,728\\ 36,911\\ 110,558\\ 36,911\\ 105,423\\ 94,558\\ 101,517\\ 81,172\\ 83,731\\ 61,91\\ \hline\end{array}$	CN Time 0.80 2.82 0.02 0.17 1.76 122.67 37.21 0.88 0.54 19.65 94.06 15.79 13.38 269.22 189.75 119.50 174.10 63.58 115.47 259.71 7.95 4	$\begin{array}{c} & 0 \\ & 5.4 \\ & 6.5 \\ \hline \\ & 6.714 \\ & 73,053 \\ & 32,538 \\ & 36,946 \\ & 41,034 \\ & 41,023 \\ & 41,025 \\ & 32,623 \\ & 22,681 \\ & 37,685 \\ & 49,493 \\ & 49,411 \\ & 38,042 \\ & 112,062 \\ & 108,296 \\ & 111,439 \\ & 99,912 \\ & 109,763 \\ & 94,020 \\ & 94,022 \\ & 64,73 \end{array}$	) 46 23 P-RN Time 0.12 0.12 254.14 0.15 160.74 3.28 54.84 0.09 6.30 1.92 174.55 13.84 2.35 221.06 17.04 109.53 280.03 244.40 33 44.40 33	$\begin{array}{c} GRAS\\ \hline \\ GRAS\\ \hline \\ Grax\\ \hline \\ 69,189\\ \hline \\ 73,149\\ \hline \\ 32,538\\ \hline \\ 35,883\\ \hline \\ 41,034\\ \hline \\ 41,174\\ \hline \\ 41,354\\ \hline \\ 32,655\\ \hline \\ 22,681\\ \hline \\ 37,685\\ \hline \\ 49,208\\ \hline \\ 48,774\\ \hline \\ 37,685\\ \hline \\ 49,208\\ \hline \\ 48,774\\ \hline \\ 37,685\\ \hline \\ 113,009\\ \hline \\ 113,000\\ \hline$	Is           IS           IS           Time           0.02           0.44           0.08           0.10           0.52           59.04           11.63           29.50           56.94           0.62           41.96           92.81           108.86           59.06           226.73           284.88           230.38           67.18           13.39           88.30           51	$\begin{array}{r} 8\\ 0.9\\ 0.9\\ \hline\\ \hline\\ C_{max}\\ \hline\\ 68,714\\ \hline\\ 72,465\\ 32,538\\ 35,883\\ 40,186\\ 40,522\\ 40,887\\ 32,573\\ 22,681\\ 39,621\\ 48,195\\ 46,728\\ 36,926\\ 110,625\\ 105,837\\ 105,905\\ 96,737\\ 103,359\\ 86,500\\ 85,867\\ \hline\\ 62,63\\ \hline\end{array}$	1           Time           0.34           0.02           0.10           1.25           4.42           13.18           38.15           0.91           0.03           4.95           149.42           33.80           9.33           259.22           197.45           226.68           239.97           242.82           2820.07           7.45           0	$\begin{array}{c} & 3\\ 2.4\\ \hline \\ 2.4\\ \hline \\ \hline$	B           45           15           CN           Time           0.03           0.04           0.00           0.02           0.03           0.61           0.17           0.00           0.24           0.00           0.24           0.02           0.03           0.17           0.02           0.03           0.04           0.02           0.03           0.17           0.09           0.48           2.14           3.63           22.50           15	$\begin{array}{c} 1;\\ 0.8\\ 1.8\\ \hline \\ C_{max}\\ \hline \\ 68,714\\ 72,465\\ 33,588\\ 35,883\\ 41,034\\ 40,784\\ 40,784\\ 40,784\\ 40,887\\ 32,681\\ 37,372\\ 47,800\\ 46,728\\ 36,911\\ 111,282\\ 105,112\\ 94,950\\ 102,477\\ 81,946\\ 84,707\\ \hline \\ 62,18\\ \end{array}$	3 3 3 3 7 7 7 7 7 7 7 7 7 7 7 7 7

Table 5: Results of applying the metaheuristics to the large-sized instances with learning rate  $\alpha=0.1.$ 

•	ILS-	RN	ILS-	CN	GRAS	P-RN	GRAS	P-CN	TS-	RN	TS-	CN	S	A
instance	$C_{\text{max}}$	Time	$C_{\text{max}}$	Time	$C_{\text{max}}$	Time	$C_{\text{max}}$	Time	$C_{\text{max}}$	Time	$C_{\text{max}}$	Time	$C_{\text{max}}$	Time
DAFJS01	$21,\!683$	17.45	$21,\!683$	7.46	21,861	8.41	21,861	136.04	22,286	0.03	22,703	0.01	21,936	0.38
DAFJS02	24,235	48.48	24,235	55.62	$24,\!618$	0.05	24,571	4.00	$24,\!875$	0.14	$24,\!477$	0.00	25,141	0.51
DAFJS03	44,266	213.30	44,453	208.60	44,481	211.71	45,079	169.49	44,419	12.80	$45,\!275$	0.37	44,266	147.45
DAFJS04	44,713	54.08	44,938	53.17	44,713	298.64	$45,\!644$	29.88	44,821	1.41	$46,\!807$	0.28	44,816	239.37
DAFJS05	30,904	28.28	30,773	144.29	31,848	54.88	32,065	22.88	32,028	0.92	31,772	0.66	31,295	61.32
DAFJS06	30,602	65.94	30,553	16.14	31,994	90.56	31,768	145.27	31,521	5.17	31,039	0.52	31,216	44.70
DAFJS07	40,343	46.23	39,788	223.54	40,321	121.98	40,891	84.05	38,731	37.49	$39,\!488$	223.99	38,833	112.43
DAFJS08	45,636	273.46	45,784	218.76	45,955	9.16	46,589	7.49	45,162	133.36	46,129	119.13	45,302	128.92
DAFJS09	35,098	25.22	35,244	74.17	35,759	18.62	35,507	224.49	35,161	5.16	36,004	0.20	35,418	193.84
DAFJS10	37,326	238.28	37,172	198.27	37,736	257.38	37,856	76.13	36,791	293.02	$38,\!453$	0.75	37,183	11.88
DAFJS11	47,417	203.56	47,221	248.85	49,271	182.94	49,049	30.18	45,861	300.00	46,470	169.13	45,822	242.59
DAFJS12	45,613	256.81	45,394	45.36	48,195	14.33	47,896	195.90	44,167	232.32	43,932	259.97	43,227	261.22
DAFJS13	45,230	112.83	45,187	255.42	45,154	195.56	45,422	200.48	44,180	128.30	46,329	0.17	45,309	154.25
DAFJS14	50,958	250.28	50,897	103.42	51,082	235.59	50,954	267.23	49,611	171.05	51,800	0.36	50,555	271.75
DAFJS15	49,326	277.73	49,120	158.41	50,696	137.86	50,910	95.17	47,211	221.78	47,414	152.93	47,151	282.47
DAFJS16	50,300	40.01	49,896	227.89	53,242	121.42	54,087	243.46	48,972	297.39	48,312	169.85	47,661	169.18
DAFJS17	53,388	122.05	52,783	157.04 102.14	52,905	171.59	53,513	237.27	51,715	55.57	52,459	2.64	52,081	94.05
DAFJS18	54,313 30,480	275.00 04.81	54,237 30,312	103.14	54,569 41.046	292.99 124.48	55,154 40.031	147.54 162.08	52,624	164.38 130.01	54,008 38.041	1.39 6.77	53,942 38 012	183.68 150.83
DAFJS19 DAFJS20	39,480 40,000	94.81 250.17	39,312 40,226	77.07	41,046	124.48	40,931	162.08 107.61	38,740 48.088	130.01 230.70	38,941 40.274	6.77 0.55	38,012	150.83
DAFJS20 DAFJS21	49,099 54,311	$259.17 \\ 5.09$	49,226 54,163	$160.00 \\ 118.65$	$49,290 \\ 54,851$	184.19 216.71	50,041 55,002	$197.61 \\ 20.65$	48,088 52,681	230.79 264.76	49,274 53,996	$0.55 \\ 9.95$	<b>47,680</b> 53,196	282.84 291.79
DAFJS21 DAFJS22			,				,						· · ·	
DAFJS22 DAFJS23	$46,679 \\ 37,459$	213.56 248.79	46,468 36,733	$161.65 \\ 262.51$	48,169 38,106	285.94 230.28	47,938 38,487	42.82 243.86	46,088 <b>36,137</b>	$288.61 \\ 166.72$	44,851 36,190	$59.63 \\ 13.53$	45,011 36,373	251.83 49.89
DAFJS23 DAFJS24	42,129	1248.79 124.24	41,596	202.31 275.85	43,617	113.82	43,693	243.80 295.60	40,079	100.72 216.52	30,190 41,307	26.26	40,453	297.11
DAFJS24 DAFJS25	42,125 53,096	203.63	52,727	275.83 274.34	43,017 54,913	115.82 107.96	45,055 55,011	235.00 220.93	52,604	210.32 264.38	50,965	20.20 248.46	50,887	116.74
DAFJS26	53,090 52,492	203.03 211.10	52,147	214.34 218.93	54,563	21.44	54,439	220.93 241.66	50,004 50,006	140.87	50,305 50,465	246.40 74.69	50,062	110.74
DAFJS27	57,249	244.03	56,428	299.00	58,674	259.45	59.078	30.84	55,599	293.44	55,398	29.41	55,291	270.23
DAFJS28	41,928	91.85	42,013	119.00	42,847	200.40 90.69	43,197	208.33	40.686	26.31	41,780	30.78	40,431	212.68
DAFJS29	49,863	282.73	49,538	162.49	51,391	213.00	51,881	188.89	48,953	155.28	48,942	2.58	47,091	293.59
	,		,		,		,		,		· · ·		· ·	
I DAFJS30	42.001	145.84	42.138	130.38	43.276	119.87	43.617	4.51	40.839	246.80	40.746	63.14	$\pm 40.325$	137.56
DAFJS30 $\overline{C}_{max}$	42,001 43,90	145.84 )4.57	42,138 43,72	130.38 28.23	43,276 44,83	119.87 38.10	43,617 45,07	4.51 71.03	40,839 43,02	246.80 21.20	40,746 43,52	63.14 4.20	<b>40,325</b> 42,86	137.56 5.53
$\overline{C}_{max}$ #best	,	94.57	,	28.23	,	38.10	,	71.03	,	21.20	,	4.20	,	5.53
$\bar{C}_{max}$	43,90	)4.57 5	43,72	28.23 4	44,8	38.10	45,07	71.03 )	43,02	21.20 1	43,52	4.20	42,86	5.53 2
$\overline{C}_{max}$ #best	43,90	)4.57 5 91	43,72	28.23 4 52	44,8	38.10 I 12	45,07	71.03 ) 52	43,02	21.20 1 13	43,52	24.20 27	42,86	5.53 2 74
$ar{C}_{\max}$ #best gap(%)	43,90 5 2.9 3.4	)4.57 5 )1 49	43,72 43,72 2,4 3,7	28.23 4 52 15	44,8 5. 5.	38.10 I 12 99	45,07 ( 5.0 6.3	71.03 ) 52 30	43,02 1 1.1 1.1	21.20 1 13 13	43,52 1 2.5 2.5	24.20 27 27	42,86 12 0.7 1.6	5.53 2 74 39
$ \begin{array}{c} \bar{C}_{\max} \\ \#best \\ gap(\%) \\ \overline{gap}(\%) \end{array} $	43,90 5 2.9 3.4 ILS-	94.57 5 91 49 RN	43,72 2.8 3.3 ILS-	28.23 4 52 15 -CN	44,8 5. 5. GRAS	38.10 1 12 99 SP-RN	45,07 ( 5.0 6.3 GRAS	71.03 ) 52 30 PP-CN	43,02 1 1.1 1.1 TS-	21.20 1 13 13 RN	43,52 1 2.1 2.1 TS-	24.20 27 27 CN	42,86 12 0.7 1.6	5.53 2 74 39 A
$ar{C}_{\max}$ #best gap(%)	43,90 5 2.9 3.4	)4.57 5 )1 49	43,72 43,72 2,4 3,7	28.23 4 52 15	44,8 5. 5.	38.10 I 12 99	45,07 ( 5.0 6.3	71.03 ) 52 30 PP-CN Time	43,02 1 1.1 1.1	21.20 1 13 13	43,52 1 2.5 2.5	24.20 27 27	42,86 12 0.7 1.6	5.53 2 74 39
$ \begin{array}{c} \bar{C}_{\max} \\ \#best \\ gap(\%) \\ \overline{gap}(\%) \end{array} $	43,90 5 2.9 3.4 ILS-	94.57 5 91 49 RN	43,72 2.8 3.3 ILS-	28.23 4 52 15 -CN	44,8 5. 5. GRAS	38.10 1 12 99 SP-RN	45,07 ( 5.0 6.3 GRAS	71.03 ) 52 30 PP-CN	43,02 1 1.1 1.1 TS-	21.20 1 13 13 RN	43,52 1 2.1 2.1 TS-	24.20 27 27 CN	42,86 12 0.7 1.6	5.53 2 74 39 A
$\begin{tabular}{ c c c c }\hline \hline $C_{\rm max}$ \\ $\# best$ \\ $gap(\%)$ \\ \hline $gap(\%)$ \\ \hline $gap(\%)$ \\ \hline $instance$ \\ \hline $YFJS01$ \\ $YFJS02$ \\ \hline $YFJS02$ \\ \hline \end{tabular}$	43,90 5 2.9 3.4 ILS- C <sub>max</sub> <b>61,606</b> <b>64,172</b>	4.57 5 149 RN Time 1.10 0.59	43,72 2.4 3.1 ILS- C <sub>max</sub> 61,606 64,172	28.23 4 52 15 CN Time 1.12 1.35	$\begin{array}{c} 44,8;\\ 5.\\ 5.\\ \hline\\ C_{max}\\ 64,456\\ 65,967\\ \end{array}$	38.10 12 99 SP-RN Time 0.19 0.99	$\begin{array}{c} 45,07\\ (5,1)\\ 6,2\\ \hline \\ GRAS\\ \hline \\ C_{max}\\ \hline \\ 62,327\\ \hline \\ 66,394\\ \end{array}$	71.03 ) 52 30 PP-CN Time 9.05 0.87	43,02 1 1.1 1.1 <u>TS-</u> <u>C<sub>max</sub></u> 61,606 64,172	RN 1.20 1.3 1.3 RN Time 3.43 1.65	$\begin{array}{c} 43,52\\ 1\\ 2.2\\ 2.2\\ \hline \\ \\ \hline \\ C_{max}\\ \hline \\ 62,366\\ 64,805\\ \end{array}$	4.20 27 27 CN Time 0.05 0.16	$\begin{array}{c} 42,86\\ 12\\ 0.7\\ 1.6\\ \hline \\ \hline \\ C_{\max}\\ \hline \\ 62,124\\ 64,172\\ \end{array}$	5.53 2 74 59 A Time 2.24 28.72
$\begin{tabular}{ c c c c }\hline \hline C_{max} & \\ \#best & \\ gap(\%) & \\ \hline gap(\%) & \\ \hline & \\ instance & \\ \hline & \\ YFJS01 & \\ YFJS02 & \\ YFJS03 & \\ \hline \end{tabular}$	43,90 5 2.9 3.4 ILS- C <sub>max</sub> 61,606 64,172 30,073	4.57 501 49 RN Time 1.10	43,72 2.3 3.3 ILS- C <sub>max</sub> 61,606 64,172 30,073	28.23 4 52 15 CN Time 1.12	$\begin{array}{c} 44,8\\ 5.\\ 5.\\ \hline \\ C_{\rm max}\\ 64,456\\ 65,967\\ \textbf{30,073} \end{array}$	38.10 12 99 5P-RN Time 0.19 0.99 0.08	$\begin{array}{c} 45,07\\(\\5.0\\6.3\\\hline\\C_{\rm max}\\\hline\\62,327\\66,394\\30,073\\\end{array}$	71.03 52 30 5P-CN Time 9.05 0.87 0.02	43,02 1 1.1 1.1 <u>TS-</u> <u>C<sub>max</sub></u> 61,606 64,172 30,073	1.20 1 13 13 RN Time 3.43 1.65 0.01	$\begin{array}{c} 43,52\\ 1\\ 2.1\\ 2.2\\ \hline \\ \hline \\ C_{\max}\\ \hline \\ 62,366\\ 64,805\\ \textbf{30,073}\\ \end{array}$	27 27 27 CN Time 0.05 0.16 0.00	42,86 12 0.7 1.6 <u>C<sub>max</sub></u> 62,124 64,172 30,073	5.53 2 74 59 A Time 2.24 28.72 0.59
$\begin{tabular}{ c c c c }\hline \hline $C_{\rm max}$ \\ $\# best$ \\ $gap(\%)$ \\ \hline $gap(\%)$ \\ \hline $instance$ \\ \hline $YFJS01$ \\ $YFJS02$ \\ $YFJS03$ \\ $YFJS04$ \\ \hline \end{tabular}$	43,90 5 2.9 3.4 ILS- <i>C</i> <sub>max</sub> 61,606 64,172 30,073 32,670	94.57 91 49 RN Time 1.10 0.59 0.36 0.51	43,72 2.1 3.1 ILS- <i>C</i> <sub>max</sub> 61,606 64,172 30,073 32,670	28.23 4 52 15 .CN Time 1.12 1.35 0.26 0.37	$\begin{array}{c} 44,8;\\ 5,\\ 5,\\ \hline\\ C_{\rm max}\\ 64,456\\ 65,967\\ \textbf{30,073}\\ 33,302 \end{array}$	38.10 12 99 SP-RN Time 0.19 0.99 0.08 226.25	$\begin{array}{c} 45,07\\(\\5.0\\\\\hline\\ GRAS\\\\\hline\\ C_{max}\\\hline\\ 62,327\\\\66,394\\\\\textbf{30,073}\\\\32,802\\\end{array}$	71.03 52 30 30 30 30 30 30 30 30 30 30	43,02 1 1.1 1.1 Cmax 61,606 64,172 30,073 32,670	1.20 1 13 13 RN Time 3.43 1.65 0.01 1.53	$\begin{array}{c} 43,52\\ 1\\ 2.1\\ \hline \\ C_{max}\\ \hline \\ 62,366\\ 64,805\\ \textbf{30,073}\\ 33,302\\ \end{array}$	24.20 27 27 CN Time 0.05 0.16 0.00 0.01	42,86 1: 0.7 1.0 C <sub>max</sub> 62,124 64,172 30,073 32,670	5.53 2 74 59 A Time 2.24 28.72 0.59 0.65
$\begin{tabular}{ c c c c c }\hline \hline $C_{\rm max}$ \\ $\# best$ \\ $gap(\%)$ \\ \hline $gap(\%)$ \\ \hline $instance$ \\ \hline $YFJS01$ \\ $YFJS02$ \\ $YFJS02$ \\ $YFJS03$ \\ $YFJS04$ \\ $YFJS05$ \\ \hline \end{tabular}$	43,90 5 2.9 3.4 ILS- C <sub>max</sub> 61,606 64,172 30,073 32,670 37,182	94.57 5 91 49 <b>RN</b> <b>Time</b> 1.10 0.59 0.36 0.51 7.66	43,72 2.4 3. <u>ILS</u> <u>C<sub>max</sub></u> 61,606 64,172 30,073 32,670 37,182	28.23 4 52 15 CN Time 1.12 1.35 0.26 0.37 6.16	44,83 5. 5. C <sub>max</sub> 64,456 65,967 <b>30,073</b> 33,302 37,670	38.10 12 99 SP-RN Time 0.19 0.99 0.08 226.25 0.33	$\begin{array}{c} 45,07\\ (\\ 5.0\\ 6.1\\ \hline \\ \\ \hline \\ \hline \\ \hline \\ \\ \hline \\ \\ \hline \\ \\ \hline \\ \hline \\ \hline \\ \\ \hline \\ \hline \\ \\ \hline \\ \hline \\ \hline \\ \\ \hline \hline \\ \hline \hline \\ \hline \\ \hline \hline \\ \hline \\ \hline \hline \hline \\ \hline \hline \hline \\ \hline \hline \hline \hline \\ \hline \hline \hline \hline \hline \\ \hline \hline \hline \hline \hline \hline \hline \hline \\ \hline \hline$	71.03 52 30 30 30 30 30 30 30 30 30 30	43,02 1 1.1 1.1 Cmax 61,606 64,172 30,073 32,670 37,182	RN 3.43 1.55 0.01 1.53 4.32	43,52 1 2.: 2.: <u>C<sub>max</sub></u> 62,366 64,805 <b>30,073</b> 33,302 38,682	27 27 27 27 27 7 7 7 7 7 7 7 27 27 27 27	42,86 1: 0.7 1.6 <i>C</i> <sub>max</sub> 62,124 64,172 30,073 32,670 37,682	5.53 2 74 39 A Time 2.24 28.72 0.59 0.65 0.68
$\begin{tabular}{ c c c c c }\hline \hline $C_{\max}$ \\ $\#best$ \\ $gap(\%)$ \\ \hline $gap(\%)$ \\ \hline $instance$ \\ \hline $YFJS01$ \\ $YFJS02$ \\ $YFJS02$ \\ $YFJS04$ \\ $YFJS05$ \\ $YFJS06$ \\ \hline $YFJS06$ \\ \hline \end{tabular}$	43,90 5 2.5 3.4 ILS- C <sub>max</sub> 61,606 64,172 30,073 32,670 37,182 36,749	44.57 5 149 RN Time 1.10 0.59 0.36 0.51 7.66 68.53	43,72 4 2.3 3. ILS- C <sub>max</sub> 61,606 64,172 30,073 32,670 37,182 36,749	28.23 4 52 15 CN Time 1.12 1.35 0.26 0.37 6.16 11.18	44,83 5. 5. 64,456 65,967 <b>30,073</b> 33,302 37,670 37,293	38.10 1 12 99 3P-RN Time 0.19 0.99 0.08 226.25 0.33 94.00	$\begin{array}{c} 45,07\\ (5,0)\\ \hline \\ 6,1 \end{array}$ GRAS $\begin{array}{c} C_{\rm max}\\ 62,327\\ 66,394\\ \textbf{30,073}\\ \textbf{32,802}\\ 37,255\\ \textbf{36,812} \end{array}$	71.03 ) 62 30 <u>PP-CN</u> <u>Time</u> 9.05 0.87 0.02 166.10 0.79 17.99	43,02 1: 1.1 1.1 C <sub>max</sub> 61,606 64,172 30,073 32,670 37,182 36,749	1.20 1 13 13 13 Time 3.43 1.65 0.01 1.53 4.32 137.03	43,52 1 2.3 TS- C <sub>max</sub> 62,366 64,805 <b>30,073</b> 33,302 38,682 37,943	27 27 27 27 27 <u>CN</u> <u>Time</u> 0.05 0.16 0.00 0.01 0.01 0.17	42,86 1: 0.7 1.6 <i>C</i> <sub>max</sub> 62,124 64,172 30,073 32,670 37,682 37,107	5.53 2 74 39 <u>Time</u> 2.24 28.72 0.59 0.65 0.68 1.01
$\begin{tabular}{ c c c c c }\hline \hline $C_{\max}$ \\ $\#best$ \\ $gap(\%)$ \\ \hline $gap(\%)$ \\ \hline $instance$ \\ \hline $YFJS01$ \\ $YFJS02$ \\ $YFJS02$ \\ $YFJS04$ \\ $YFJS05$ \\ $YFJS06$ \\ $YFJS06$ \\ $YFJS07$ \\ \hline YFJS07$ \\ \hline YFJS0$	43,90 5 2.9 3.4 61,606 64,172 30,073 32,670 37,182 36,749 36,611	44.57 5 149 RN Time 1.10 0.59 0.36 0.51 7.66 68.53 102.75	43,72 4 2.3 3.3 C <sub>max</sub> 61,606 64,172 30,073 32,670 37,182 36,749 36,611	28.23 4 52 15 	44,83 5. 5. 64,456 65,967 <b>30,073</b> 33,302 37,670 37,293 37,159	38.10 1 12 99 3P-RN Time 0.19 0.08 226.25 0.33 94.00 3.75	$\begin{array}{c} 45,07\\ (5,0)\\ \hline \\ 6,327\\ 66,327\\ 66,327\\ 66,327\\ 30,073\\ 32,802\\ 37,255\\ 36,812\\ 37,159\\ \end{array}$	71.03 ) 32 30 Time 9.05 0.87 0.02 166.10 0.79 17.99 8.11	43,02 1: 1.1 1.1 1.1 C <sub>max</sub> 61,606 64,172 30,073 32,670 37,182 36,749 36,611	1.20 1 13 13 13 Time 3.43 1.65 0.01 1.53 4.32 137.03 77.85	43,52 1 2.1 Cmax 62,366 64,805 <b>30,073</b> 33,302 33,302 33,682 37,943 37,159	27 27 27 CN Time 0.05 0.16 0.00 0.01 0.01 0.01 0.17 0.34	42,86 1: 0.7 1.6 <i>C</i> <sub>max</sub> 62,124 64,172 30,073 32,670 37,682 37,107 36,611	5.5.53 274 39 <b>T</b> ime 2.24 28.72 0.59 0.65 0.68 1.01 1.07
$\begin{tabular}{ c c c c c }\hline \hline $C_{\rm max}$ & $\# best$ \\ $gap(\%)$ & $gap(\%)$ \\ \hline $instance$ & $$instance$ & $$in$	43,90 5 2.9 3.4 61,606 64,172 30,073 32,670 37,182 36,749 36,611 30,184	44.57 5 14 149 RN Time 1.10 0.59 0.36 0.51 7.66 68.53 102.75 0.23	43,72 4 2.2 3. 3. 61,606 64,172 30,073 32,670 37,182 36,749 36,611 30,184	28.23 4 52 15 	44,83 5. 5. 64,456 65,967 <b>30,073</b> 33,302 37,670 37,293 37,159 30,267	38.10 1 12 99 3P-RN Time 0.19 0.99 0.09 226.25 0.33 94.00 3.75 0.46	45,07 (5.4, 6.3, 6.3, 62,327 66,394 <b>30,073</b> 32,802 37,255 36,812 37,159 30,384	71.03 ) 52 30 Time 9.05 0.87 0.02 166.10 0.79 17.99 8.11 227.80	43,02 1: 1.1. 1.1. TS- C <sub>max</sub> 61,606 64,172 30,073 32,670 37,182 36,749 36,611 30,267	1.20 1 13 13 RN Time 3.43 1.65 0.01 1.53 4.32 137.03 77.85 1.93	43,52 1 2.2 TS- Cmax 62,366 64,805 <b>30,073</b> 33,302 38,682 37,943 37,159 32,595	27 27 27 CN Time 0.05 0.16 0.00 0.01 0.01 0.01 0.17 0.34 0.00	42,86 1: 0.7 5. C <sub>max</sub> 62,124 64,172 30,073 32,670 37,682 37,107 36,611 30,184	5.5.53 274 39 <b>Time</b> <b>2.24</b> 28.72 0.59 0.65 0.68 1.01 1.07 1.10
$\begin{tabular}{ c c c c c }\hline \hline $C_{\rm max}$ \\ $\# best$ \\ $gap(\%)$ \\ \hline $gap(\%)$ \\ \hline $instance$ \\ \hline $YFJS01$ \\ $YFJS02$ \\ $YFJS03$ \\ $YFJS03$ \\ $YFJS04$ \\ $YFJS04$ \\ $YFJS05$ \\ $YFJS06$ \\ $YFJS06$ \\ $YFJS08$ \\ $YFJS09$ \\ \hline $YFJS09$ \\ \hline \end{tabular}$	43,90 5 2.9 3.4 61,606 64,172 30,073 32,670 37,182 36,749 36,611 30,184 21,363	04.57 11 19 RN Time 1.10 0.59 0.36 0.51 7.66 68.53 102.75 0.23 12.05	43,72 4 2.2 4 2.2 3. Cmax 61,606 64,172 30,073 32,670 37,182 36,749 36,611 30,184 21,363	28.23 4 52 55 55 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	44,83 5. 5. 64,456 65,967 <b>30,073</b> 33,302 37,670 37,293 37,293 37,159 30,267 <b>21,363</b>	38.10 1 12 99 Time 0.19 0.08 226.25 0.33 94.00 3.75 0.46 130.79	45,07 (5.4, 6.3) (6.3) (6.3) (6.3) (6.3) (6.3) (6.3) (6.3) (6.3) (7.3) (	71.03 ) 32 330 P-CN Time 9.05 0.87 0.02 166.10 0.79 17.99 8.11 227.80 141.45	43,02 1: 1.1. TS- Cmax 61,606 64,172 30,073 32,670 37,182 36,611 30,267 21,363	RN Time 3.43 1.65 0.01 1.53 4.32 137.03 77.85 1.93 10.87	43,52 1 2.2 TS- Cmax 62,366 64,805 <b>30,073</b> 33,302 38,682 37,943 37,159 <b>21,363</b>	27 27 27 CN Time 0.05 0.16 0.00 0.01 0.01 0.01 0.34 0.00 0.89	42,86 1: 0.7 1.( Cmax 62,124 64,172 30,073 32,670 37,107 36,611 30,184 21,450	5.5.53 2 74 39 74 74 75 75 75 75 75 75 75 75 75 75 75 75 75
$\begin{tabular}{ c c c c c }\hline \hline $C_{\max}$ \\ $\#best$ \\ $gap(\%)$ \\ \hline $gap(\%)$ \\ \hline $instance$ \\ \hline $YFJS01$ \\ $YFJS02$ \\ $YFJS03$ \\ $YFJS03$ \\ $YFJS04$ \\ $YFJS05$ \\ $YFJS06$ \\ $YFJS06$ \\ $YFJS06$ \\ $YFJS06$ \\ $YFJS08$ \\ $YFJS09$ \\ $YFJS10$ \\ \hline \end{tabular}$	43,90 5 2.9 3.4 61,606 64,172 30,073 32,670 37,182 36,749 36,611 30,184 21,363 34,364	04.57 5 11 19 RN Time 1.10 0.59 0.36 0.51 7.66 68.53 102.75 0.23 12.05 10.57	43,72 4 2.1 4 2.2 3. 3. 6 1,606 64,172 30,073 32,670 37,182 36,749 36,611 30,184 21,363 34,364	28.23 4 52 15 CN Time 1.12 1.35 0.26 0.37 6.16 11.18 57.41 0.51 1.63 8.30	44,83 5. 5. 64,456 65,967 <b>30,073</b> 33,302 37,670 37,293 37,670 37,293 30,267 <b>21,363</b> 35,389	38.10 12 99 3P-RN Time 0.19 0.99 0.08 226.25 0.33 94.00 3.75 0.46 130.79 0.03	45,07 (5.0,5.0,6.7) GRAS C <sub>max</sub> 62,327 66,394 <b>30,073</b> 32,802 37,255 36,812 37,255 36,812 37,159 30,384 2 <b>1,363</b> 34,689	71.03 ) 32 30 P-CN Time 9.05 0.87 0.02 166.10 0.79 17.99 8.11 227.80 141.45 11.28	43,02 1,1 1,1 TS- C <sub>max</sub> 61,606 64,172 30,073 32,670 37,182 36,749 36,611 30,267 21,363 35,251	RN         3.43         1.65         0.01         1.53         4.32         137.03         77.85         1.93         10.87         0.14	43,52 1 2.: TS- C <sub>max</sub> 62,366 64,805 30,073 33,302 38,682 37,943 37,159 32,595 21,363 35,116	24.20 27 27 CN Time 0.05 0.16 0.00 0.01 0.01 0.01 0.17 0.34 0.00 0.89 0.00	42,86 1: 0.7. 1.( Cmax 62,124 64,172 30,073 32,670 37,682 37,107 36,611 30,184 21,450 34,364	5.53 2 74 39 A <u>Time</u> 2.24 28.72 0.59 0.65 0.68 1.01 1.07 1.10 2.64 38.75
$\begin{tabular}{ c c c c c }\hline \hline $C_{\max}$ & $\#best$ \\ $gap(\%)$ & $gap(\%)$ \\ \hline $instance$ & $instance$ \\ \hline $YFJS01$ & $YFJS02$ & $YFJS02$ & $YFJS02$ & $YFJS04$ & $YFJS05$ & $YFJS06$ & $YFJS06$ & $YFJS06$ & $YFJS06$ & $YFJS07$ & $YFJS08$ & $YFJS09$ & $YFJS10$ & $YFJS11$ \\ \hline \end{tabular}$	$\begin{array}{c} 43,90\\ & 5\\ & 5\\ & 2.9, \\ & 2.9, \\ & 3.4, \\ & 3.4, \\ & 5\\ & 5\\ & 5\\ & 5\\ & 5\\ & 5\\ & 5\\ &$	$\begin{array}{c} 44.57\\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ $	43,72 4 2.1 4 2.2 3. 3. 5 6 1,606 64,172 30,073 32,670 37,182 36,749 36,611 30,184 21,363 34,364	28.23 4 52 15 CN Time 1.12 1.35 0.26 0.37 6.16 11.18 57.41 0.51 1.63 8.30 164.27	$\begin{array}{c} 44,83\\ 5.\\ 5.\\ \hline 5.\\ \hline 64,456\\ 65,967\\ 30,073\\ 33,302\\ 37,670\\ 37,293\\ 37,670\\ 37,293\\ 30,267\\ 21,363\\ 35,389\\ 45,613\\ \end{array}$	38.10 12 99 3P-RN Time 0.19 0.99 0.08 226.25 0.33 94.00 3.75 0.46 130.79 0.03 12.83	45,07 (5.1, 5.1, 6.3, 62,327 (66,394 <b>30,073</b> 32,802 37,255 36,812 37,159 30,384 <b>21,363</b> 34,689 45,649	71.03 ) 32 30 P-CN Time 9.05 0.87 0.02 166.10 0.79 17.99 8.11 227.80 141.45 11.28 33.90	43,02 1.1 1.1 1.1 TS- C <sub>max</sub> 61,606 64,172 30,073 32,670 37,182 36,749 36,611 30,267 21,363 35,251 44,094	$\begin{array}{c} \text{R.N} \\ \hline \text{RN} \\ \hline \text{3.43} \\ \hline \text{3.43} \\ 1.65 \\ 0.01 \\ 1.53 \\ 4.32 \\ 137.03 \\ 77.85 \\ 1.93 \\ 10.87 \\ 0.14 \\ 0.53 \\ \end{array}$	43,52 1 2.: TS- C <sub>max</sub> 62,366 64,805 <b>30,073</b> 33,302 37,943 37,159 32,595 <b>21,363</b> 35,116 46,983	27 27 27 27 <u>CN</u> <u>Time</u> 0.05 0.16 0.00 0.01 0.01 0.01 0.01 0.17 0.34 0.00 0.89 0.00 0.00	42,86 1: 0.7 0.7 1. 0.7 0.7 0.7 0.7 0.7 0.7 0.7 0.	$5.53 \\ 2 \\ 74 \\ 39 \\ \hline \\ \hline \\ \hline \\ 2.24 \\ 28.72 \\ 0.59 \\ 0.65 \\ 0.68 \\ 1.01 \\ 1.07 \\ 1.10 \\ 2.64 \\ 38.75 \\ 81.93 \\ \hline \\ \end{cases}$
$\begin{tabular}{ c c c c c }\hline \hline $C_{\max}$ & $\#best$ & $gap(\%)$ & $gap(\%)$ & $gap(\%)$ & $instance$ & $FJS01$ & $YFJS02$ & $YFJS02$ & $YFJS04$ & $YFJS05$ & $YFJS06$ & $YFJS06$ & $YFJS06$ & $YFJS06$ & $YFJS07$ & $YFJS06$ & $YFJS09$ & $YFJS09$ & $YFJS10$ & $YFJS11$ & $YFJS12$ & $FJS12$ & $$	$\begin{array}{c} 43,90\\ 5\\ 2.9,\\ 2.9,\\ 3.4\\ \hline \\ \hline \\ C_{max} \end{array}$	44.57 5 11 49 RN Time 1.10 0.59 0.36 0.51 7.66 68.53 102.75 0.23 12.05 10.57 158.07 177.44	43,72 43,72 4 2.1 3.3 3.3 4 2.3 3.3 5 6 1,606 64,172 30,073 32,670 37,182 36,749 36,611 30,184 21,363 34,364 43,544 42,397 (1,604) (	28.23 4 52 15 CN 1.12 1.35 0.26 0.37 6.16 11.18 57.41 0.51 1.63 8.30 164.27 131.72	44,83 5. 5. 64,456 65,967 <b>30,073</b> 33,302 37,670 37,293 37,159 30,267 <b>21,363</b> 35,389 45,613 45,207	38.10 12 99 3P-RN Time 0.19 0.99 0.08 226.25 0.33 94.00 3.75 0.46 130.79 0.03 12.83 91.71	$\begin{array}{c} 45,07\\ (5,1)\\ \hline \\ 6,307\\ \hline \\ 62,327\\ \hline \\ 66,394\\ 30,073\\ 32,802\\ 37,255\\ 36,812\\ 37,159\\ 30,384\\ 21,363\\ 34,689\\ 45,649\\ 44,084\\ \end{array}$	71.03 ) 32 30 P-CN Time 9.05 0.87 0.02 166.10 0.79 17.99 8.11 227.80 141.45 11.28 33.90 69.04	43,02 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.	$\begin{array}{c} \text{RN} \\ \hline \text{RN} \\ \hline \text{3.43} \\ \hline \text{3.43} \\ \hline \text{1.65} \\ 0.01 \\ 1.53 \\ 4.32 \\ 137.03 \\ 77.85 \\ 1.93 \\ 10.87 \\ 0.14 \\ 0.53 \\ 221.30 \end{array}$	$\begin{array}{c} 43,52\\ 1\\ 2.2\\ 1\\ 2.2\\ 2.2\\ \end{array}$	44.20 27 27 CN Time 0.05 0.16 0.00 0.01 0.17 0.34 0.00 0.89 0.00 0.00 0.00 0.00 0.00	42,86 1: 0.1 0.1 0.1 1. 0.1 0.1 0.1 0.1	5.53 2 4 39 <b>A</b> <b>Time</b> 2.24 28.72 0.59 0.68 1.01 1.07 1.10 2.64 38.75 81.93 4.28
$\begin{tabular}{ c c c c c }\hline \hline $C_{\max}$ \\ $\#best$ \\ $gap(\%)$ \\ \hline $gap(\%)$ \\ \hline $gap(\%)$ \\ \hline $instance$ \\ \hline $YFJS01$ \\ $YFJS02$ \\ $YFJS02$ \\ $YFJS02$ \\ $YFJS03$ \\ $YFJS03$ \\ $YFJS03$ \\ $YFJS05$ \\ $YFJS06$ \\ $YFJS06$ \\ $YFJS06$ \\ $YFJS07$ \\ $YFJS08$ \\ $YFJS08$ \\ $YFJS09$ \\ $YFJS10$ \\ $YFJS11$ \\ $YFJS12$ \\ $YFJS13$ \\ \hline YFJS13$ \\ \hline $	$\begin{array}{c} 43,90\\ 5\\ 2.6, 3\\ 2.6, 3\\ 3.4\\ \hline \\ \hline$	44.57 5 11 49 RN Time 1.10 0.59 0.36 0.51 7.66 68.53 102.75 0.23 12.05 10.57 158.07 177.44 34.01	43,72 43,72 4 2.1 3. 3. 61,606 64,172 30,073 32,670 37,182 36,749 36,611 30,184 21,363 34,364 43,544 42,397 33,875	28.23 4 52 15 CN Time 1.12 1.35 0.26 0.37 6.16 11.18 57.41 0.51 1.63 8.30 164.27 131.72 18.97	44,83           5.           GRAS <i>C</i> max           64,456           65,967 <b>30,073</b> 37,670           37,293           37,159           30,267 <b>21,363</b> 35,889           45,613           45,207           34,401	38.10 12 399 3P-RN Time 0.19 0.08 226.25 0.33 94.00 3.75 0.46 130.79 0.03 12.83 91.71 4.99	45,07 (5.4,07) 62,327 66,394 <b>30,073</b> 32,802 37,255 36,812 37,159 30,384 <b>21,363</b> 34,689 45,649 44,084 34,240	$\begin{array}{c} 71.03 \\ 0 \\ 32 \\ 30 \\ \hline \\ $	43,02 1: 1.1. 1.1. 1.1. TS- Cmax 61,606 64,172 30,073 32,670 37,182 36,749 36,611 30,267 21,363 35,251 44,094 42,597 33,875	$\begin{array}{c} 1.20\\ 1\\ 13\\ 13\\ 13\\ \hline \\ \hline$	43,52 1 2.2 TS- C <sub>max</sub> 62,366 64,805 <b>30,073</b> 33,302 38,682 <b>37,943</b> 37,159 32,595 <b>21,363</b> 35,116 46,983 46,047 34,335	27 27 27 27 27 27 27 27 27 27 27 20 0.05 0.16 0.00 0.01 0.01 0.17 0.34 0.00 0.89 0.00 0.01 0.01 0.020	42,86 1: 0.7 5: Cmax 62,124 64,172 30,073 32,670 37,682 37,107 36,611 30,184 21,450 34,364 43,454 43,454 42,232 33,875	$\begin{array}{c} 5.53\\ 2\\ 4\\ 39\\ \hline \\ \hline$
$\begin{tabular}{ c c c c c }\hline \hline $C_{\rm max}$ & $\# best$ \\ $gap(\%)$ & $gap(\%)$ \\ \hline $gap(\%)$ & $$instance$ \\ \hline $YFJS01$ & $YFJS02$ \\ $YFJS02$ & $YFJS02$ \\ $YFJS03$ & $YFJS03$ \\ $YFJS03$ & $YFJS05$ \\ $YFJS06$ & $YFJS07$ \\ $YFJS06$ & $YFJS07$ \\ $YFJS06$ & $YFJS07$ \\ $YFJS08$ & $YFJS08$ \\ $YFJS09$ & $YFJS10$ \\ $YFJS11$ & $YFJS12$ \\ $YFJS13$ & $YFJS14$ \\ \hline $YFJS14$ & $YFJS14$ \\ \hline \end{tabular}$	$\begin{array}{c} 43,90\\ 5\\ 2.9, 0\\ 5\\ \hline \\ \\ \hline \\ \hline \\ \hline \\ \\ \hline \\ \hline \\ \\ \hline \\ \hline \\ \hline \\ \hline \\ \\ \hline \hline \\ \hline \\ \hline \\ \hline \\ \hline \hline \\ \hline \hline \\ \hline \\ \hline \\ \hline \\ \hline \hline \hline \hline \hline \hline \hline \hline \\ \hline \hline \hline \hline \hline \hline \hline \hline \\ \hline \hline$	$\begin{array}{c} 44.57\\ \\ 5\\ \\ 11\\ \\ 49\\ \hline \\ \hline \\ RN\\ \hline \\ \hline \\ 1.10\\ 0.59\\ 0.36\\ 0.51\\ 7.66\\ 68.53\\ 102.75\\ 0.23\\ 12.05\\ 10.57\\ 158.07\\ 177.44\\ 34.01\\ 58.55\\ \end{array}$	43,72           43,72           2.1           3.3           61,606           64,172           30,073           32,670           37,182           36,749           36,744           21,363           34,364           43,544           42,397           33,875           93,435	28.23 4 52 15 CCN Time 1.12 1.35 0.26 0.37 6.16 11.18 57.41 0.51 1.63 8.30 164.27 18.97 164.41	44,83           5.           GRAS           Cmax           64,456           65,967           30,073           37,670           37,159           30,267           21,363           35,389           45,207           34,401           96,665	38.10 12 99 99 99 0.19 0.99 0.08 226.25 0.33 94.00 3.75 0.46 130.79 0.03 12.83 91.71 4.99 218.81	45,07 (5,4,6,7) (5,4,6,7) (6,7) (6,7) (6,394 (7,25)	$\begin{array}{c} 71.03 \\ 0 \\ 32 \\ 30 \\ \hline \\ $	43,02 1: 1.1 1.1 1.1 1.1 1.1 1.1 1.1	$\begin{array}{c} 1.20\\ 1\\ 1\\ 13\\ 13\\ \hline \\ 13\\ \hline \\ \hline \\ RN\\ \hline \\ \hline \\ \hline \\ \hline \\ \\ 1.53\\ 1.65\\ 0.01\\ 1.53\\ 1.65\\ 0.01\\ 1.53\\ 1.65\\ 1.93\\ 10.87\\ 0.14\\ 0.53\\ 221.30\\ 34.33\\ 43.69\\ \hline \end{array}$	43,52 1 2.2 TS- Cmax 62,366 64,805 <b>30,073</b> 33,302 38,682 37,943 37,159 32,595 <b>21,363</b> 35,116 46,983 46,047 <b>9</b> ,34,335 97,155	24.20 27 27 CN Time 0.05 0.16 0.00 0.01 0.17 0.34 0.00 0.89 0.00 0.00 0.01 0.20 0.11	42,86 1: 0.1. 0	$\begin{array}{c} 5.53\\ 2\\ 74\\ 39\\ \hline \\ \hline$
$\begin{tabular}{ c c c c c }\hline\hline $C_{\max}$ & $\#best$ & $gap(\%)$ & $gap(\%)$ & $gap(\%)$ & $instance$ & $instance$ & $VFJS01$ & $VFJS02$ & $VFJS03$ & $VFJS03$ & $VFJS05$ & $VFJS06$ $	$\begin{array}{c} 43,90\\ 5\\ 2.9\\ 2.9\\ 3.4\\ \hline \\ \hline \\ C_{max} \end{array}$	$\begin{array}{c} \text{A4.57} \\ \text{i} \\ \text{i} \\ \text{49} \\ \hline \\ \hline \\ \hline \\ \text{1.10} \\ 0.59 \\ 0.36 \\ 0.51 \\ 7.66 \\ 68.53 \\ 102.75 \\ 0.23 \\ 12.05 \\ 10.57 \\ 158.07 \\ 177.44 \\ 34.01 \\ 58.55 \\ 188.91 \\ \end{array}$	$\begin{array}{c} 43,72\\ 43,72\\ 2.1\\ 3.2\\ \hline \\ C_{max} \end{array} \\ \begin{array}{c} 61,606\\ 64,172\\ 30,073\\ 32,670\\ 37,182\\ 36,749\\ 36,611\\ 30,184\\ 41,544\\ 43,544\\ 43,544\\ 43,544\\ 42,397\\ 33,875\\ 93,435\\ 93,435\\ 91,006 \end{array}$	28.23 4 52 15 CN 1.12 1.35 0.26 0.37 6.16 11.18 57.41 0.57 41 0.63 8.30 164.27 131.72 18.97 164.41 203.20	$\begin{array}{c} 44,83\\ 5.\\ 5.\\ 5.\\ \hline \\ 64,456\\ 65,967\\ 30,073\\ 33,302\\ 37,670\\ 37,293\\ 37,670\\ 37,293\\ 33,670\\ 35,389\\ 45,613\\ 45,207\\ 34,401\\ 96,665\\ 96,697\\ \end{array}$	38.10           12           99           3P-RN           Time           0.19           0.99           206.25           0.33           94.00           3.75           0.46           130.79           0.03           12.83           91.71           4.99           218.81           210.91	$\begin{array}{c} 45,07\\ (5,0)\\ (5$	$\begin{array}{c} 71.03 \\ \hline \\ 71.03 \\ \hline \\ 52 \\ 30 \\ \hline \\ \hline \\ \hline \\ 9.05 \\ 0.87 \\ 0.02 \\ 166.10 \\ 0.79 \\ 17.99 \\ 8.11 \\ 227.80 \\ 141.45 \\ 11.28 \\ 33.90 \\ 69.04 \\ 50.77 \\ 81.18 \\ 71.71 \\ \end{array}$	43,02 1.1 1.1 1.1 TS- C <sub>max</sub> 61,606 64,172 30,073 32,670 37,182 36,749 36,611 30,267 21,363 35,251 44,094 42,597 33,875 93,409 90,801	$\begin{array}{c} 1.20\\ 1\\ 1\\ 3\\ 3\\ 3\\ \hline \\$	$\begin{array}{c} 43,52\\ 1\\ 2.1\\ 2.2\\ 1\\ \hline \\ C_{max} \end{array}$	27 27 27 27 <u>CN</u> <u>Time</u> 0.05 0.16 0.00 0.01 0.01 0.01 0.34 0.00 0.89 0.00 0.00 0.00 0.01 0.20 0.01 0.20 0.01 0.02 0.03 0.00 0.04 0.05	42,86 1: 0.7 1.( 2. 2. 2. 2. 2. 2. 4. 4. 1. 2. 2. 2. 4. 4. 1. 2. 2. 2. 4. 4. 1. 2. 2. 4. 4. 4. 1. 2. 2. 4. 4. 4. 4. 1. 2. 4. 4. 4. 4. 4. 4. 4. 4. 4. 4	$5.53 \\ 2 \\ 74 \\ 39 \\ \hline Time \\ 2.24 \\ 28.72 \\ 0.59 \\ 0.65 \\ 0.68 \\ 1.01 \\ 1.07 \\ 1.10 \\ 2.64 \\ 38.75 \\ 81.93 \\ 4.28 \\ 3.48 \\ 3.48 \\ 117.48 \\ 253.51 \\ \hline \end{cases}$
$\begin{tabular}{ c c c c c }\hline\hline $C_{\max}$ & \#best$ & $gap(\%)$ & $gap(\%)$ & $gap(\%)$ & $gap(\%)$ & $instance$ & $VFJS01$ & $YFJS02$ & $YFJS02$ & $YFJS02$ & $YFJS03$ & $YFJS04$ & $YFJS05$ & $YFJS06$ & $YFJS16$ & $YFFT16$ & $YFFT16$ & $YFFT16$ & $YFFT16$ & $$	$\begin{array}{c} 43,90\\ & 5\\ & 5\\ & 2.9, \\ & 2.9, \\ & 2.9, \\ & 2.9, \\ & 2.9, \\ & 2.9, \\ & 2.9, \\ & 2.9, \\ & 2.9, \\ & 30,$	$\begin{array}{c} 44.57\\ \\ 5\\ \\ 11\\ \\ 19\\ \hline \\ \\ 1.10\\ \\ 0.59\\ \\ 0.59\\ \\ 0.59\\ \\ 0.51\\ \\ 7.66\\ \\ 68.53\\ \\ 102.75\\ \\ 0.23\\ \\ 12.05\\ \\ 10.57\\ \\ 158.07\\ \\ 177.44\\ \\ 34.01\\ \\ 58.55\\ \\ 188.91\\ \\ 133.94\\ \end{array}$	$\begin{array}{c} 43,72\\ 43,72\\ 2.3\\ 3.\\ \hline \\ C_{max} \end{array} \\ \begin{array}{c} 61,606\\ 64,172\\ 30,073\\ 32,670\\ 37,182\\ 36,749\\ 36,611\\ 30,184\\ 21,363\\ 34,364\\ 43,544\\ 42,397\\ 33,875\\ 93,435\\ 91,006\\ 90,591 \end{array}$	28.23 4 52 15 CN Time 1.12 1.35 0.26 0.37 6.16 11.18 57.41 0.51 1.63 8.30 164.27 181.72 18.97 164.41 203.20 138.68	$\begin{array}{c} 44,83\\ 5.\\ 5.\\ 5.\\ \hline \\ 64,456\\ 65,967\\ 30,073\\ 33,302\\ 37,670\\ 37,293\\ 37,670\\ 37,293\\ 37,670\\ 37,293\\ 37,670\\ 34,605\\ 34,605\\ 45,207\\ 34,401\\ 96,667\\ 95,294\\ \end{array}$	38.10           12           99           3P-RN           Time           0.19           0.99           0.08           226.25           0.33           94.00           3.75           0.46           130.75           0.03           12.83           91.71           4.99           218.81           210.91           289.35	$\begin{array}{c} 45,07\\ (5,0)\\ (5$	$\begin{array}{c} 71.03 \\ \hline \\ 71.03 \\ \hline \\ 82 \\ 30 \\ \hline \\ \hline \\ 9.05 \\ 0.87 \\ 0.02 \\ 166.10 \\ 0.79 \\ 17.99 \\ 8.11 \\ 227.80 \\ 141.45 \\ 1.28 \\ 33.90 \\ 69.04 \\ 50.77 \\ 81.18 \\ 33.90 \\ 69.04 \\ 50.77 \\ 81.171 \\ 283.70 \\ \hline \end{array}$	43,02 1: 1.1. 1.1. TS- C <sub>max</sub> 61,606 64,172 30,073 32,670 37,182 36,749 36,611 30,267 21,363 35,251 44,094 42,597 33,875 93,809 90,801 91,357	$\begin{array}{c} 1.20\\ 1\\ 1\\ 3\\ 3\\ 13\\ \hline \\ \hline \\ \\ \\ \\$	$\begin{array}{c} 43,52\\ 1\\ 2.2\\ 1\\ 2.2\\ 2.2\\ \end{array}$	H.20           27           27           CN           0.05           0.16           0.00           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.02           0.00           0.00           0.00           0.00           0.00           0.01           0.20           0.11	42,86 1: 0.7 1. 1. 1. 1. 1. 1. 1. 1. 1. 1.	$\begin{array}{c} 5.53\\ 2\\ 74\\ 39\\ \hline \\ \hline \\ \hline \\ 2.24\\ 28.72\\ 0.59\\ 0.65\\ 0.68\\ 1.01\\ 1.07\\ 1.10\\ 2.64\\ 38.75\\ 81.93\\ 4.28\\ 3.48\\ 117.48\\ 117.48\\ 117.48\\ 117.68\\ 253.51\\ 150.82\\ \end{array}$
$\begin{tabular}{ c c c c c }\hline\hline $C_{\max}$ & \#best$ & $gap(\%)$ & $gap(\%)$ & $gap(\%)$ & $instance$ & $VFJS01$ & $YFJS02$ & $YFJS02$ & $YFJS04$ & $YFJS04$ & $YFJS05$ & $YFJS06$ & $YFJS06$ & $YFJS07$ & $YFJS06$ & $YFJS07$ & $YFJS06$ & $YFJS07$ & $$	$\begin{array}{c} 43,90\\ 5\\ 2.9, 0\\ 5\\ 2.9, 0\\ 5\\ 2.9, 0\\ 5\\ 2.9, 0\\ 5\\ 2.9, 0\\ 5\\ 5\\ 5\\ 5\\ 5\\ 5\\ 5\\ 5\\ 5\\ 5\\ 5\\ 5\\ 5\\$	44.57 5 11 49 Time 1.10 0.59 0.36 0.51 7.66 68.53 102.75 0.23 12.05 105.77 105.807 177.44 34.01 58.55 188.91 133.94 203.06	43,72 43,72 4 2.1 3. 3. 61,606 64,172 30,073 32,670 37,182 36,749 36,611 30,184 21,363 34,364 42,397 33,875 93,435 91,006 90,591 78,585	28.23 4 52 15 CN 1.12 1.35 0.26 0.37 6.16 11.18 57.41 0.51 1.63 8.30 164.27 131.72 18.97 164.41 203.20 138.68 294.38	$\begin{array}{c} 44,83\\ 5.\\ 5.\\ \hline \\ 64,456\\ 65,967\\ 30,073\\ 33,302\\ 37,670\\ 37,293\\ 37,159\\ 30,267\\ 21,363\\ 35,389\\ 45,613\\ 45,207\\ 34,401\\ 96,667\\ 96,697\\ 95,294\\ 85,736\end{array}$	38.10           12           99           3P-RN           Time           0.19           0.99           0.08           226.25           0.33           94.00           3.75           0.46           130.79           0.03           91.71           4.99           210.81           210.91           289.35           0.00	$\begin{array}{c} 45,07\\ (5,1)\\ \hline \\ 6,327\\ 66,394\\ 30,073\\ 32,802\\ 37,255\\ 36,812\\ 37,159\\ 30,384\\ 21,363\\ 34,689\\ 44,084\\ 34,240\\ 96,415\\ 97,126\\ 96,871\\ 85,736\\ \end{array}$	71.03 52 30 P-CN Time 9.05 0.87 0.02 166.10 0.79 17.99 8.11 227.80 141.45 11.28 33.90 69.04 50.77 81.18 223.70 0.00	43,02 1: 1.1. 1.1. TS- C <sub>max</sub> 61,606 64,172 30,073 32,670 37,182 36,749 36,611 30,267 21,363 35,251 44,094 42,597 33,875 93,409 90,801 91,357 78,982	$\begin{array}{c} 1.20\\ 1\\ 1\\ 3\\ 13\\ 13\\ \hline \\ \hline$	$\begin{array}{c} 43,52\\ 1\\ 2.2\\ 1\\ 2.2\\ 2.2\\ 2.2\\ 30,073\\ 30,073\\ 33,302\\ 38,682\\ 37,943\\ 37,159\\ 32,595\\ 21,363\\ 35,116\\ 46,983\\ 46,047\\ 34,335\\ 97,155\\ 95,840\\ 100,478\\ 83,631\\ \end{array}$	44.20           27           27           CN           0.05           0.16           0.00           0.01           0.017           0.34           0.00           0.00           0.00           0.00           0.00           0.01           0.20           0.11           0.18	42,86 1: 0.1 0.1 0.1 1. 0.1 0.1 0.1 0.1	5.53 2 4 39 <b>A</b> <b>Time</b> 2.24 28.72 0.59 0.68 1.01 1.07 1.10 2.64 81.93 4.28 3.48 117.48 253.51 150.82 283.88
$\begin{tabular}{ c c c c c }\hline \hline $C_{\max}$ \\ $\#best$ \\ $gap(\%)$ \\ \hline $gap(\%)$ \\ \hline $gap(\%)$ \\ \hline $instance$ \\ \hline $YFJS01$ \\ $YFJS02$ \\ $YFJS02$ \\ $YFJS02$ \\ $YFJS03$ \\ $YFJS03$ \\ $YFJS03$ \\ $YFJS04$ \\ $YFJS06$ \\ $YFJS06$ \\ $YFJS06$ \\ $YFJS06$ \\ $YFJS07$ \\ $YFJS08$ \\ $YFJS08$ \\ $YFJS08$ \\ $YFJS08$ \\ $YFJS08$ \\ $YFJS08$ \\ $YFJS10$ \\ $YFJS12$ \\ $YFJS12$ \\ $YFJS14$ \\ $YFJS16$ \\ $YFJS18$ \\ \hline YFJS18$ \\ \hline YFJS18$$	$\begin{array}{c} 43,90\\ 5\\ 2.4,390\\ 5\\ 2.4,390\\ 10\\ 3.4,390\\ 10\\ 3.4,390\\ 3.4,390\\ 3.4,390\\ 3.4,390\\ 3.4,390\\ 3.4,390\\ 3.4,390\\ 4.3,454\\ 4.2,232\\ 3.3,875\\ 9.2,522\\ 9.1,555\\ 9.0,957\\ 7.8,747\\ 8.5,415\\ \end{array}$	$\begin{array}{c} 44.57\\ \\ 5\\ \\ 11\\ \\ 49\\ \hline \\ \hline \\ \hline \\ RN\\ \hline \\ \hline \\ \hline \\ 1.10\\ \\ 0.59\\ \\ 0.50\\ \hline \\ 0.50\\ \hline \\ 0.51\\ \hline \\ 7.66\\ \hline \\ 68.53\\ \\ 102.75\\ \\ 0.23\\ \hline \\ 10.57\\ \hline \\ 0.23\\ \hline \\ 10.57\\ \hline \\ 158.07\\ \\ 177.44\\ \hline \\ 34.01\\ \hline \\ 58.55\\ \\ 188.91\\ \\ 133.94\\ \hline \\ 203.06\\ \hline \\ 2055.16\\ \hline \end{array}$	$\begin{array}{c} 43,72\\ 43,72\\ 2.1\\ 3.2\\ \hline \\ C_{max} \end{array}$	28.23 4 52 15 CN Time 1.12 1.35 0.26 0.37 6.16 11.18 57.41 0.51 1.63 8.30 164.27 131.72 18.97 164.41 203.20 138.68 56.76	$\begin{array}{c} 44,8;\\ 5,\\ 5,\\ \hline\\ 64,456\\ 65,967\\ 30,073\\ 33,302\\ 37,670\\ 37,293\\ 37,159\\ 30,267\\ 21,363\\ 35,380\\ 45,613\\ 45,207\\ 34,401\\ 96,665\\ 96,697\\ 95,294\\ 45,736\\ 92,382\\ \end{array}$	38.10           12           99           3P-RN           Time           0.19           0.99           0.08           226.25           0.33           94.00           3.75           0.46           130.79           0.03           91.71           4.99           218.81           210.91           289.35           0.00           86.94	$\begin{array}{c} 45,07\\ (5,1)\\ \hline \\ 6.3\\ \hline \\ 6.327\\ 66,394\\ 30,073\\ 32,802\\ 37,255\\ 36,812\\ 37,159\\ 30,384\\ 21,363\\ 34,689\\ 44,084\\ 34,240\\ 96,415\\ 97,126\\ 96,871\\ 85,736\\ 94,410\\ \end{array}$	$\begin{array}{c} 71.03 \\ \hline 71.03 \\ \hline 82 \\ 30 \\ \hline \end{array}$	$\begin{array}{c} 43,02\\ 1,\\ 1,1\\ 1,1\\ 1,1\\ \hline \\ 1,1\\ \hline 1,$	$\begin{array}{c} 1.20\\ 1\\ 1\\ 3\\ 13\\ 13\\ \hline \\ \hline \\ RN\\ \hline \\ \hline \\ \hline \\ \hline \\ \\ RN\\ \hline \\ \hline \\ \\ \hline \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\$	$\begin{array}{c} 43,52\\ 1\\ 2.2\\ 1\\ 2.2\\ 2.2\\ 2.2\\ 30,073\\ 30,073\\ 33,302\\ 38,682\\ 37,943\\ 37,159\\ 32,595\\ 21,363\\ 35,116\\ 46,983\\ 46,047\\ 34,335\\ 97,155\\ 95,840\\ 100,478\\ 83,631\\ 97,864\\ \end{array}$	H.20           27           27           CN           0.05           0.16           0.00           0.01           0.01           0.01           0.034           0.000           0.001           0.000           0.001           0.001           0.001           0.001           0.001           0.001           0.001           0.001           0.001           0.001           0.001           0.001           0.001           0.002           0.111           0.18           0.04	42,86 1: 0.1 0.1 0.1 1. 0.1 0.1 0.1 0.1	$\begin{array}{c} 5.53\\ 2\\ 4\\ 39\\ \hline \\ \hline \\ \hline \\ \hline \\ 2.24\\ 28.72\\ 0.59\\ 0.65\\ 0.68\\ 1.01\\ 1.07\\ 1.10\\ 2.64\\ 38.75\\ 81.93\\ 4.28\\ 3.48\\ 117.48\\ 253.51\\ 150.82\\ 283.88\\ 263.05\\ \end{array}$
$\begin{tabular}{ c c c c c }\hline\hline $C_{\rm max}$ & \#best$ & $gap(\%)$ & $gap(\%)$ & $gap(\%)$ & $gap(\%)$ & $instance$ & $VFJS01$ & $YFJS02$ & $YFJS03$ & $YFJS04$ & $YFJS03$ & $YFJS04$ & $YFJS05$ & $YFJS06$ & $YFJS06$ & $YFJS07$ & $YFJS06$ & $YFJS06$ & $YFJS07$ & $YFJS06$ & $YFJS07$ & $YFJS16$ & $YFJS11$ & $YFJS11$ & $YFJS11$ & $YFJS12$ & $YFJS14$ & $YFJS15$ & $YFJS14$ & $YFJS15$ & $YFJS16$ & $YFJS17$ & $YFJS18$ & $YFJS19$ & $YFJS16$ & $YFJS16$$	43,90 5 2.9 1LS- C <sub>max</sub> 61,606 64,172 30,073 32,670 37,182 36,6749 36,611 30,184 43,454 43,454 43,454 43,454 92,522 91,555 90,957 78,747 85,415 70,527	$\begin{array}{c} 44.57\\ \\ 5\\ \\ 91\\ \\ 49\\ \hline \\ \hline \\ \hline \\ 10\\ \\ \hline \\ 10\\ \\ 0.36\\ \\ 0.59\\ \\ 0.36\\ \\ 0.59\\ \\ 0.35\\ \\ 0.59\\ \\ 0.51\\ \\ 7.66\\ \\ 68.53\\ \\ 102.75\\ \\ 0.23\\ \\ 12.05\\ \\ 10.57\\ \\ 158.07\\ \\ 177.44\\ \\ 34.01\\ \\ 58.55\\ \\ 188.91\\ \\ 133.94\\ \\ 203.06\\ \\ 255.16\\ \\ 299.05\\ \end{array}$	43,72 4 2.1 3. Cmax 61,606 64,172 30,073 32,670 37,182 36,611 30,184 21,363 34,364 43,544 42,397 33,875 91,006 90,591 78,585 85,191 68,718	28.23 4 52 15 CN Time 1.12 1.35 0.26 0.37 6.16 11.18 57.41 0.51 1.63 8.30 164.27 131.72 18.97 164.41 203.20 138.68 294.38 56.76 122.25	$\begin{array}{c} 44,83\\ 5.\\ 5.\\ \hline 5.\\ \hline 64,456\\ 65,967\\ \textbf{30,073}\\ \textbf{33,302}\\ \textbf{37,670}\\ \textbf{37,293}\\ \textbf{37,670}\\ \textbf{37,570}\\ \textbf{37,570}$	38.10           12           99           SP-RN           Time           0.19           0.99           0.08           226.25           0.33           94.00           3.75           0.46           130.79           0.03           12.83           91.71           4.99           218.81           210.91           289.35           0.86.94           245.26	$\begin{array}{c} 45,07\\ (5,0)\\ \hline \\ 6,1 \\ \hline \\ 6,2 \\ \hline \\ 6,394\\ 30,073\\ 30,802\\ 37,255\\ 36,812\\ 37,255\\ 36,812\\ 37,255\\ 36,812\\ 37,255\\ 36,812\\ 37,255\\ 36,812\\ 37,255\\ 36,812\\ 37,255\\ 36,812\\ 37,255\\ 37,255\\ 36,812\\ 37,255\\ 37,255\\ 36,812\\ 37,255\\ 3$	$\begin{array}{c} 71.03 \\ \hline 71.03 \\ \hline 82 \\ \hline 52 \\ 30 \\ \hline \hline \\ \hline \\ 9.05 \\ 0.02 \\ 0.02 \\ 166.10 \\ 0.79 \\ 17.99 \\ 8.11 \\ 227.80 \\ 141.45 \\ 11.28 \\ 33.90 \\ 69.04 \\ 1425 \\ 11.28 \\ 33.90 \\ 69.04 \\ 141.8 \\ 50.77 \\ 81.18 \\ 71.71 \\ 283.70 \\ 0.00 \\ 189.36 \\ 14.98 \\ \end{array}$	43,02 1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,	$\begin{array}{c} 1.20\\ 1\\ 1\\ 3\\ 3\\ 3\\ \hline \\ \\ \\ \\$	43,52 1 2.: 2.: TS- C <sub>max</sub> 62,366 64,805 <b>30,073</b> 33,302 38,682 37,943 37,195 <b>32,595</b> <b>21,363</b> 35,116 46,983 46,047 34,335 <b>97,864</b> 100,478 <b>83,631</b> <b>97,864</b> 71,701	EA.20           27           27           CN           0.05           0.16           0.00           0.01           0.01           0.17           0.34           0.00           0.01           0.17           0.34           0.00           0.01           0.20           0.11           0.40           0.18           0.04           8.45	42,86 1: 0.1. 0.1. 1.( 0.1. 0.1. 0.1. 0.1. 1.( 0.1. 0.1	5.53 2 74 39 39 4 2.24 28.72 0.59 0.65 0.68 1.01 1.07 1.10 2.64 38.75 81.93 4.28 3.48 117.48 253.51 150.82 283.88 263.05 57.52
$\begin{tabular}{ c c c c c }\hline\hline $C_{\rm max}$ & \#best$ & $gap(\%)$ & $gap(\%)$ & $gap(\%)$ & $gap(\%)$ & $instance$ & $VFJS01$ & $YFJS01$ & $YFJS02$ & $YFJS03$ & $YFJS03$ & $YFJS05$ & $YFJS06$ & $YFJS06$ & $YFJS06$ & $YFJS06$ & $YFJS06$ & $YFJS06$ & $YFJS10$ & $YFJS11$ & $YFJS11$ & $YFJS13$ & $YFJS15$ & $YFJS16$ & $YFJS18$ & $YFJS18$ & $YFJS18$ & $YFJS18$ & $YFJS16$ & $YFJS16$$	$\begin{array}{c} 43,90\\ 5\\ 2.9,\\ 2.9,\\ 3.4\\ \hline \\ \hline \\ C_{max} \\ \hline \\ 61,606\\ 64,172\\ 30,073\\ 32,670\\ 37,182\\ 36,749\\ 36,611\\ 30,184\\ 21,363\\ 34,364\\ 43,454\\ 43,454\\ 43,454\\ 43,454\\ 43,454\\ 43,454\\ 92,522\\ 91,555\\ 90,957\\ 78,747\\ 85,415\\ 90,957\\ 78,747\\ 85,415\\ 70,527\\ 70,527\\ 72,991\\ \end{array}$	$\begin{array}{c} 44.57\\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ $	$\begin{array}{c} 43,72\\ 43,72\\ 2.1\\ 3.2\\ \hline \\ C_{max} \end{array} \\ \begin{array}{c} 61,606\\ 64,172\\ 30,073\\ 32,670\\ 37,182\\ 36,749\\ 36,611\\ 30,184\\ 42,397\\ 33,875\\ 33,875\\ 33,875\\ 33,875\\ 91,006\\ 90,591\\ 78,585\\ 85,191\\ 68,718\\ 70,286\\ \end{array}$	28.23 4 52 15 CN Time 1.12 1.35 0.26 0.37 6.16 11.18 57.41 0.57 1.12 1.35 0.26 0.37 6.16 11.18 57.41 0.63 8.30 164.27 131.72 18.97 164.41 203.20 138.68 294.38 56.76 122.25 170.65	$\begin{array}{c} 44,83\\ 5.\\ 5.\\ 5.\\ \hline \\ 64,456\\ 65,967\\ 30,073\\ 33,302\\ 37,670\\ 37,293\\ 37,670\\ 37,293\\ 37,670\\ 37,293\\ 35,389\\ 45,613\\ 45,207\\ 34,401\\ 96,665\\ 96,697\\ 95,294\\ 85,736\\ 92,382\\ 78,364\\ 80,074\\ \end{array}$	38.10           12           99           3P-RN           Time           0.19           0.98           226.25           0.33           94.00           3.75           0.46           130.79           0.03           12.83           91.71           4.99           218.81           210.91           289.35           0.00           86.94           245.26           29.02	$\begin{array}{c} 45,07\\ (5,0)\\ (5$	$\begin{array}{c} 71.03 \\ \hline 71.03 \\ \hline 82 \\ 30 \\ \hline \hline 82 \\ \hline 9.05 \\ 0.87 \\ 0.02 \\ 166.10 \\ 0.79 \\ 17.99 \\ 8.11 \\ 227.80 \\ 141.45 \\ 11.28 \\ 33.90 \\ 69.04 \\ 50.77 \\ 81.18 \\ 71.71 \\ 283.70 \\ 0.00 \\ 189.36 \\ 14.98 \\ 36.17 \\ \end{array}$	43,02 1: 1.1 1.1 TS- C <sub>max</sub> 61,606 64,172 30,073 32,670 37,182 36,749 36,611 30,267 21,363 35,251 44,094 42,597 33,875 93,409 90,801 91,357 78,982 92,710 92,710 74,284 71,131	$\begin{array}{c} 1.20\\ 1\\ 1\\ 3\\ 3\\ 3\\ 3\\ \hline \\ \\ \\ \\$	$\begin{array}{c} 43,52\\ 1\\ 2.2\\ 1\\ 2.2\\ 2.2\\ \end{array}$	27 27 27 27 <u>CN</u> <u>Time</u> 0.05 0.16 0.00 0.01 0.01 0.01 0.01 0.34 0.00 0.89 0.00 0.00 0.01 0.20 0.01 0.00 0.11 0.40 0.11 0.48 8.45 0.97	42,86 1: 0.7: 1.( 2. 2. 2. 2. 4. 4. 4. 4. 4. 4. 4. 4. 4. 4	5.53 2 74 39 4 2.24 28.72 0.59 0.65 0.68 1.01 1.07 1.07 1.07 1.07 2.64 38.75 81.93 4.28 3.428 3.428 117.48 253.51 150.82 283.88 263.05 57.52 138.10
$\begin{tabular}{ c c c c c }\hline\hline $C_{\max}$ & $\#best$ \\ $gap(\%)$ \\ \hline $gap(\%)$ \\ \hline $gap(\%)$ \\ \hline $instance$ \\ \hline $YFJS01$ \\ $YFJS02$ \\ $YFJS02$ \\ $YFJS03$ \\ $YFJS03$ \\ $YFJS04$ \\ $YFJS05$ \\ $YFJS06$ \\ $YFJS06$ \\ $YFJS06$ \\ $YFJS06$ \\ $YFJS06$ \\ $YFJS07$ \\ $YFJS06$ \\ $YFJS07$ \\ $YFJS07$ \\ $YFJS10$ \\ $YFJS10$ \\ $YFJS11$ \\ $YFJS12$ \\ $YFJS15$ \\ $YFJS16$ \\ $YFJS20$ \\ $YFJS16$ \\ $YFJS20$ \\ $YFJS20$ \\ $YFJS16$ \\ $YFJS20$ \\ $YFJS20$ \\ $YFJS20$ \\ $YFJS16$ \\ $YFJS20$ \\ $YF$	$\begin{array}{c} 43,90\\ & 5\\ & 5\\ & 2.9, \\ & 2.9, \\ & 2.9, \\ & 2.9, \\ & 2.9, \\ & 2.9, \\ & 2.9, \\ & 2.9, \\ & 2.9, \\ & 30, 073\\ & 30,$	$\begin{array}{c} 44.57\\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ $	$\begin{array}{c} 43,72\\ 4\\ 2.1\\ 3\\ 2.3\\ 3\\ 3\\ 2.3\\ 3\\ 3\\ 3\\ 3\\ 3\\ 3\\ 3\\ 3\\ 3\\ 3\\ 3\\ 3\\ 3$	28.23           4           52           15           CN           1.12           1.35           0.26           0.37           6.16           11.18           57.41           0.51           1.63           8.30           164.27           18.97           164.41           203.20           138.68           294.38           56.76           122.25           170.65           30.10	$\begin{array}{c} 44,83\\ 5.\\ 5.\\ 5.\\ \hline \\ 64,456\\ 65,967\\ 30,073\\ 33,302\\ 37,670\\ 37,293\\ 37,670\\ 37,293\\ 37,670\\ 37,293\\ 37,670\\ 34,607\\ 34,601\\ 45,207\\ 34,401\\ 96,667\\ 95,294\\ 85,736\\ 96,697\\ 95,294\\ 85,736\\ 92,382\\ 78,364\\ 57,10$	$\begin{array}{c} 38.10 \\ 12 \\ 99 \\ \hline \\ \hline \\ 3P-RN \\ \hline \\ \hline \\ 0.19 \\ 0.09 \\ 0.08 \\ 226.25 \\ 0.33 \\ 94.00 \\ 3.75 \\ 0.46 \\ 130.75 \\ 0.46 \\ 130.75 \\ 0.03 \\ 12.83 \\ 91.71 \\ 4.99 \\ 218.81 \\ 210.91 \\ 248.25 \\ 0.00 \\ 86.94 \\ 245.26 \\ 29.02 \\ \overline{38.60} \\ \end{array}$	$\begin{array}{c} 45,07\\ (5,1)\\ 5,1)\\ 6,2)\\ 6,32\\ 6,32\\ 6,32\\ 6,32\\ 6,394\\ 30,073\\ 30,073\\ 32,802\\ 37,255\\ 36,812\\ 37,159\\ 30,384\\ 21,363\\ 34,689\\ 45,649\\ 44,084\\ 34,240\\ 96,415\\ 34,689\\ 45,649\\ 44,084\\ 34,240\\ 96,871\\ 85,736\\ 97,126\\ 96,871\\ 85,736\\ 94,410\\ 79,427\\ 81,808\\ 81,808\\ 57,25\\ 81,808\\$	71.03         71.03         71.03         71.03         71.03         72.02 <th< td=""><td><math display="block">\begin{array}{c} 43,02\\ 1.1\\ 1.1\\ 1.1\\ 1.1\\ \hline 1</math></td><td><math display="block">\begin{array}{c} 1.20\\ 1\\ 1\\ 3\\ 3\\ 13\\ \hline \\ \hline \\ \\ \\ \hline \\</math></td><td><math display="block">\begin{array}{c} 43,52\\ 1\\ 2.2\\ 1\\ 2.2\\ 2.2\\ 2.2\\ 30,073\\ 30,073\\ 33,302\\ 33,302\\ 33,302\\ 33,302\\ 33,682\\ 37,943\\ 37,159\\ 32,595\\ 21,363\\ 35,116\\ 46,983\\ 46,047\\ 34,335\\ 97,155\\ 35,140\\ 46,983\\ 46,047\\ 34,335\\ 97,155\\ 83,631\\ 97,864\\ 71,701\\ 74,652\\ 57,10\\ 74,652\\ 74,70\\ 74,70\\ 74,7</math></td><td>H.20           27           27           CN           Time           0.05           0.16           0.00           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.020           0.01           0.200           0.01           0.200           0.11           0.40           0.11           0.18           0.97           14.50</td><td><math display="block">\begin{array}{c} 42,86\\ 12\\ 0.7\\ 0.7\\ 0.7\\ 0.7\\ 0.7\\ 0.7\\ 0.7\\ 0.7</math></td><td><math display="block">\begin{array}{c} 5.53\\ 2\\ 74\\ 39\\ \hline \\ \hline \\ \hline \\ 2.24\\ 28.72\\ 0.59\\ 0.68\\ 1.01\\ 1.07\\ 1.10\\ 2.64\\ 38.75\\ 81.93\\ 4.28\\ 3.48\\ 117.48\\ 117.48\\ 117.48\\ 117.48\\ 253.51\\ 150.82\\ 283.88\\ 263.05\\ 57.52\\ 138.10\\ \hline \\ 3.25\\ \end{array}</math></td></th<>	$\begin{array}{c} 43,02\\ 1.1\\ 1.1\\ 1.1\\ 1.1\\ \hline 1$	$\begin{array}{c} 1.20\\ 1\\ 1\\ 3\\ 3\\ 13\\ \hline \\ \hline \\ \\ \\ \hline \\$	$\begin{array}{c} 43,52\\ 1\\ 2.2\\ 1\\ 2.2\\ 2.2\\ 2.2\\ 30,073\\ 30,073\\ 33,302\\ 33,302\\ 33,302\\ 33,302\\ 33,682\\ 37,943\\ 37,159\\ 32,595\\ 21,363\\ 35,116\\ 46,983\\ 46,047\\ 34,335\\ 97,155\\ 35,140\\ 46,983\\ 46,047\\ 34,335\\ 97,155\\ 83,631\\ 97,864\\ 71,701\\ 74,652\\ 57,10\\ 74,652\\ 74,70\\ 74,70\\ 74,7$	H.20           27           27           CN           Time           0.05           0.16           0.00           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.020           0.01           0.200           0.01           0.200           0.11           0.40           0.11           0.18           0.97           14.50	$\begin{array}{c} 42,86\\ 12\\ 0.7\\ 0.7\\ 0.7\\ 0.7\\ 0.7\\ 0.7\\ 0.7\\ 0.7$	$\begin{array}{c} 5.53\\ 2\\ 74\\ 39\\ \hline \\ \hline \\ \hline \\ 2.24\\ 28.72\\ 0.59\\ 0.68\\ 1.01\\ 1.07\\ 1.10\\ 2.64\\ 38.75\\ 81.93\\ 4.28\\ 3.48\\ 117.48\\ 117.48\\ 117.48\\ 117.48\\ 253.51\\ 150.82\\ 283.88\\ 263.05\\ 57.52\\ 138.10\\ \hline \\ 3.25\\ \end{array}$
$\begin{tabular}{ c c c c c }\hline\hline $C_{\max}$ \\ $\#best$ \\ $gap(\%)$ \\ \hline $YFJS01$ \\ $YFJS02$ \\ $YFJS02$ \\ $YFJS02$ \\ $YFJS02$ \\ $YFJS02$ \\ $YFJS03$ \\ $YFJS04$ \\ $YFJS05$ \\ $YFJS06$ \\ $YFJS09$ \\ $YFJS10$ \\ $YFJS11$ \\ $YFJS12$ \\ $YFJS14$ \\ $YFJS15$ \\ $YFJS16$ \\ $YFJS20$ \\ \hline $Cmax$ \\ $\#best$ \\ \hline \end{tabular}$	$\begin{array}{c} 43,90\\ & 5\\ & 2.2,\\ & 3.4\\ \hline \\ \hline$	44.57 5 11 49 Time 1.10 0.59 0.36 0.51 7.66 68.53 102.75 0.23 12.05 10.57 158.07 177.44 34.01 58.55 108.55 133.94 203.06 255.16 299.05 221.56 12.45 4	$\begin{array}{c} 43,72\\ 43,72\\ 4\\ 2.3\\ 3\\ 3.\\ \end{array}$	28.23 4 52 15 CN Time 1.12 1.35 0.26 0.37 6.16 11.18 57.41 0.51 1.63 8.30 164.27 131.72 18.97 164.41 203.20 138.68 294.38 56.76 122.25 170.65 10.10 5	$\begin{array}{c} 44,83\\ 5.\\ 5.\\ 5.\\ \hline \\ 64,456\\ 65,967\\ 33,302\\ 37,670\\ 37,293\\ 37,670\\ 37,293\\ 37,159\\ 30,267\\ 21,363\\ 35,389\\ 45,613\\ 45,207\\ 34,401\\ 96,697\\ 96,697\\ 34,401\\ 96,697\\ 95,294\\ 85,736\\ 92,382\\ 78,364\\ 80,074\\ 57,11\\ 80,074\\ 57,11\\ 95,122\\ 80,074\\ 80,074\\ 57,11\\ 95,122\\ 80,074\\ 80,074\\ 95,122\\ 80,074\\ 80,074\\ 95,122\\ 80,074\\ 80,$	38.10           12           99           3P-RN           Time           0.19           0.99           20.25           0.33           94.00           3.75           0.46           130.79           0.03           91.81           210.91           289.35           0.00           86.94           29.02           38.60	$\begin{array}{c} 45,07\\ (5,1)\\ 5,1)\\ 6,2)\\ 6,327\\ 66,394\\ 30,073\\ 32,802\\ 37,255\\ 36,812\\ 37,255\\ 36,812\\ 37,159\\ 30,384\\ 21,363\\ 34,689\\ 45,649\\ 44,084\\ 34,240\\ 96,415\\ 97,126\\ 96,871\\ 85,736\\ 94,410\\ 79,427\\ 81,808\\ 57,22\\ 22\\ 32,222\\ 33,232\\ 34,689\\ 34,$	71.03 52 30 P-CN Time 9.05 0.87 0.02 166.10 0.79 17.99 8.11 227.80 141.45 11.28 33.90 69.04 50.77 81.18 71.71 283.70 0.00 189.36 14.98 36.17 51.20	$\begin{array}{c} 43,02\\ 1.1\\ 1.1\\ 1.1\\ 1.1\\ \hline 1$	$\begin{array}{c} \text{RN} \\ \hline \text{RN} \\ \hline \text{Time} \\ \hline 3.43 \\ 1.65 \\ 0.01 \\ 1.53 \\ 4.32 \\ 137.03 \\ 77.85 \\ 1.93 \\ 10.87 \\ 0.14 \\ 0.53 \\ 221.30 \\ 34.33 \\ 43.69 \\ 216.11 \\ 103.88 \\ 276.75 \\ 70.33 \\ 184.84 \\ 268.24 \\ 9.20 \\ 0 \end{array}$	$\begin{array}{c} 43,52\\ 1\\ 2.2\\ 1\\ 2.2\\ 2.2\\ 2.2\\ 3\\ 2.2\\ 3\\ 3\\ 3\\ 3\\ 3\\ 3\\ 3\\ 3\\ 3\\ 3\\ 3\\ 3\\ 3\\$	44.20           27           27           CN           0.05           0.16           0.00           0.01           0.17           0.34           0.00           0.00           0.01           0.17           0.34           0.00           0.01           0.20           0.11           0.40           0.11           0.40           0.97           4.50	$\begin{array}{c} 42,86\\ 12\\ 0.7\\ 0.7\\ 0.7\\ 0.7\\ 0.7\\ 0.7\\ 0.7\\ 0.7$	5.53 2 74 39 $\overline{A}$ 2.24 28.72 0.59 0.68 1.01 1.07 1.10 2.64 38.75 81.93 4.28 3.48 117.48 253.51 150.82 283.88 263.05 57.52 138.10 3.25 0
$\begin{tabular}{ c c c c c } \hline $C_{\max}$ \\ $\#best$ \\ $gap(\%)$ \\ \hline $gap(\%)$ \\ \hline $gap(\%)$ \\ \hline $gap(\%)$ \\ \hline $vFJS01$ \\ $YFJS01$ \\ $YFJS02$ \\ $YFJS02$ \\ $YFJS02$ \\ $YFJS03$ \\ $YFJS04$ \\ $YFJS05$ \\ $YFJS06$ \\ $YFJS10$ \\ $YFJS10$ \\ $YFJS11$ \\ $YFJS12$ \\ $YFJS15$ \\ $YFJS16$ \\ $YFJS20$ \\ $YFJS20$ \\ $YFJS16$ \\ $YFJS20$ \\ $YFJS16$ \\ $YFJS20$ \\ $YFJS16$ \\ $YFJS16$ \\ $YFJS20$ \\ $YFJS20$ \\ $YFJS16$ \\ $YFJS20$ \\ $YFJS$	$\begin{array}{c} 43,90\\ & 5\\ & 5\\ & 2.9, \\ & 2.9, \\ & 2.9, \\ & 2.9, \\ & 2.9, \\ & 2.9, \\ & 2.9, \\ & 2.9, \\ & 2.9, \\ & 30, 073\\ & 30,$	$\begin{array}{c} 44.57\\ \\ \hline \\ 11\\ 49\\ \hline \\ \hline$	$\begin{array}{c} 43,72\\ 4\\ 2.1\\ 3\\ 2.3\\ 3\\ 3\\ 2.3\\ 3\\ 3\\ 3\\ 3\\ 3\\ 3\\ 3\\ 3\\ 3\\ 3\\ 3\\ 3\\ 3$	28.23 4 52 15 CN Time 1.12 1.35 0.26 0.37 6.16 11.18 57.41 0.51 1.63 8.30 164.27 131.72 18.97 164.41 203.20 138.68 294.38 56.76 122.25 170.65 100.10 5 11	$\begin{array}{c} 44,83\\ 5.\\ 5.\\ \hline \\ 64,456\\ 65,967\\ 30,073\\ 33,302\\ 37,670\\ 37,293\\ 37,159\\ 30,267\\ 21,363\\ 35,389\\ 45,613\\ 45,207\\ 34,401\\ 96,667\\ 96,697\\ 34,401\\ 96,667\\ 95,294\\ 85,736\\ 92,382\\ 78,364\\ 80,074\\ 57,10\\ 4.\\ \end{array}$	$\begin{array}{c} 38.10 \\ 12 \\ 99 \\ \hline \\ \hline \\ 3P-RN \\ \hline \\ \hline \\ 0.19 \\ 0.09 \\ 0.08 \\ 226.25 \\ 0.33 \\ 94.00 \\ 3.75 \\ 0.46 \\ 130.75 \\ 0.46 \\ 130.75 \\ 0.03 \\ 12.83 \\ 91.71 \\ 4.99 \\ 218.81 \\ 210.91 \\ 248.25 \\ 0.00 \\ 86.94 \\ 245.26 \\ 29.02 \\ \overline{38.60} \\ \end{array}$	$\begin{array}{c} 45,07\\ (5,1)\\ 5,1)\\ 6,2)\\ 6,32\\ 6,32\\ 6,32\\ 6,32\\ 6,394\\ 30,073\\ 30,073\\ 32,802\\ 37,255\\ 36,812\\ 37,159\\ 30,384\\ 21,363\\ 34,689\\ 45,649\\ 44,084\\ 34,240\\ 96,415\\ 34,689\\ 45,649\\ 44,084\\ 34,240\\ 96,871\\ 85,736\\ 97,126\\ 96,871\\ 85,736\\ 94,410\\ 79,427\\ 81,808\\ 81,808\\ 57,25\\ 81,808\\$	71.03           52           30           P-CN           Time           9.05           0.87           0.02           166.10           0.79           17.99           8.11           227.80           141.45           11.28           33.90           69.04           50.77           81.18           71.71           283.70           0.00           189.36           14.98           36.17           51.20           2           47	$\begin{array}{c} 43,02\\ 1.1\\ 1.1\\ 1.1\\ 1.1\\ \hline 1$	$\begin{array}{c} 1.20\\ 1\\ 1\\ 3\\ 13\\ 13\\ \hline \\ \hline \\ \\ \\ \\$	$\begin{array}{c} 43,52\\ 1\\ 2.2\\ 1\\ 2.2\\ 2.2\\ 2.2\\ 30,073\\ 30,073\\ 33,302\\ 33,302\\ 33,302\\ 33,302\\ 33,682\\ 37,943\\ 37,159\\ 32,595\\ 21,363\\ 35,116\\ 46,983\\ 46,047\\ 34,335\\ 97,155\\ 35,140\\ 46,983\\ 46,047\\ 34,335\\ 97,155\\ 83,631\\ 97,864\\ 71,701\\ 74,652\\ 57,10\\ 74,652\\ 74,70\\ 74,70\\ 74,7$	44.20           Z7           27           CN           Time           0.05           0.16           0.00           0.01           0.017           0.34           0.00           0.01           0.17           0.34           0.00           0.01           0.20           0.11           0.18           0.04           8.45           0.97           4.50           27	$\begin{array}{c} 42,86\\ 12\\ 0.7\\ 0.7\\ 0.7\\ 0.7\\ 0.7\\ 0.7\\ 0.7\\ 0.7$	$\begin{array}{c} \overline{5.53} \\ 2 \\ \overline{44} \\ \overline{59} \\ \hline \\ \hline \\ 2.24 \\ 28.72 \\ 0.59 \\ 0.65 \\ 0.68 \\ 1.01 \\ 1.07 \\ 1.10 \\ 2.64 \\ 1.07 \\ 1.10 \\ 2.64 \\ 81.93 \\ 4.28 \\ 3.48 \\ 117.48 \\ 253.51 \\ 4.28 \\ 3.48 \\ 117.48 \\ 253.51 \\ 150.82 \\ 283.88 \\ 263.05 \\ 57.52 \\ 138.10 \\ 3.25 \\ 0 \\ 54 \end{array}$

Table 6: Results of applying the metaheuristics to the large-sized instances with learning rate  $\alpha=0.2.$ 

:	ILS-	RN	ILS-	CN	GRAS	P-RN	GRAS	P-CN	TS-	RN	TS-	CN	S	A
instance	$C_{\text{max}}$	Time	$C_{\max}$	Time	$C_{\text{max}}$	Time	$C_{\text{max}}$	Time	$C_{\max}$	Time	$C_{\max}$	Time	$C_{\max}$	Time
DAFJS01	19,716	42.15	19,716	93.26	19,969	181.01	19,994	1.14	20,137	0.35	21,082	0.01	20,092	0.59
DAFJS02	$22,\!147$	44.81	22,147	33.01	22,404	1.20	22,236	0.04	22,191	0.44	22,429	0.00	22,695	25.70
DAFJS03	38,916	229.98	38,994	282.80	39,280	94.82	40,454	111.31	38,928	105.79	40,724	7.17	38,853	42.33
DAFJS04	39,117	275.95	39,492	39.94	39,358	60.46	39,943	283.63	39,347	1.53	40,425	0.53	39,285	246.66
DAFJS05	27,192	175.00	27,221	266.61	27,438	55.27	28,152	92.66	27,401	0.83	28,767	0.14	27,453	0.86
DAFJS06	26,565	224.96	26,552	138.78	27,706	107.01	27,111	240.56	26,535	10.26	28,134	0.06	26,763	23.70
DAFJS07	35,287	15.78	35,262	252.14	36,318	168.90	36,309	197.95	35,735	8.84	35,074	74.05	34,493	271.96
DAFJS08	39,120	225.81	39,413	106.90	39,394	121.44	40,345	135.78	38,629	192.08	39,620	201.57	38,605	53.16
DAFJS09	30,627	93.31	30,945	4.12	31,421	14.02	31,004	255.55	30,353	79.14	32,242	0.11	30,833	46.92
DAFJS10 DAFJS11	<b>30,880</b> 40,212	$131.80 \\ 68.69$	$31,191 \\ 40,549$	202.19 187.16	$31,544 \\ 41,870$	192.89 242.15	31,802 42,027	279.43 84.21	30,983 39,227	182.18 253.69	31,853 39,751	1.87 124.91	31,252 38,537	197.99 252.92
DAFJS11 DAFJS12	38,128	83.41	40,549 38,671	61.78	40,625	242.13 271.43	42,027 40,937	93.63	37,351	174.33	39,731 37,394	124.91 263.18	37,030	232.92 286.43
DAFJS12 DAFJS13	37,672	48.20	37,699	163.35	40,025 37,806	244.56	40,957 38,010	273.30	37,324	59.41	37,354 38,811	0.32	37,197	230.43 242.77
DAFJS14	42,469	275.82	42,260	88.40	42,350	198.57	42,507	278.76	41,203	164.66	41,969	0.43	41,854	234.65
DAFJS15	42,125	156.71	42,172	190.76	43,215	186.52	43,776	40.58	40.092	252.92	40,345	40.70	40,465	180.67
DAFJS16	43,378	39.90	42,572	191.37	45,354	201.36	45,439	214.16	41,337	298.16	41,201	18.64	40,487	102.62
DAFJS17	43,350	289.76	43,143	193.23	43,698	248.64	43,121	173.83	42,367	156.85	42,622	6.69	43,083	219.02
DAFJS18	44,635	0.79	45,043	140.76	45,611	263.32	45,211	76.37	43,899	105.90	43,981	0.84	44,417	250.00
DAFJS19	34,218	89.09	34,104	52.36	35,401	198.41	35,425	94.86	33,501	43.82	34,187	0.66	33,250	238.49
DAFJS20	41,035	31.13	41,242	196.95	41,550	118.66	42,268	165.12	40,059	214.87	40,245	8.86	39,812	262.00
DAFJS21	45,000	50.80	44,519	215.72	45,409	141.46	44,883	249.15	44,190	297.58	$43,\!840$	25.11	$43,\!684$	173.57
DAFJS22	$37,\!634$	290.20	37,610	55.93	38,705	135.46	39,392	124.86	37,083	120.04	36,276	131.71	36,866	124.16
DAFJS23	33,077	95.58	32,960	10.78	33,756	107.08	33,543	44.93	31,860	39.67	32,412	15.90	32,017	188.80
DAFJS24	36,252	239.59	36,121	68.70	37,838	92.47	37,964	29.84	35,122	299.58	35,273	54.63	34,422	268.69
DAFJS25	44,698	215.09	45,061	277.98	46,361	44.37	47,007	1.62	$43,\!654$	198.69	43,176	115.77	$43,\!050$	244.18
DAFJS26	44,105	263.42	43,877	72.88	47,208	44.13	46,799	79.24	43,025	189.92	42,082	249.03	42,080	211.51
DAFJS27	47,643	81.38	47,648	269.30	48,748	188.12	49,400	275.14	46,192	284.20	46,887	17.37	46,510	204.55
DAFJS28	36,496	246.88	36,494	299.25	37,703	157.63	37,808	192.62	35,694	31.02	36,285	31.11	35,637	191.18
DAFJS29	42,923	148.58	43,334	244.96	45,174	110.20	44,735	40.40	42,218	267.02	$42,\!648$	22.61	41,410	281.11
DAF 1930	27 051	148 50	37.006	100 53	38.067	104.66	37 491	258 42	35 600	250.85	35 503	14.62	25 949	983 70
DAFJS30	37,051 37.38	148.59	37,006	190.53 33.93	38,067 38.37	194.66 76.03	37,421	258.42 0.77	35,609 36.70	250.85	35,593 37.17	14.62	35,242 36.57	283.70 79.13
$\bar{C}_{max}$	37,051 37,38	38.93	37,43		38,067 38,37	76.03	37,421 38,50	0.77	35,609 36,70 8	8.20	35,593 37,17 1	7.60	35,242 36,57 10	9.13
-	37,38	38.93 5	37,43	33.93 2	38,37	76.03 )	38,50	)0.77 )	36,70	8.20	37,17	7.60	36,57	79.13 6
$\overline{C}_{max}$ #best	37,38 5	38.93 5 58	37,43	33.93 2 71	38,37	76.03 ) 26	38,50	00.77 ) 57	36,70	8.20 39	37,17 1	7.60 38	36,57 10	79.13 6 59
$ar{C}_{\max}$ #best gap(%)	37,38 5 2.8 3.8	38.93 5 58 31	37,43 2. 3.	33.93 2 71 17	38,37 ( 5.1 6.0	76.03 ) 26 04	38,50 0 5.5 6.2	00.77 ) 57 23	36,70 8 0.8 0.8	8.20 39 39	37,17 1 2.3 2.3	77.60 38 38	36,57 10 0.5 1.5	79.13 6 59 53
$ar{C}_{\max}$ #best gap(%)	37,38 5 2.5 3.5 ILS-	38.93 5 58 31 -RN	37,43 2. 3. ILS-	33.93 2 71 17 -CN	38,37 ( 5.1 6.0 GRAS	76.03 ) 26 04 SP-RN	38,50 0 5.8 6.2 GRAS	00.77 57 23 P-CN	36,70 8 0.8 0.8 TS-1	8.20 89 89 RN	37,17 1 2.3 2.3 TS-	77.60 38 38 CN	36,57 10 0.5 1.5	79.13 6 59 53 A
$ \begin{array}{c} \bar{C}_{\max} \\ \#best \\ gap(\%) \\ \overline{gap}(\%) \end{array} $ instance	37,38 5 2.8 3.3 ILS- C <sub>max</sub>	88.93 5 58 31 -RN Time	37,43 2. 3. ILS- C <sub>max</sub>	33.93 2 71 17 -CN Time	38,37 ( 5.1 6.0 GRAS C <sub>max</sub>	76.03 ) 26 04 SP-RN Time	38,50 0 5.8 6.2 GRAS C <sub>max</sub>	00.77 57 23 P-CN Time	36,70 8 0.8 0.8 TS- C <sub>max</sub>	8.20 39 39 RN Time	$\begin{array}{c} 37,17\\1\\2.3\\2.3\\\hline\\C_{\rm max}\end{array}$	7.60 38 38 CN Time	36,57 10 0.5 1.5 <i>C</i> max	79.13 6 59 53 A Time
$\begin{tabular}{ccc} $\bar{C}_{max}$ \\ $\#best$ \\ $gap(\%)$ \\ \hline $gap(\%)$ \\ \hline $instance$ \\ \hline $YFJS01$ \\ \hline \end{tabular}$	37,38 2.8 3.3 ILS- C <sub>max</sub> 55,128	88.93 558 31 RN Time 1.60	37,45 2. 3. <u>ILS</u> <i>C</i> <sub>max</sub> <b>55,128</b>	33.93 2 71 17 •CN Time 1.29	$\begin{array}{c} 38,37\\ (5.2)\\ 6.0\\ \hline \\ GRAS\\ \hline \\ C_{max}\\ \hline \\ 55,458\\ \end{array}$	76.03 ) 26 04 SP-RN Time 0.18	$\begin{array}{c} 38,50\\ 0\\ 5.8\\ 6.2\\ \hline \\ GRAS\\ \hline \\ C_{max}\\ \hline \\ 56,790 \end{array}$	0.77 57 23 P-CN Time 2.84	$\begin{array}{c} 36,70\\ 8\\ 0.8\\ 0.8\\ \hline \\ C_{\rm max}\\ \hline \\ 55,693 \end{array}$	8.20 39 39 RN Time 0.92	$\begin{array}{c} 37,17\\ 1\\ 2.3\\ 2.3\\ \hline \\ \hline \\ C_{\rm max}\\ \hline \\ 57,900 \end{array}$	7.60 38 38 38 CN Time 0.02	36,57 10 0.5 1.5 C <sub>max</sub> 55,128	79.13 6 59 53 A Time 0.73
$\begin{tabular}{ c c c c }\hline \hline $C_{\rm max}$ \\ $\# best$ \\ $gap(\%)$ \\ \hline $gap(\%)$ \\ \hline $gap(\%)$ \\ \hline $instance$ \\ \hline $YFJS01$ \\ $YFJS02$ \\ \hline $YFJS02$ \\ \hline \end{tabular}$	37,38 2.8 3.8 ILS- C <sub>max</sub> 55,128 57,187	88.93 58 31 -RN Time 1.60 1.20	37,43 2. 3. <u>ILS</u> <i>C</i> <sub>max</sub> <b>55,128</b> <b>57,187</b>	33.93 2 71 17 •CN Time 1.29 2.25	$\begin{array}{c} 38,37\\ (5,5,2)\\ 6,0\\ \hline\\ GRAS\\ \hline\\ C_{max}\\ 55,458\\ 59,000\\ \end{array}$	76.03 ) 26 04 SP-RN Time 0.18 0.32	$\begin{array}{c} 38,50\\ 0\\ 5.8\\ 6.2\\ \hline \\ GRAS\\ \hline \\ C_{max}\\ \hline \\ 56,790\\ 58,470\\ \end{array}$	0.77 57 23 P-CN Time 2.84 0.21	36,70 8 0.8 0.8 <u>Cmax</u> 55,693 57,187	8.20 39 39 RN Time 0.92 1.60	$\begin{array}{c} 37,17\\ 1\\ 2.3\\ 2.3\\ \hline \\ C_{\rm max}\\ \hline \\ 57,900\\ 57,634\\ \end{array}$	7.60 38 38 38 <u>CN</u> <u>Time</u> 0.02 0.18	36,57 10 0.5 <u>Cmax</u> 55,128 57,187	79.13         6         59         53         A         Time         0.73         10.48
$\begin{tabular}{ c c c c }\hline \hline $C_{\rm max}$ \\ $\# best$ \\ $gap(\%)$ \\ \hline $gap(\%)$ \\ \hline $instance$ \\ \hline $YFJS01$ \\ $YFJS02$ \\ $YFJS02$ \\ $YFJS03$ \\ \hline \end{tabular}$	37,38 2.5 3.5 <u>C<sub>max</sub></u> 55,128 57,187 27,686	88.93 558 31 -RN Time 1.60 1.20 0.03	37,45 2. 3. ILS: C <sub>max</sub> 55,128 57,187 27,686	33.93 2 71 17 •CN •CN •Time 1.29 2.25 0.03	$\begin{array}{c} 38,37\\ (\\ 5.1\\ 6.0\\ \hline \\ GRAS\\ \hline \\ C_{max}\\ \hline \\ 55,458\\ 59,000\\ \textbf{27,686} \end{array}$	76.03 ) 26 04 <u>SP-RN</u> <u>Time</u> 0.18 0.32 0.00	$\begin{array}{c} 38,50\\ 0\\ 5.8\\ 6.2\\ \hline \\ GRAS\\ \hline \\ C_{max}\\ \hline \\ 56,790\\ 58,470\\ \textbf{27,686} \end{array}$	00.77 57 23 P-CN Time 2.84 0.21 0.01	36,70 8 0.8 0.8 <u>Cmax</u> 55,693 57,187 27,686	8.20 39 39 RN Time 0.92 1.60 0.02	$\begin{array}{c} 37,17\\ 1\\ 2.3\\ \hline \\ C_{max}\\ \hline \\ 57,900\\ 57,634\\ 28,772\\ \end{array}$	7.60 38 38 38 <u>CN</u> <u>Time</u> 0.02 0.18 0.00	36,57 10 0.5 1.5 <i>C</i> <sub>max</sub> 55,128 57,187 27,686	79.13 6 59 53 A Time 0.73 10.48 0.47
$\begin{tabular}{ c c c c }\hline \hline $C_{\rm max}$ \\ \#best$ \\ $gap(\%)$ \\ \hline $gap(\%)$ \\ \hline $instance$ \\ \hline $YFJS01$ \\ $YFJS02$ \\ $YFJS03$ \\ $YFJS04$ \\ \hline \end{tabular}$	37,38 2.5 3.5 <u>C<sub>max</sub></u> 55,128 57,187 27,686 29,692	88.93 558 31 -RN Time 1.60 1.20 0.03 0.29	37,45 2. 3. <u>ILS</u> <i>C</i> <sub>max</sub> <b>55,128</b> <b>57,187</b> <b>27,686</b> <b>29,692</b>	33.93 2 71 17 •CN Time 1.29 2.25 0.03 1.66	38,37 ( 5.: 6.0 GRAS <i>C</i> <sub>max</sub> 55,458 59,000 <b>27,686</b> <b>29,692</b>	76.03 ) 26 04 <u>SP-RN</u> <u>Time</u> 0.18 0.32 0.00 23.14	$\begin{array}{c} 38,50\\ 0\\ 5.8\\ 6.2\\ \hline \\ \hline \\ GRAS\\ \hline \\ C_{max}\\ \hline \\ 56,790\\ 58,470\\ \hline \\ 27,686\\ 30,683\\ \end{array}$	0.77 57 23 P-CN Time 2.84 0.21 0.01 160.12	36,70 8 0.8 0.8 C <sub>max</sub> 55,693 57,187 27,686 29,692	8.20 39 89 RN Time 0.92 1.60 0.02 0.20	$\begin{array}{c} 37,17\\ 1\\ 2.3\\ \hline \\ C_{max}\\ \hline \\ 57,900\\ 57,634\\ 28,772\\ \textbf{29,692}\\ \end{array}$	7.60 38 38 <u>CN</u> <u>Time</u> 0.02 0.18 0.00 0.05	36,57 1( 0.5 1.5 C <sub>max</sub> 55,128 57,187 27,686 29,692	79.13 6 59 53 A Time 0.73 10.48 0.47 0.49
$\begin{tabular}{ c c c c c }\hline \hline $C_{\rm max}$ & $\# best$ \\ $gap(\%)$ \\ \hline $gap(\%)$ \\ \hline $instance$ \\ \hline $YFJS01$ \\ $YFJS02$ \\ $YFJS03$ \\ $YFJS04$ \\ $YFJS05$ \\ \hline \end{tabular}$	37,38 5 2.5 3.5 <i>C</i> <sub>max</sub> 55,128 57,187 27,686 29,692 33,736	88.93 558 31 -RN Time 1.60 1.20 0.03 0.29 2.48	37,43 2 2. 3. <u>ILS</u> <i>C</i> <sub>max</sub> <b>55,128</b> <b>57,187</b> <b>27,686</b> <b>29,692</b> <b>33,736</b>	33.93 2 71 17 •CN Time 1.29 2.25 0.03 1.66 3.45	38,37 ( 5.: 6.0 GRAS <i>C</i> <sub>max</sub> 55,458 59,000 <b>27,686</b> <b>29,692</b> 34,430	76.03 26 04 SP-RN Time 0.18 0.32 0.00 23.14 2.41	38,50 0 5.8 6.2 GRAS C <sub>max</sub> 56,790 58,470 <b>27,686</b> 30,683 33,856	0.77 57 23 <u>P-CN</u> <u>Time</u> 2.84 0.21 0.01 160.12 182.52	36,70 8 0.8 0.8 C <sub>max</sub> 55,693 57,187 27,686 29,692 33,736	8.20 39 39 RN Time 0.92 1.60 0.02 0.20 12.59	37,17 1 2.5 2.5 <u>C<sub>max</sub></u> 57,900 57,634 28,772 <b>29,692</b> 35,577	77.60 38 38 CN Time 0.02 0.18 0.00 0.05 0.01	36,57 1( 0.5 <i>C</i> <sub>max</sub> 55,128 57,187 27,686 29,692 33,736	79.13         6           59         53           A         10.48           0.47         0.49           0.90         0.90
$\begin{tabular}{ c c c c }\hline \hline $C_{\rm max}$ \\ \#best$ \\ $gap(\%)$ \\ \hline $gap(\%)$ \\ \hline $instance$ \\ \hline $YFJS01$ \\ $YFJS02$ \\ $YFJS02$ \\ $YFJS04$ \\ $YFJS05$ \\ $YFJS05$ \\ $YFJS06$ \\ \hline \end{tabular}$	37,38 52,2,3 3,3,3 55,128 55,128 57,187 27,686 29,692 33,736 33,276	88.93 558 31 <u>RN</u> <u>Time</u> 1.60 1.20 0.03 0.29 2.48 35.79	37,43 2 2. 3. 55,128 57,187 27,686 29,692 33,736 33,276	33.93 2 71 17 CCN 1.29 2.25 0.03 1.66 3.45 111.43	38,37 (1) 5 5 55,458 59,000 <b>27,686</b> <b>29,692</b> 34,430 33,557	76.03 ) 226 04 Time 0.18 0.32 0.00 23.14 2.41 23.84	$\begin{array}{c} 38,50\\ 0\\ 5.8\\ 6.2\\ \hline \\ GRAS\\ \hline \\ C_{max}\\ \hline \\ 56,790\\ 58,470\\ \textbf{27,686}\\ 30,683\\ 33,856\\ 33,856\\ 33,557\\ \end{array}$	0.77 57 23 <u>P-CN</u> <u>Time</u> 2.84 0.21 0.01 160.12 182.52 6.56	36,70 8 0.8 0.8 7 55,693 57,187 27,686 29,692 33,736 33,276	8.20 39 39 RN Time 0.92 1.60 0.02 0.20 12.59 32.04	$\begin{array}{c} 37,17\\ 1\\ 2.3\\ 2.3\\ \hline \\ C_{\rm max}\\ 57,900\\ 57,634\\ 28,772\\ \textbf{29,692}\\ 35,577\\ 33,892 \end{array}$	7.60 38 38 38 CN Time 0.02 0.18 0.00 0.05 0.01 0.09	36,57 16 0.5 1.5 <i>C</i> <sub>max</sub> 55,128 57,187 27,686 29,692 33,736 33,892	79.13         6           559         53           A         Time           0.73         10.48           0.47         0.49           0.90         0.78
$\begin{tabular}{ c c c c c }\hline \hline $C_{\rm max}$ & $\# best$ \\ $gap(\%)$ & $gap(\%)$ \\ \hline $instance$ & $$instance$ & $$in$	37,38 2.3 3.3 <i>C</i> <sub>max</sub> 55,128 57,187 27,686 29,692 33,736 33,276 33,011	88.93 55 81 RN 1.60 1.20 0.03 0.29 2.48 35.79 91.58	37,43 2 2. 3. <u>ILS</u> <i>C</i> <sub>max</sub> <b>55,128</b> <b>57,187</b> <b>27,686</b> <b>29,692</b> <b>33,736</b>	33.93 2 71 17 .CN 1.29 2.25 0.03 1.66 3.45 111.43 82.50	38,37 (1) 5.1 6.1 GRAS <i>C</i> <sub>max</sub> 55,458 59,000 <b>27,686</b> <b>29,692</b> 34,430 33,557 33,352	76.03 ) 26 04 39P-RN 0.18 0.32 0.00 23.14 2.41 2.3.84 30.98	$\begin{array}{c} 38,50\\ 0.5.8\\ 6.2\\ \hline \\ GRAS\\ \hline \\ C_{max}\\ \hline \\ 56,790\\ \hline \\ 58,470\\ \hline \\ 27,686\\ 30,683\\ \hline \\ 33,856\\ \hline \\ 33,856\\ \hline \\ 33,557\\ \hline \\ 33,059\\ \end{array}$	0.77 57 23 P-CN 7 ime 2.84 0.21 0.01 160.12 182.52 6.56 126.97	36,70 8 0.8 0.8 7 55,693 57,187 27,686 29,692 33,736 33,276 33,92	8.20 39 89 RN Time 0.92 1.60 0.02 0.20 12.59 32.04 4.76	37,17 1 2.3 2.3 57,900 57,630 28,772 29,692 35,577 33,892 33,317	7.60 38 38 CN Time 0.02 0.18 0.00 0.05 0.01 0.09 0.01	36,57 10 0.5 <i>C</i> <sub>max</sub> 55,128 57,187 27,686 29,692 33,736 33,892 33,092	79.13         6           59         53           A         7           0.73         10.48           0.47         0.49           0.90         0.78           0.55         0.55
$\begin{tabular}{ c c c c }\hline \hline $C_{\rm max}$ \\ \#best$ \\ $gap(\%)$ \\ \hline $gap(\%)$ \\ \hline $instance$ \\ \hline $YFJS01$ \\ $YFJS02$ \\ $YFJS02$ \\ $YFJS04$ \\ $YFJS05$ \\ $YFJS05$ \\ $YFJS06$ \\ \hline \end{tabular}$	37,38 52,2,3 3,3,3 55,128 55,128 57,187 27,686 29,692 33,736 33,276	88.93 558 31 <u>RN</u> <u>Time</u> 1.60 1.20 0.03 0.29 2.48 35.79	37,43 2 2. 3. 55,128 57,187 27,686 29,692 33,736 33,276 33,011	33.93 2 71 17 CCN 1.29 2.25 0.03 1.66 3.45 111.43	38,37 (1) 5 5 55,458 59,000 <b>27,686</b> <b>29,692</b> 34,430 33,557	76.03 ) 226 04 Time 0.18 0.32 0.00 23.14 2.41 23.84	$\begin{array}{c} 38,50\\ 0\\ 5.8\\ 6.2\\ \hline \\ GRAS\\ \hline \\ C_{max}\\ \hline \\ 56,790\\ 58,470\\ \textbf{27,686}\\ 30,683\\ 33,856\\ 33,856\\ 33,557\\ \end{array}$	0.77 57 23 <u>P-CN</u> <u>Time</u> 2.84 0.21 0.01 160.12 182.52 6.56	36,70 8 0.8 0.8 7 55,693 57,187 27,686 29,692 33,736 33,276	8.20 39 39 RN Time 0.92 1.60 0.02 0.20 12.59 32.04	$\begin{array}{c} 37,17\\ 1\\ 2.3\\ 2.3\\ \hline \\ C_{\rm max}\\ 57,900\\ 57,634\\ 28,772\\ \textbf{29,692}\\ 35,577\\ 33,892 \end{array}$	7.60 38 38 38 CN Time 0.02 0.18 0.00 0.05 0.01 0.09	36,57 16 0.5 1.5 <i>C</i> <sub>max</sub> 55,128 57,187 27,686 29,692 33,736 33,892	79.13         6           559         53           A         10.48           0.73         10.48           0.47         0.49           0.90         0.78
$\begin{tabular}{ c c c c c }\hline \hline $C_{\rm max}$ & $\# best$ \\ $gap(\%)$ & $gap(\%)$ \\ \hline $instance$ & $$instance$ & $$in$	37,38 5,128 55,128 57,187 27,686 29,692 33,736 33,276 33,276	88.93 558 31 RN 1.60 1.20 0.03 0.29 2.48 35.79 91.58 0.35	37,43 2.2 3. 55,128 57,187 27,686 29,692 33,736 33,276 33,276 33,271 28,192	33.93 2 71 17 .CN 1.29 2.25 0.03 1.66 3.45 111.43 82.50 0.62	38,37 (5.5, 6.( GRAS <i>C</i> max 55,458 59,000 <b>27,686</b> <b>29,692</b> 34,430 33,557 33,352 28,597	76.03 ) 26 04 3P-RN Time 0.18 0.32 0.00 23.14 2.41 23.84 30.98 0.07	38,50 C GRAS Cmax 56,790 58,470 27,686 33,683 33,557 33,059 28,355	0.77 57 23 P-CN 2.84 0.21 160.12 182.52 6.56 126.97 0.14	36,70 8 0.8 0.8 0.8 0.8 55,693 57,187 27,686 29,692 33,786 33,276 33,276 33,092 28,192	8.20 39 89 RN Time 0.92 1.60 0.02 0.20 12.59 32.04 4.76 0.09	37,17 1 2.; <u>Cmax</u> 57,900 57,634 28,772 29,692 35,577 33,892 33,317 28,638	7.60 38 38 7 7 7 8 8 7 7 7 8 8 8 8 8 7 7 8 8 8 8	36,57 14 0.5 25,128 55,128 57,187 27,686 29,692 33,792 33,092 33,092 28,192	79.13         6           59         53           A         Time           0.73         10.48           0.47         0.49           0.90         0.78           0.55         0.82
$\begin{tabular}{ c c c c c }\hline \hline $C_{\rm max}$ \\ $\# best$ \\ $gap(\%)$ \\ \hline $gap(\%)$ \\ \hline $instance$ \\ \hline $YFJS01$ \\ $YFJS02$ \\ $YFJS03$ \\ $YFJS04$ \\ $YFJS04$ \\ $YFJS05$ \\ $YFJS06$ \\ $YFJS06$ \\ $YFJS07$ \\ $YFJS08$ \\ $YFJS09$ \\ \hline $YFJS09$ \\ \hline \end{tabular}$	37,38 2.9 3.3 55,128 57,187 27,686 29,692 33,736 33,276 33,276 33,276 33,271	88.93 58.93 58 31 Time 1.60 1.20 0.03 0.29 2.48 35.79 91.58 0.35 3.69	37,43 2.2 3. Cmax 55,128 57,187 27,686 29,692 33,736 33,276 33,276 33,276 28,192 20,077	33.93 2 71 17 •CN Time 1.29 2.25 0.03 1.66 3.45 111.43 82.50 0.62 2.38	38,37 (5.5. 6.( GRAS <i>C</i> max 55,458 59,000 <b>27,686</b> <b>29,692</b> 34,430 33,557 33,352 28,597 <b>20,077</b>	76.03 ) 26 04 Time 0.18 0.32 0.00 23.14 2.41 23.84 30.98 0.07 33.66	38,50 C 5.3 6.2 C max 56,790 58,470 <b>27,686</b> 30,683 33,856 33,855 <b>28,355</b> <b>20,077</b>	0.77 77 23 P-CN Time 2.84 0.21 0.01 160.12 182.52 6.56 126.59 0.14 22.83	36,70 8 0.8 0.8 0.8 0.8 0.8 0.8 0.8 0.8 0.8	8.20 39 39 RN Time 0.92 1.60 0.02 0.20 12.59 32.04 4.76 0.09 9.58	37,17 1 2.5 Cmax 57,900 57,634 28,772 29,692 33,872 28,638 20,077	7.60 38 38 Time 0.02 0.18 0.00 0.05 0.01 0.09 0.01 0.00 0.00 0.23	36,57 14 0.5 27 35,128 57,187 27,686 29,692 33,736 33,892 33,736 33,892 28,192 20,121	79.13         6           59         53           A         Time           0.73         10.48           0.47         0.49           0.90         0.78           0.55         0.82           165.05         0.82
$\begin{tabular}{ c c c c c }\hline \hline $C_{\rm max}$ & $\# best$ \\ $gap(\%)$ \\ \hline $gap(\%)$ \\ \hline $instance$ \\ \hline $YFJS01$ \\ $YFJS02$ \\ $YFJS03$ \\ $YFJS04$ \\ $YFJS05$ \\ $YFJS05$ \\ $YFJS06$ \\ $YFJS07$ \\ $YFJS08$ \\ $YFJS09$ \\ $YFJS10$ \\ \hline YFJS10$ \\ \hline$	37,38 5 2.8 3.3 55,128 55,128 55,128 57,187 27,686 29,692 33,736 33,276 33,011 28,192 20,077 31,559	88.93 55 58 31 Time 1.60 1.20 0.03 0.29 2.48 35.79 91.58 0.35 3.69 33.20	37,43 2. 3. 55,128 57,187 27,682 29,692 33,736 33,276 33,276 33,276 33,277 31,559	33.93 2 71 17 CN Time 1.29 2.25 0.03 1.66 3.45 111.43 82.50 0.62 2.38 119.22	38,37 (5.5.3) GRAS C <sub>max</sub> 55,458 59,000 <b>27,686</b> <b>29,692</b> 34,430 33,557 33,352 28,597 <b>20,077</b> 32,582	76.03 ) 26 04 3P-RN Time 0.18 0.32 0.00 23.14 2.41 23.84 30.98 0.07 33.66 0.72	38,50 0 5.5. 6.2 GRAS C <sub>max</sub> 56,790 58,470 <b>27,686</b> 30,683 33,856 33,856 33,557 33,059 28,355 <b>20,077</b> 32,159	$\begin{array}{c} 0.77 \\ \hline \\ 57 \\ 23 \\ \hline \\ \hline \\ \hline \\ \hline \\ \hline \\ 2.84 \\ 0.21 \\ 0.01 \\ 160.12 \\ 182.52 \\ 6.56 \\ 126.97 \\ 0.14 \\ 22.83 \\ 0.57 \\ \end{array}$	36,70 8 0.8 7 55,693 57,187 27,686 29,692 33,736 33,276 33,092 28,192 20,077 31,998	8.20 39 39 Time 0.92 1.60 0.02 0.20 12.59 32.04 4.76 0.09 9.58 0.77	37,17 1 2.; TS- C <sub>max</sub> 57,900 57,634 28,772 29,692 35,577 33,892 33,317 28,638 20,077 33,111	7.60 38 38 Time 0.02 0.18 0.00 0.05 0.01 0.09 0.01 0.09 0.01 0.09 0.01 0.09 0.01 0.00 0.02 0.00 0.02 0.00 0.02 0.00 0.02 0.00 0.02 0.00	36,57 10 0.5 1.5 27,686 55,128 55,128 55,128 57,187 27,686 29,692 33,736 33,892 33,092 28,192 20,121 31,559	$\begin{array}{c} 9.13 \\ 6 \\ 59 \\ 53 \\ \hline \\ $
$\begin{tabular}{ c c c c c }\hline \hline $C_{\rm max}$ & $\# best$ \\ $gap(\%)$ & $gap(\%)$ \\ \hline $instance$ & $	37,38 2.3 3.3 ILS- <i>C</i> <sub>max</sub> <b>55,128</b> <b>57,187</b> <b>27,686</b> <b>29,692</b> <b>33,736</b> <b>33,276</b> <b>33,276</b> <b>33,011</b> <b>28,192</b> <b>20,077</b> <b>31,559</b> <b>40,204</b>	88.93 558 31 Time 1.60 1.20 0.03 0.29 2.48 35.79 91.58 0.35 3.69 33.20 102.14	37,43 2.2 3. 55,128 57,187 27,686 29,692 33,736 33,276 33,011 28,192 20,077 31,559 40,103	33.93 2 71 17 CCN 1.29 2.25 0.03 1.66 3.45 111.43 82.50 0.62 2.38 119.22 105.15	38,37 (5.5.3) GRAS C <sub>max</sub> 55,458 59,080 <b>27,686</b> <b>29,692</b> 34,430 33,557 33,352 28,597 <b>20,077</b> 32,582 41,079	76.03 ) 26 39-RN Time 0.18 0.32 0.00 23.14 2.41 23.84 30.98 0.07 33.66 0.72 136.76	$\begin{array}{c} 38,50\\ 0\\ 5.5\\ 6.2\\ \hline \\ 6.2\\ \hline \\ 6.3\\ \hline \\ 6.4\\ \hline \\ 6.5\\ \hline \\ 6.5\\ \hline \\ 7.6\\ \hline \\ 8.470\\ \hline \\ 58,470\\ \hline \\ 58,470\\ \hline \\ 58,470\\ \hline \\ 30,683\\ \hline \\ 33,856\\ \hline \\ 33,856\\ \hline \\ 33,855\\ \hline \\ 20,077\\ \hline \\ 32,159\\ \hline \\ 40,619\\ \end{array}$	$\begin{array}{c} 0.77 \\ \hline \\ 57 \\ 23 \\ \hline \\ \hline \\ \hline \\ 2.84 \\ 0.21 \\ 0.01 \\ 160.12 \\ 182.52 \\ 6.56 \\ 126.97 \\ 0.14 \\ 22.83 \\ 0.57 \\ 20.45 \\ \end{array}$	36,70 8 0.8 7 55,693 57,187 27,686 29,692 33,736 33,276 33,092 28,192 20,077 31,998 40,350	8.20 	37,17 1 2.; 2.; TS <u>C<sub>max</sub></u> 57,900 57,634 28,772 <b>29,692</b> 33,577 33,892 33,317 28,638 <b>20,077</b> 33,111 41,547	7.60 38 38 CN Time 0.02 0.18 0.00 0.01 0.00 0.01 0.00 0.00 0.00 0.00	36,57 14 0.5 14 0.5 14 0.5 15 15 128 55,128 55,128 57,187 27,686 29,692 33,736 33,892 33,092 28,192 20,121 31,529 40,319 40,319	$\begin{array}{c} 9.13 \\ 6 \\ 59 \\ 53 \\ \hline \\ $
$\begin{tabular}{ c c c c c }\hline \hline $C_{\rm max}$ & $\# best$ \\ $gap(\%)$ & $gap(\%)$ \\ \hline $instance$ & $$instance$ & $$in$	37,38 2.3 3.3 3.3 55,128 57,187 27,686 29,692 33,736 33,276 33,011 28,192 20,077 31,559 40,204 38,003	88.93 558 31 Time 1.60 1.20 0.03 0.248 35.79 91.58 0.35 3.69 33.20 102.14 173.04	37,43 2.2 3. 55,128 57,187 27,686 29,692 33,736 33,276 33,011 28,192 20,077 31,559 40,103 38,003	33.93 2 71 17 CCN 1.29 2.25 0.03 1.66 3.45 111.43 82.50 0.62 2.38 119.22 105.15 154.12	38,37           (1)           GRAS           Cmax           55,458           59,000           27,686           29,692           34,430           33,557           33,352           28,597           20,677           32,582           41,079           39,993	76.03 26 26 27 27 28 29 29 20 20 20 20 20 20 20 20 20 20	38,50           0           5.6,790           56,790           58,470           27,686           33,856           33,855           20,077           32,159           40,619           38,618	$\begin{array}{c} 0.77 \\ \hline 0.77 \\ \hline 23 \\ \hline \\ \hline P-CN \\ \hline 2.84 \\ \hline 0.21 \\ 0.01 \\ 160.12 \\ 182.52 \\ 6.56 \\ 126.97 \\ 0.14 \\ 22.83 \\ 0.57 \\ 20.45 \\ 35.05 \\ \end{array}$	36,70 8 0.8 7 55,693 57,187 27,686 29,692 33,736 33,276 33,922 28,192 20,077 31,998 40,350 38,392	8.20 	37,17           1           2.;           TS-           57,900           57,634           28,672           29,692           33,317           28,638           20,077           33,117           41,547           41,620	7.60 38 38 CN Time 0.02 0.18 0.00 0.01 0.00 0.01 0.00 0.23 0.00 0.00 0.00 0.02	36,57 14 0.5 27 35,128 55,128 57,187 27,686 29,692 33,786 33,892 20,121 31,559 40,319 38,392 20,121 31,559 40,319 38,392 20,121 31,559 40,319 38,392 28,192 20,121 31,559 40,319 38,392 28,192 20,121 31,559 40,319 38,392 28,192 20,121 31,559 40,319 38,392 28,192 20,121 31,559 40,319 38,892 20,121 31,559 40,319 30,874 79,486 30,874 79,486 30,874 30	9.13         6           59         53           A         Time           0.73         10.48           0.47         0.49           0.90         0.78           0.55         0.82           165.05         74.40           2.58         103.93
$\begin{tabular}{ c c c c c }\hline\hline $C_{\rm max}$ & $\# best$ \\ $gap(\%)$ & $gap(\%)$ \\\hline\hline $instance$ & $instance$ \\\hline $YFJS01$ & $YFJS02$ \\ $YFJS03$ & $YFJS04$ \\ $YFJS04$ & $YFJS05$ \\ $YFJS06$ & $YFJS06$ \\ $YFJS10$ & $YFJS11$ \\ $YFJS12$ & $YFJS13$ \\ $YFJS15$ \\\hline \end{tabular}$	37,38 5 2.8 3.3 55,128 55,128 57,187 27,686 29,692 33,736 33,011 28,192 20,077 31,559 40,204 38,003 30,711 79,051 79,374	RN           Time           1.60           1.20           0.03           0.29           2.48           35.79           91.58           0.32.0           102.14           173.04           88.73           186.80           139.96	$\begin{array}{c} 37,43\\ 2\\ 2.\\ 3\\ .\\ .\\ .\\ .\\ .\\ .\\ .\\ .\\ .\\ .\\ .\\ .\\ .\\$	33.93 2 71 17 CN 1.29 2.25 0.03 1.66 3.45 111.43 82.50 0.62 2.38 119.22 105.15 154.12 89.29 200.32 198.52	38,37 (5.5.3) 55,458 55,458 59,000 <b>27,686</b> <b>29,692</b> 34,430 33,557 33,352 28,597 <b>20,077</b> 32,582 41,079 39,993 31,823 81,558 84,181	76.03 ) 26 04 3P-RN Time 0.18 0.32 0.00 23.14 2.41 23.84 30.98 0.07 33.66 0.72 136.76 21.82 1.59 137.18 133.33	38,50 0 5.5 6.2 0 0 0 0 0 0 0 0 0 0 0 0 0	$\begin{array}{c} 0.77 \\ \hline 0.77 \\ \hline 23 \\ \hline \\ \hline \\ \hline \\ 2.84 \\ 0.21 \\ 0.01 \\ 160.12 \\ 182.52 \\ 6.56 \\ 126.97 \\ 0.14 \\ 22.83 \\ 0.57 \\ 20.45 \\ 35.05 \\ 55.89 \\ 176.28 \\ 230.45 \\ \end{array}$	36,70 8 0.8 0.8 0.8 0.8 0.8 0.8 0.8 0.8 0.8	8.20 39 89 RN Time 0.92 1.60 0.02 12.59 32.04 4.76 0.09 9.58 0.77 6.53 268.63 180.10 142.02 191.45	37,17 1 2.; TS- Cmax 57,900 57,634 28,752 29,692 35,577 33,892 33,317 28,638 20,077 33,111 41,547 41,620 33,449 83,816 87,555	7.60 38 38 CN Time 0.02 0.18 0.00 0.05 0.01 0.09 0.01 0.09 0.01 0.09 0.01 0.09 0.01 0.09 0.01 0.02 0.01 0.09 0.01 0.02 0.01 0.09 0.01 0.02 0.01 0.09 0.01 0.02 0.01 0.09 0.01 0.00 0.01	36,57 14 0.3 14 0.5 14 0.5 15 15 18 55,128 55,128 55,128 55,128 55,128 57,187 27,686 29,692 29,692 29,692 20,121 31,559 40,319 38,392 30,874 79,486 78,545	$\begin{array}{c} 9.13 \\ 6 \\ 59 \\ 53 \\ \hline \\ $
$\begin{tabular}{ c c c c c }\hline\hline $C_{\rm max}$ & \# best \\ $gap(\%)$ & $gap(\%)$ & $gap(\%)$ & $$instance$ & $$instance$ & $$instance$ & $$instance$ & $$instance$ & $$YFJS01$ & $YFJS02$ & $YFJS02$ & $YFJS03$ & $YFJS04$ & $YFJS06$ & $YFJS10$ & $YFJS11$ & $YFJS12$ & $YFJS14$ & $YFJS15$ & $YFJS16$ & $YFFTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTT$	37,38 2.2 3.3 3.3 55,128 57,187 27,686 29,692 20,077 33,736 33,276 33,736 33,276 33,011 28,192 20,072 31,559 40,204 38,003 30,711 79,374 78,426	88.93         5           558         31           Time           1.60         1.20           0.03         0.29           2.48         35.79           91.58         0.35           3.69         33.20           102.14         173.04           139.96         106.57	37,43 2.2 3. 55,128 57,187 27,686 29,692 20,077 33,736 33,276 33,011 28,192 20,077 31,559 40,103 38,003 38,003 30,711 79,386 78,660 78,333	33.93 2 71 17 CN Time 1.29 2.25 0.03 1.66 3.45 111.43 82.50 0.62 2.38 119.22 105.15 154.12 89.29 200.32 198.52	38,37           (1)           GRAS           Cmax           55,458           59,000           27,686           29,692           28,597           20,077           20,077           32,582           41,079           39,993           31,823           81,558           84,181           83,753	76.03 26 26 27 27 28 29 29 20 20 20 20 20 20 20 20 20 20	38,50           0           5.5.           6.2           6.3           56,790           58,470 <b>27,686</b> 30,683           33,856           33,855 <b>33,557</b> 33,059 <b>28,355 20,077</b> 32,159           40,619           38,618           31,518           84,481           84,227           85,453	$\begin{array}{c} 0.77\\ 0.77\\ 23\\ \hline \\ 2.84\\ 0.21\\ 0.01\\ 160.12\\ 6.56\\ 126.97\\ 0.14\\ 22.83\\ 0.57\\ 20.45\\ 35.05\\ 55.89\\ 176.28\\ 230.45\\ 230.45\\ 230.45\\ 230.45\\ 230.41\\ \end{array}$	36,70 8 0.8 0.8 0.8 0.8 0.8 0.8 0.8	8.20 39 89 RN Time 0.92 1.60 0.02 0.20 12.59 32.04 4.76 0.09 9.58 0.77 6.53 268.63 180.10 142.02 191.45 112.32	$\begin{array}{c} 37,17\\ 1\\ 2.5\\ \hline \\ C_{max} \end{array}$	7.60 38 38 CN Time 0.02 0.18 0.00 0.01 0.00 0.01 0.00 0.01 0.00 0.01 0.00 0.01 0.00 0.02 0.01 0.02 0.01 0.02 0.01 0.02 0.01 0.02 0.01 0.02 0.01 0.02 0.01 0.02 0.01 0.02 0.01 0.00 0.02 0.01 0.00 0.02 0.01 0.00 0.02 0.01 0.00 0.02 0.01 0.00 0.01 0.00 0.00 0.01 0.00 0.00 0.01 0.00 0.00 0.01 0.00 0.00 0.01 0.00 0.00 0.01 0.00 0.00 0.01 0.00 0.00 0.00 0.01 0.00 0.01 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.01 0.00 0.00 0.01 0.00 0.00 0.01 0.00 0.01 0.01 0.00 0.01 0.00 0.01 0.01 0.01 0.00 0.01 0.01 0.01 0.01 0.00 0.01 0.01 0.01 0.01 0.01 0.00 0.01 0.00 0.01 0.01 0.01 0.01 0.00 0.01 0.00 0.01 0.01 0.01 0.01 0.00 0.01	36,57 14 0.3 55,128 57,187 27,686 29,692 20,121 33,736 33,892 33,092 28,192 20,121 31,559 40,319 38,392 30,874 78,545 78,004	$\begin{array}{c} 9.13 \\ 6 \\ 59 \\ 53 \\ \hline \\ $
$\begin{tabular}{ c c c c c }\hline\hline $C_{\rm max}$ & \# best \\ $gap(\%)$ & $gap(\%)$ & $gap(\%)$ & $instance$ & $VFJS01$ & $YFJS02$ & $YFJS02$ & $YFJS02$ & $YFJS03$ & $YFJS04$ & $YFJS05$ & $YFJS06$ & $YFJS06$ & $YFJS07$ & $YFJS06$ & $YFJS07$ & $YFJS06$ & $YFJS07$ & $YFJS11$ & $YFJS12$ & $YFJS11$ & $YFJS12$ & $YFJS13$ & $YFJS14$ & $YFJS15$ & $YFJS16$ & $YFJS17$ & $YFJS17$ & $YFJS16$ & $YFJS17$ & $YFJS16$ & $YFJS17$ & $YFJS17$$	37,38 2.3 3.3 3.3 55,128 57,187 27,686 29,692 20,077 33,736 33,276 33,011 28,192 20,077 31,559 40,204 38,003 30,711 79,374 40,204 38,003 30,711 79,374 40,204 38,003 30,711 79,374 66,188	88.93         5           558         31           RN           1.60         1.20           0.03         0.29           2.48         35.79           91.58         0.35           3.69         3.320           102.14         173.04           139.96         139.96           106.57         295.79	37,43 2.2 3. 55,128 57,187 27,686 29,692 33,736 33,276 33,011 28,192 20,077 31,559 40,103 38,003 30,711 79,386 78,660 78,333 66,029	33.93 2 71 17 CCN 1.29 2.25 0.03 1.66 3.45 111.43 82.50 0.62 2.38 119.22 105.15 154.12 89.29 200.32 198.20 82.47	38,37 (5.5) 5.5,458 59,000 <b>27,686</b> <b>29,692</b> 34,430 33,557 33,352 28,597 <b>20,072</b> 41,079 39,993 31,823 81,558 84,181 83,753 73,682	76.03 76.03 26 26 27 28 29 29 20 20 20 20 20 20 20 20 20 20	38,50           0           5.5.           6.3           56,790           58,470           27,686           33,856           33,855           20,077           32,159           38,618           31,518           84,481           84,277           73,682	$\begin{array}{c} 0.77\\ 0.77\\ 23\\ \hline \\ \hline$	36,70 8 0.8 0.8 0.8 0.8 0.8 0.8 0.8	8.20 	$\begin{array}{c} 37,17\\ 1\\ 2.5\\ \hline \\ C_{max} \end{array}$	7.60 38 38 CN Time 0.02 0.18 0.00 0.00 0.01 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.01 0.00 0.00 0.00 0.01 0.00	36,57 14 0.5 55,128 55,128 57,187 27,686 29,692 33,736 33,892 33,092 28,192 20,121 31,559 40,319 38,392 30,874 79,486 78,504 66,388	$\begin{array}{c} 9.13\\ 6\\ 59\\ 53\\ \hline \\ \hline$
$\begin{tabular}{ c c c c c } \hline $C_{\max}$ \\ $\#best$ \\ $gap(\%)$ \\ \hline $gap(\%)$ \\ \hline $instance$ \\ \hline $YFJS01$ \\ $YFJS02$ \\ $YFJS02$ \\ $YFJS02$ \\ $YFJS04$ \\ $YFJS05$ \\ $YFJS04$ \\ $YFJS05$ \\ $YFJS06$ \\ $YFJS06$ \\ $YFJS06$ \\ $YFJS06$ \\ $YFJS06$ \\ $YFJS07$ \\ $YFJS08$ \\ $YFJS08$ \\ $YFJS08$ \\ $YFJS08$ \\ $YFJS08$ \\ $YFJS10$ \\ $YFJS11$ \\ $YFJS12$ \\ $YFJS14$ \\ $YFJS16$ \\ $YFJS16$ \\ $YFJS18$ \\ \hline YFJS18$ $	37,38 55,128 55,128 57,187 27,686 29,692 33,736 33,276 33,276 33,011 28,192 20,077 31,559 40,204 38,003 30,711 79,051 79,374 78,426 66,188 73,732	88.93         5           558         31           RN           1.60         1.20           0.03         0.29           2.48         35.79           91.58         0.35           3.69         33.20           102.14         173.04           88.73         186.80           139.96         109.57           295.79         298.52	37,43 2.2 3. 55,128 57,187 27,686 29,692 33,736 33,276 33,276 33,276 33,011 28,192 20,077 31,559 40,103 38,003 30,711 79,386 78,333 30,711 79,386 66,029 71,791	33.93 2 71 17 CCN Time 1.29 2.25 0.03 1.66 3.45 111.43 82.50 0.62 2.38 119.22 105.15 154.12 89.29 200.32 198.52 198.52 198.52 198.52 198.52 198.52	38,37           (1)           GRAS           Cmax           55,458           59,000           27,686           29,692           34,430           33,557           33,352           28,597           20,077           32,582           41,079           39,993           31,823           81,558           84,181           83,557           73,682           80,279	76.03         76.03           26         26           04         77.00           3P-RN         1100           0.18         0.32           0.00         23.14           23.84         30.98           0.07         33.66           0.72         136.76           21.82         1.59           137.18         133.33           2.48         0.00           246.11         1100	38,50           0           5.5.           6.2.           6.3.           56,790           58,470           27,686           30,683           33,856           20,077           32,159           40,619           38,618           31,518           84,481           84,277           73,682           82,201	0.77 77 23 P-CN Time 2.84 0.21 0.01 160.12 182.52 6.56 126.97 0.14 22.83 0.57 20.45 35.05 55.89 176.28 230.45 284.11 0.00 17.58	36,70 8 0.8 0.8 0.8 0.8 0.8 0.8 0.8 0.8 0.8	8.20 39 89 RN Time 0.92 1.60 0.02 0.20 12.59 32.04 4.76 0.09 9.58 0.77 6.53 268.63 180.10 142.02 191.45 112.32 275.82 298.20	$\begin{array}{r} 37,17\\ 1\\ 2.5\\ \hline \\ C_{max} \end{array}$	$\begin{array}{c} 7.60 \\ \hline 7.60 \\ \hline 88 \\ \hline 88 \\ \hline \hline 0.02 \\ 0.18 \\ 0.00 \\ 0.05 \\ 0.01 \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.0$	36,57 14 0.5 55,128 55,128 57,187 27,686 29,692 33,736 33,892 33,092 20,121 31,559 40,319 38,392 30,874 79,486 78,504 78,504 78,504 78,0078	$\begin{array}{c} 9.13\\ 6\\ 59\\ 53\\ \hline \\ \hline$
$\begin{tabular}{ c c c c c }\hline\hline $C_{\max}$ \\ $\#best$ \\ $gap(\%)$ \\ \hline $gap(\%)$ \\ \hline $gap(\%)$ \\ \hline $instance$ \\ \hline $YFJS01$ \\ $YFJS02$ \\ $YFJS02$ \\ $YFJS03$ \\ $YFJS04$ \\ $YFJS05$ \\ $YFJS05$ \\ $YFJS05$ \\ $YFJS06$ \\ $YFJS06$ \\ $YFJS06$ \\ $YFJS06$ \\ $YFJS06$ \\ $YFJS10$ \\ $YFJS10$ \\ $YFJS10$ \\ $YFJS12$ \\ $YFJS14$ \\ $YFJS15$ \\ $YFJS15$ \\ $YFJS16$ \\ $YFJS17$ \\ $YFJS18$ \\ $YFJS19$ \\ \hline end{tabular}$	37,38 5 2.2 3.3 ILS- C <sub>max</sub> 55,128 57,187 27,686 33,276 33,011 28,192 20,077 31,559 40,204 38,003 30,711 79,051 79,374 78,426 66,188 73,732 61,283	88.93         5           58         58           58         58           58         58           58         58           58         58           58         58           58         58           58         58           58         58           58         58           58         1.20           0.03         0.29           2.48         35.79           91.58         0.35           3.69         33.20           102.14         173.04           88.73         186.80           139.96         106.57           295.79         298.52           149.66         106	37,43 2. 3. 55,128 55,128 55,128 57,187 27,686 33,276 33,276 33,276 33,276 33,276 33,276 33,011 28,192 20,077 31,559 40,103 38,003 30,711 79,386 78,333 66,029 71,791 58,933	33.93 2 71 17 CN Time 1.29 2.25 0.03 1.66 3.45 111.43 82.50 0.62 2.38 119.22 105.15 154.12 89.29 200.32 198.53 105.15 105.15 105.15 105.15 105.15 105.15 105.25 10	38,37           (1)           GRAS           Cmax           55,458           59,000 <b>27,686</b> 29,692           34,430           33,557           28,597           20,077           32,582           41,079           39,993           31,823           81,558           84,181           83,753           73,682           80,279           70,115	76.03 26 26 26 27 27 28 29 29 20 20 20 20 20 20 20 20 20 20	38,50           0           5.5.           6.2           GRAS           Cmax           56,790           58,470           27,686           30,683           33,856           33,557           33,055           20,077           32,159           40,619           38,618           31,518           84,481           84,481           84,4277           85,453           73,682           82,201           68,545	$\begin{array}{c} 0.77\\ 0.77\\ 23\\ \hline \\ \hline$	36,70 8 0.8 0.8 0.8 0.8 0.8 0.8 0.8 0.8 0.8	8.20 	$\begin{array}{c} 37,17\\ 1\\ 2.;\\ \hline \\ C_{max} \\ 57,900\\ 57,634\\ 28,772\\ 29,692\\ 35,577\\ 33,892\\ 35,577\\ 33,892\\ 33,317\\ 28,638\\ 20,077\\ 33,111\\ 41,547\\ 41,620\\ 33,449\\ 83,816\\ 87,555\\ 83,317\\ 71,161\\ 77,670\\ 61,788\\ \end{array}$	$\begin{array}{c} 7.60 \\ \hline 7.60 \\ \hline 88 \\ \hline 88 \\ \hline \\ \hline \\ \hline \\ \hline \\ \hline \\ \hline \\$	36,57 14 0.5 55,128 55,128 57,187 27,686 29,692 33,736 33,892 33,092 28,192 20,121 31,559 40,319 38,392 30,874 79,486 78,545 78,004 66,388 59,633	$\begin{array}{c} 9.13\\ 6\\ 59\\ 53\\ \hline \\ \hline$
$\begin{tabular}{ c c c c c }\hline\hline $C_{\rm max}$ & $\# best$ \\ $gap(\%)$ & $gap(\%)$ \\\hline\hline $instance$ & $$instance$ & $$instance$ \\\hline\hline $YFJS01$ & $$YFJS02$ & $$YFJS03$ & $$YFJS03$ & $$YFJS04$ & $$YFJS05$ & $$YFJS06$ & $$YFJS06$ & $$YFJS06$ & $$YFJS06$ & $$YFJS06$ & $$YFJS07$ & $$YFJS08$ & $$YFJS10$ & $$YFJS10$ & $$YFJS11$ & $$YFJS12$ & $$YFJS14$ & $$YFJS15$ & $$YFJS16$ & $$YFJS20$ & $$YFJS20$ & $$YFJS20$ & $YFJS20$ & $YFJS20$$	37,38 5 2.3 3.3 55,128 57,187 27,686 33,276 33,276 33,276 33,276 33,276 33,276 33,011 28,192 20,077 31,559 40,204 30,711 79,374 78,426 66,188 73,732 36,283 60,960	88.93         38.93         55           558         31         Time           1.60         1.20         0.03           0.29         2.48         35.79           91.58         0.35         3.69           33.20         102.14         173.04           186.80         139.96         106.57           298.52         149.66         148.73	$\begin{array}{c} 37,43\\ 2\\ 2.3\\ 3.\\ \hline \\ C_{max}\\ 55,128\\ 57,187\\ 27,686\\ 33,736\\ 33,276\\ 33,276\\ 33,276\\ 33,011\\ 28,192\\ 20,077\\ 31,559\\ 40,103\\ 30,711\\ 79,386\\ 78,660\\ 78,333\\ 30,711\\ 79,386\\ 78,660\\ 78,333\\ 30,711\\ 79,385\\ 78,660\\ 78,333\\ 59,846\\ \end{array}$	33.93 2 71 17 CN Time 1.29 2.25 0.03 1.66 3.45 111.43 82.50 0.62 2.38 119.22 105.15 154.12 89.29 200.32 198.55 198.52 198.52 198.55 19	38,37 (5.5.3) 55,458 59,000 <b>27,686</b> <b>29,692</b> 34,430 33,557 <b>33,352</b> 28,597 <b>20,077</b> <b>32,582</b> 41,079 <b>33,1823</b> 81,558 <b>41,079</b> <b>31,823</b> 81,558 <b>41,079</b> <b>31,823</b> 81,558 <b>41,079</b> <b>31,823</b> 81,558 <b>41,079</b> <b>31,823</b> 81,558 <b>41,079</b> <b>31,823</b> 81,558 <b>41,079</b> <b>31,823</b> 81,558 <b>41,079</b> <b>31,823</b> 81,558 <b>41,079</b> <b>31,823</b> 81,558 <b>41,079</b> <b>31,823</b> 81,558 <b>41,079</b> <b>31,823</b> 81,558 <b>41,079</b> <b>31,823</b> 81,558 <b>41,079</b> <b>31,823</b> 81,558 <b>41,079</b> <b>31,823</b> <b>81,558</b> <b>41,079</b> <b>31,823</b> <b>81,557</b> <b>31,823</b> <b>31,823</b> <b>31,823</b> <b>31,823</b> <b>31,825</b> <b>41,079</b> <b>31,823</b> <b>81,556</b> <b>41,079</b> <b>31,823</b> <b>81,557</b> <b>33,557</b> <b>33,557</b> <b>33,557</b> <b>33,557</b> <b>33,557</b> <b>33,557</b> <b>33,557</b> <b>33,557</b> <b>33,557</b> <b>33,557</b> <b>33,557</b> <b>33,557</b> <b>33,557</b> <b>33,557</b> <b>33,557</b> <b>33,557</b> <b>33,557</b> <b>33,557</b> <b>33,557</b> <b>33,557</b> <b>33,557</b> <b>33,557</b> <b>33,557</b> <b>33,557</b> <b>33,557</b> <b>33,557</b> <b>33,557</b> <b>33,557</b> <b>33,557</b> <b>33,557</b> <b>33,557</b> <b>33,557</b> <b>33,557</b> <b>33,557</b> <b>33,557</b> <b>33,557</b> <b>33,557</b> <b>33,557</b> <b>34,558</b> <b>41,079</b> <b>35,558</b> <b>41,079</b> <b>36,993</b> <b>31,823</b> <b>80,279</b> <b>70,115</b> <b>60,963</b>	76.03 76.03 26 26 26 27 28 29 29 20 39 20 20 23.14 2.41 23.84 30.98 0.07 23.14 2.41 23.84 30.98 0.07 136.76 21.82 1.59 137.18 133.33 2.48 0.00 246.11 118.17 197.07	38,50           0           5.1           6.2           6.3           56,790           58,470 <b>27,686</b> 30,683           33,856           33,557           33,059           28,355 <b>20,077</b> 32,159           40,619           38,618           31,518           84,481           84,277           85,453           73,682           82,201           68,545           71,916	$\begin{array}{c} 0.77\\ 0.77\\ 23\\ \hline \\ \hline \\ \hline \\ \hline \\ 2.84\\ 0.21\\ 0.01\\ 160.12\\ 182.52\\ 6.56\\ 126.97\\ 0.14\\ 22.83\\ 0.57\\ 20.45\\ 35.05\\ 55.89\\ 176.28\\ 230.45\\ 284.11\\ 0.00\\ 17.58\\ 185.31\\ 244.37\\ \end{array}$	36,70 8 0.8 0.8 0.8 0.8 0.8 0.8 0.8	8.20 8.99 8.99 Time 0.92 1.60 0.02 12.59 32.04 4.76 0.09 9.58 0.77 6.53 268.63 180.10 142.02 191.45 112.32 275.82 298.20 297.73 237.53	$\begin{array}{c} 37,17\\ 1\\ 2.5\\ \hline \\ C_{max} \end{array}$	$\begin{array}{c} 7.60 \\ \hline \\ 88 \\ \hline \\ $	36,57 10 11 11 11 11 11 11 11 11 11	$\begin{array}{c} 9.13\\ 6\\ 59\\ 59\\ 53\\ \hline \\ \hline$
$\begin{tabular}{ c c c c c } \hline $C_{\rm max}$ & $\# best$ \\ $gap(\%)$ & $gap(\%)$ \\ \hline $gap(\%)$ & $$instance$ \\ \hline $YFJS01$ & $YFJS02$ \\ $YFJS02$ & $YFJS03$ \\ $YFJS02$ & $YFJS03$ \\ $YFJS04$ & $YFJS05$ \\ $YFJS06$ & $YFJS06$ \\ $YFJS06$ & $YFJS06$ \\ $YFJS07$ & $YFJS06$ \\ $YFJS07$ & $YFJS06$ \\ $YFJS07$ & $YFJS06$ \\ $YFJS10$ & $YFJS12$ \\ $YFJS12$ & $YFJS12$ \\ $YFJS15$ & $YFJS16$ \\ $YFJS16$ & $YFJS16$ \\ $YFJS17$ & $YFJS16$ \\ $YFJS16$ & $YFJS16$ \\ $YFJS17$ & $YFJS16$ \\ $YFJS17$ & $YFJS16$ \\ $YFJS16$ & $YFJS16$ \\ $YFJS20$ & $Zmax$ \\ \hlineend{tabular}$	37,38 2.2 3.3 3.3 55,128 57,187 27,686 29,692 20,077 33,736 33,276 33,011 28,192 20,077 31,559 40,204 38,003 30,711 79,374 78,426 66,188 73,732 61,283 60,960 47,87	88.93         38.93         55           558         31         Time           1.60         1.20         0.03         0.29           2.48         35.79         91.58         0.35         3.69           3.63         3.69         102.14         173.04         88.73         186.80         139.96         106.57         295.79         298.52         149.66         148.73         73.80         73.80	$\begin{array}{c} 37,43\\ 2\\ 2.3\\ 3.\\ \hline \\ \\ \hline \\ \hline \\ \hline \\ \\ \hline \\ \hline \\ \\ \hline \\ \\ \hline \\ \hline \\ \hline \\ \\ \hline \hline \\ \hline \\ \hline \\ \hline \hline \hline \\ \hline \hline \hline \hline \\ \hline \hline \hline \\ \hline \hline \hline \hline \\ \hline \hline$	33.93 2 71 17 CN Time 1.29 2.25 0.03 1.66 3.45 111.43 82.50 0.62 2.38 119.22 105.15 154.12 89.29 200.32 198.20 82.47 115.35 123.03 186.72 36.65	$\begin{array}{c} 38,37\\ (5,5,458)\\ \hline \\ 6,10\\ \hline \\ \\ \\ \hline \\ \hline \\ \\ \hline \\ \\ \hline \\ \\ \hline \\ \hline \\ \\ \hline \\ \hline \\ \hline \\ \\ \hline \hline \\ \hline \hline \\ \hline \\ \hline \\ \hline \\ \hline \hline \\ \hline \\ \hline \\ \hline \\ \hline \hline \\ \hline \\ \hline \\ \hline \\ \hline \hline \\ \hline \\ \hline \\ \hline \\ \hline \hline \\ \hline \\ \hline \hline \\ \hline \\ \hline \\ \hline \hline \\ \hline \hline \\ \hline \\ \hline \hline \\ \hline \hline \\ \hline \hline \\ \hline \\ \hline \hline \\ \hline \\ \hline \hline \\ \hline \hline \\ \hline \hline \\ \hline \\ \hline \hline \\ \hline \\ \hline \hline \hline \hline \hline \\ \hline \hline \hline \hline \hline \\ \hline \hline \hline \hline \hline \hline \\ \hline \hline$	76.03 76.03 26 26 27 28 29 29 20 20 20 20 20 20 20 20 20 20	$\begin{array}{c} 338,50\\ 0\\ 5.5,\\ 6.2\\ \hline \\ 6.2\\ \hline \\ 6.3\\ \hline \\ 6.4\\ \hline \\ 7.68\\ \hline \\ 8.470\\ \hline \\ 56,790\\ \hline \\ 58,470\\ \hline \\ 27,68\\ \hline \\ 30,683\\ \hline \\ 33,557\\ \hline \\ 33,059\\ \hline \\ 28,355\\ \hline \\ 20,077\\ \hline \\ 33,059\\ \hline \\ 28,355\\ \hline \\ 20,077\\ \hline \\ 33,059\\ \hline \\ 28,355\\ \hline \\ 20,077\\ \hline \\ 33,557\\ \hline \\ 33,059\\ \hline \\ 28,355\\ \hline \\ 20,077\\ \hline \\ 33,682\\ \hline \\ 84,481\\ \hline \\ 31,518\\ \hline \\ 84,217\\ \hline \\ 85,453\\ \hline \\ 73,682\\ \hline \\ 82,201\\ \hline \\ 68,545\\ \hline \\ 71,916\\ \hline \\ 68,545\\ \hline \\ 71,916\\ \hline \\ 50,802\\ \hline \end{array}$	$\begin{array}{c} 0.77\\ 0.77\\ 23\\ \hline \hline \\ \hline \\ \hline \\ 2.84\\ 0.21\\ 0.01\\ 160.12\\ 182.52\\ 6.56\\ 126.97\\ 0.14\\ 22.83\\ 0.57\\ 20.45\\ 35.05\\ 55.89\\ 176.28\\ 230.45\\ 230.45\\ 230.45\\ 238.411\\ 0.00\\ 17.58\\ 185.31\\ 224.37\\ 0.10\\ \hline \end{array}$	36,70 8 0.8 0.8 0.8 0.8 0.8 0.8 0.8	8.20 39 89 Time 0.92 1.60 0.02 0.20 12.59 32.04 4.76 0.09 9.58 0.77 6.53 268.63 180.10 142.02 295.82 298.20 297.73 237.53 5.95	$\begin{array}{c} 37,17\\ 1\\ 2.5\\ \hline \\ C_{max} \end{array}$	$\begin{array}{c} 7.60 \\ \hline 7.60 \\ \hline 88 \\ \hline 88 \\ \hline \\ \hline \\ \hline \\ \hline \\ \hline \\ \hline \\$	36,57 14 0.5 14 0.5 14 0.5 14 0.5 15 18 55,128 55,128 55,128 57,187 27,686 29,692 28,192 20,121 33,092 28,192 20,121 31,559 40,319 38,392 30,874 78,545 78,004 66,388 73,078 59,633 61,277 47,81	$\begin{array}{c} 9.13\\ 6\\ 59\\ 53\\ \hline \\ \hline$
$\begin{tabular}{ c c c c c } \hline $C_{\max}$ \\ $\#best$ \\ $gap(\%)$ \\ \hline $gap(\%)$ \\ \hline $gap(\%)$ \\ \hline $instance$ \\ \hline $YFJS01$ \\ $YFJS02$ \\ $YFJS02$ \\ $YFJS02$ \\ $YFJS02$ \\ $YFJS02$ \\ $YFJS03$ \\ $YFJS04$ \\ $YFJS05$ \\ $YFJS06$ \\ $YFJS06$ \\ $YFJS06$ \\ $YFJS07$ \\ $YFJS06$ \\ $YFJS07$ \\ $YFJS06$ \\ $YFJS07$ \\ $YFJS07$ \\ $YFJS07$ \\ $YFJS07$ \\ $YFJS07$ \\ $YFJS10$ \\ $YFJS14$ \\ $YFJS15$ \\ $YFJS16$ \\ $YFJS20$ \\ \hline $C_{\max}$ \\ $\#best$ \\ \hline \end{tabular}$	37,38 2.3 3.3 3.3 55,128 57,187 27,686 29,692 20,077 33,736 33,276 33,736 33,276 33,011 28,192 20,077 31,559 40,204 38,003 30,711 79,374 40,204 38,003 30,711 79,374 66,188 73,732 61,283 60,960 47,87 1	88.93         5           558         31           Imme         1.60           1.20         0.03           0.29         2.48           35.79         91.58           0.35         3.63           3.63         3.20           102.14         173.04           138.96         106.57           295.79         298.52           148.73         73.80           23         20	$\begin{array}{c} 37,43\\ 2\\ 2.2\\ 3.\\ \end{array}$	33.93 2 71 17 CCN Time 1.29 2.25 0.03 1.66 3.45 111.43 82.50 0.62 2.38 119.22 105.15 154.12 89.29 200.32 198.52 198.20 82.47 115.35 123.03 186.72 36.65 7	$\begin{array}{c} 38,37\\ (5,5,1)\\ GRAS\\ \hline C_{max}\\ \hline 55,458\\ 59,000\\ \textbf{27,686}\\ \textbf{29,692}\\ \textbf{34,430}\\ 33,557\\ \textbf{33,352}\\ \textbf{29,692}\\ \textbf{34,430}\\ 33,557\\ \textbf{33,352}\\ \textbf{29,692}\\ \textbf{34,430}\\ \textbf{33,557}\\ \textbf{33,352}\\ \textbf{29,692}\\ \textbf{34,430}\\ \textbf{33,557}\\ \textbf{33,352}\\ \textbf{29,692}\\ \textbf{34,430}\\ \textbf{33,557}\\ \textbf{33,352}\\ \textbf{29,692}\\ \textbf{34,181}\\ \textbf{33,558}\\ \textbf{84,181}\\ \textbf{83,753}\\ \textbf{73,682}\\ \textbf{80,279}\\ \textbf{70,115}\\ \textbf{68,963}\\ \textbf{50,44}\\ 50$	76.03 76.03 26 26 27 28 29 29 20 20 20 20 20 20 20 20 20 20	$\begin{array}{c} 38,50\\ 0.5,5\\ 0.5,6\\ 0.5,5\\ 0.5,6\\ 0.5,5\\ 0.5,6\\ 0.$	$\begin{array}{c} 0.77\\ 0.77\\ 23\\ \hline \hline \\ \hline \\ \hline \\ 2.84\\ 0.21\\ 0.01\\ 160.12\\ 182.52\\ 6.56\\ 126.97\\ 0.14\\ 22.83\\ 0.57\\ 20.45\\ 35.05\\ 55.89\\ 176.28\\ 230.45\\ 25.89\\ 176.28\\ 230.45\\ 230.45\\ 175.8\\ 185.31\\ 244.37\\ 0.00\\ 17.58\\ 185.31\\ 244.37\\ 0.00\\ 10\\ 24\\ 24.37\\ 0.00\\ 10\\ 24\\ 35\\ 10\\ 24\\ 35\\ 10\\ 24\\ 35\\ 10\\ 24\\ 35\\ 10\\ 24\\ 35\\ 10\\ 24\\ 35\\ 10\\ 24\\ 35\\ 10\\ 24\\ 35\\ 10\\ 24\\ 35\\ 10\\ 24\\ 35\\ 10\\ 24\\ 35\\ 10\\ 35\\ 10\\ 35\\ 10\\ 35\\ 10\\ 10\\ 35\\ 10\\ 10\\ 10\\ 24\\ 10\\ 10\\ 10\\ 10\\ 10\\ 10\\ 10\\ 10\\ 10\\ 10$	36,70 8 0.8 0.8 0.8 0.8 0.8 0.8 0.8	8.20 39 89 RN Time 0.92 1.60 0.02 0.20 12.59 32.04 4.76 0.09 9.58 0.77 6.53 268.63 180.10 142.02 191.45 275.82 298.20 297.73 237.53 5.95	$\begin{array}{c} 37,17\\ 1\\ 2.5\\ \hline \\ C_{max} \\ 57,900\\ 57,634\\ 28,772\\ \textbf{29,692}\\ 35,577\\ 33,892\\ 33,317\\ 28,638\\ \textbf{20,077}\\ 33,317\\ 28,638\\ \textbf{20,077}\\ 33,111\\ 41,547\\ 41,620\\ 33,449\\ 83,846\\ 87,555\\ 83,317\\ 71,161\\ 77,670\\ 61,788\\ 62,668\\ \hline 50,166\\ 2\end{array}$	7.60 38 38 CN Time 0.02 0.18 0.00 0.00 0.01 0.00 0.01 0.02 0.01 0.18 0.00 0.02 0.01 0.02	36,57 14 0.5 27,686 29,692 33,736 33,892 33,092 28,192 20,121 31,559 30,874 79,866 78,504 66,388 73,078 59,633 61,277 47,81 9	$\begin{array}{c} 9.13\\ 6\\ 59\\ 53\\ \hline \\ \hline$
$\begin{tabular}{ c c c c c } \hline $C_{\rm max}$ & $\# best$ \\ $gap(\%)$ & $gap(\%)$ \\ \hline $gap(\%)$ & $$instance$ \\ \hline $YFJS01$ & $YFJS02$ \\ $YFJS02$ & $YFJS03$ \\ $YFJS02$ & $YFJS03$ \\ $YFJS04$ & $YFJS05$ \\ $YFJS06$ & $YFJS06$ \\ $YFJS06$ & $YFJS06$ \\ $YFJS07$ & $YFJS06$ \\ $YFJS07$ & $YFJS06$ \\ $YFJS07$ & $YFJS06$ \\ $YFJS10$ & $YFJS12$ \\ $YFJS12$ & $YFJS12$ \\ $YFJS15$ & $YFJS16$ \\ $YFJS16$ & $YFJS16$ \\ $YFJS17$ & $YFJS16$ \\ $YFJS16$ & $YFJS16$ \\ $YFJS17$ & $YFJS16$ \\ $YFJS17$ & $YFJS16$ \\ $YFJS16$ & $YFJS16$ \\ $YFJS20$ & $Zmax$ \\ \hlineend{tabular}$	37,38 2.2 3.3 3.3 55,128 57,187 27,686 29,692 20,077 33,736 33,276 33,011 28,192 20,077 31,559 40,204 38,003 30,711 79,374 78,426 66,188 73,732 61,283 60,960 47,87	88.93         38.93         38.93         35.55         36.55         36.55         36.75         36.75         36.75         36.76         37.79         91.58         0.35         36.20         33.20         34.55         35.55	$\begin{array}{c} 37,43\\ 2\\ 2.3\\ 3.\\ \hline \\ \\ \hline \\ \hline \\ \hline \\ \\ \hline \\ \\ \hline \\ \hline \\ \hline \\ \\ \hline \hline \\ \hline \hline \\ \hline \\ \hline \\ \hline \hline \\ \hline \\ \hline \\ \hline \\ \hline \hline \hline \\ \hline \hline \hline \hline \\ \hline \hline \hline \\ \hline \hline \hline \hline \\ \hline \hline$	33.93         2           71         71           17         17           CCN         1.29           2.25         0.03           1.66         3.45           111.43         82.50           0.62         2.38           119.515         154.12           89.29         200.32           198.52         198.52           198.52         198.52           198.20         82.47           115.35         123.03           186.72         166.95           7         07	$\begin{array}{c} 38,37\\ (5,5,45)\\ GRAS\\ \hline C_{max}\\ 55,458\\ 59,000\\ \textbf{27,686}\\ \textbf{29,692}\\ \textbf{29,692}\\ \textbf{29,692}\\ \textbf{29,692}\\ \textbf{29,692}\\ \textbf{29,692}\\ \textbf{29,692}\\ \textbf{29,692}\\ \textbf{33,3557}\\ \textbf{33,352}\\ \textbf{28,557}\\ \textbf{20,077}\\ \textbf{20,077}\\ \textbf{39,993}\\ \textbf{31,558}\\ \textbf{41,079}\\ \textbf{32,582}\\ \textbf{41,079}\\ \textbf{32,582}\\ \textbf{41,079}\\ \textbf{32,582}\\ \textbf{41,079}\\ \textbf{32,582}\\ \textbf{41,079}\\ \textbf{32,582}\\ \textbf{41,079}\\ \textbf{32,582}\\ \textbf{41,079}\\ \textbf{33,557}\\ 33,557$	76.03 76.03 26 26 27 28 29 29 20 20 20 20 20 20 20 20 20 20	$\begin{array}{c} 338,50\\ 0\\ 5.5,\\ 6.2\\ \hline \\ 6.2\\ \hline \\ 6.3\\ \hline \\ 6.4\\ \hline \\ 7.68\\ \hline \\ 8.470\\ \hline \\ 56,790\\ \hline \\ 58,470\\ \hline \\ 27,68\\ \hline \\ 30,683\\ \hline \\ 33,557\\ \hline \\ 33,059\\ \hline \\ 28,355\\ \hline \\ 20,077\\ \hline \\ 33,059\\ \hline \\ 28,355\\ \hline \\ 20,077\\ \hline \\ 33,059\\ \hline \\ 28,355\\ \hline \\ 20,077\\ \hline \\ 33,557\\ \hline \\ 33,059\\ \hline \\ 28,355\\ \hline \\ 20,077\\ \hline \\ 33,682\\ \hline \\ 84,481\\ \hline \\ 31,518\\ \hline \\ 84,217\\ \hline \\ 85,453\\ \hline \\ 73,682\\ \hline \\ 82,201\\ \hline \\ 68,545\\ \hline \\ 71,916\\ \hline \\ 68,545\\ \hline \\ 71,916\\ \hline \\ 50,802\\ \hline \end{array}$	$\begin{array}{c} 0.77 \\ \hline 0.77 \\ \hline 23 \\ \hline \\ \hline 2.84 \\ \hline 0.21 \\ 0.01 \\ 160.12 \\ 182.52 \\ 6.56 \\ 126.97 \\ 0.14 \\ 22.83 \\ 0.57 \\ 20.45 \\ 35.05 \\ 55.89 \\ 176.28 \\ 230.45 \\$	36,70 8 0.8 0.8 0.8 0.8 0.8 0.8 0.8	8.20 39 89 RN Time 0.92 1.60 0.02 0.20 12.59 32.04 4.76 0.09 9.58 0.77 6.53 268.63 180.10 142.02 191.45 112.32 275.82 298.20 297.73 237.53 5.95 33	$\begin{array}{c} 37,17\\ 1\\ 2.5\\ \hline \\ C_{max} \end{array}$	7.60 7.60 38 38 CN Time 0.02 0.18 0.00 0.01 0.00 0.01 0.00 0.01 0.00 0.23 0.00 0.00 0.02 0.01 0.00 0.23 0.00 0.02 0.01 0.00 0.02 0.01 0.09 0.01 0.09 0.01 0.00 0.02 0.01 0.00 0.02 0.01 0.00 0.02 0.01 0.00 0.02 0.01 0.00 0.02 0.01 0.00 0.02 0.01 0.00 0.01 0.00 0.02 0.01 0.00 0.02 0.01 0.00 0.02 0.01 0.00 0.00 0.01 0.00 0.04 3.3 0.00 0.00 0.04 3.3 0.00 0.05 5.3 5.3 5.3 5.3 5.3 5.3 5.3 5.	36,57 14 0.5 14 0.5 14 0.5 14 0.5 15 18 55,128 55,128 55,128 57,187 27,686 29,692 28,192 20,121 33,092 28,192 20,121 31,559 40,319 38,392 30,874 78,545 78,004 66,388 73,078 59,633 61,277 47,81	$\begin{array}{c} 9.13\\ 6\\ 59\\ 53\\ \hline \\ \hline$

Table 7: Results of applying the metaheuristics to the large-sized instances with learning rate  $\alpha=0.3.$ 

6, and 7, i.e., it is the average of the best makespan over the five runs for each method/instance pair. Using this value in the comparison is harmful for the TS-RN and TS-CN methods. Note that if, we consider five minutes of CPU time, the TN-RN method is the second best, even using this unfair measure in the comparison. Figure 4 shows the same thing except that, for methods that solve each instance five times, instead of considering the best of the five makespan, we consider the average of the five makespan. With this measure, and considering that we have five minutes of CPU time available, the TS-RN method appears as the best. The ranking of all the other methods, considering the five-minutes CPU time budget, remains the same.

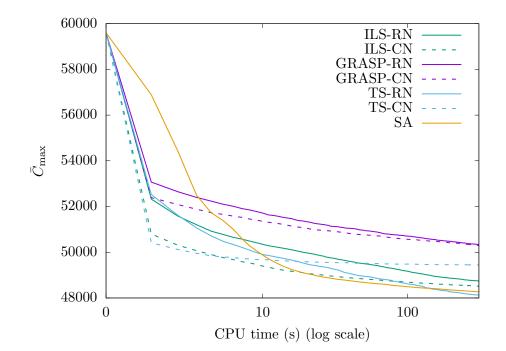


Figure 4: This figure is similar to Figure 3. The difference is that, for methods that solve each instance five times, instead of considering the best of the five makespan, we consider the average of the five makespan. This measure is more fair when in the comparison there are methods that do not posses a random ingredient and, therefore, are run only one time per instance.

Figures 3 and 4 show that the ranking of the methods in relation to the average quality of the solutions found is affected by the time limit used in the stopping criterion, since shorter times would yield a different ranking. On the other hand, the figures also show that longer times would have little effect on the comparison. (Note that the time axis in the figures is in logarithmic scale and that the methods almost stabilize at five minutes). Figures 3 and 4 and Table 13 clearly show that GRASP-RN, GRASP-CN and TS-CN were the worst performing methods. There seems to be an explanation for that: lack of diversification. In the case of TS-CN, the difference in efficacy is remarkable when compared to TS-RN. It is worth noting that the cropped neighborhood is radically smaller than the reduced neighborhood and this fact limits the ability of the tabu search to escape from local solutions. Something similar occurs in the two versions of GRASP, in which local searches are initiated from solutions constructed by a randomized

version of the constructive heuristics ECT and EST. Apparently, the randomization of these constructive heuristics was not able to generate sufficiently diverse solutions and repeated runs of the local search ended up repeatedly converging to the same local solutions. On the other side of the spectrum, TS-RN and SA performed outstandingly well, followed closely by the two versions of ILS. The fact that SA (see Figures 3 and 4) takes a little longer to get good quality solutions is entirely expected, since it is the method that less explores the neighborhood of the current solution in the search for a new solution. Regardless of anything else, it is important to note that all metaheuristics substantially improved the solutions delivered by the constructive heuristics and found by the local search. The constructive heuristics EST and ECT deliver solutions that are, on average, 32.36% and 33.01% worse than the best solutions found, respectively. The local search with the reduced neighborhood, which considered as a stand-alone method finds solutions of better quality than the local search with the cropped neighborhood, provides solutions that are on average 16.18% worse than the best solutions found. On the other hand, all metaheuristics deliver solutions that are, on average, at no more than 6% of the best solutions found. If we discard the three worst performing methods, this number drops to approximately 2%. The highlight is for TS-RN and SA, which deliver solutions, on average, at approximately 1% and 1.5% of the best solutions found. The two versions of ILS deliver solutions that at approximately 2% of the best solutions found, in average. SA also stands out for the number of best solutions obtained, 71 out of a total of 150, followed closely by ILS-RN and ILS-CN, with 59 and 58, respectively. TS-RN finds 55 best solutions with the merit of having run only once for each instance, while the others run five times and the best of the five is considered in these statistics.

In order to strengthen the comparison between the methods, we applied the Wilcoxon [46] test for each pair of methods, with a significance level of  $\alpha = 0.05$ , to accept or reject the null hypothesis "the samples of the two methods come from the same distribution" or, equivalently, "the difference between the samples of the two methods follows a symmetrical distribution around zero". In this test we left out the GRASP-RN and GRASP-CN methods, which clearly performed worse than all the others. Table 8 shows the results. Suppose that two methods  $M_1$  and  $M_2$  are compared and that these methods, when applied to a set of N instances, find solutions with makespan  $c_{1i}$  and  $c_{2i}$ , respectively, for  $i = 1, \ldots, N$ . Instances i with  $c_{2i} = c_{1i}$  are eliminated from the test. For simplicity, let's assume that N already represents the number of instances in which the methods found different makespans. The test assigns each instance i a weight  $R_i$  which corresponds to the position of the instance when they are ordered from lowest to highest by the value of  $|c_{2i} - c_{1i}|$ . In the case of ties,  $R_i$  corresponds to the average of the positions of the tied values. With the values of  $R_i$  for each instance, we calculate the statistic

$$W = R^+ - R^-$$
, where  $R^+ = \sum_{\{i \mid c_{2i} > c_{1i}\}} R_i$  and  $R^- = \sum_{\{i \mid c_{1i} > c_{2i}\}} R_i$ .

Under the null hypothesis and for large values of N, the value of W is divided by its variance N(N+1)(2N+1)/6 to obtain z. In a two-tailed test, the null hypothesis is rejected if  $|z| > z_{\text{critical}}(\alpha/2)$  or, equivalently, if  $p < \alpha$ . The table shows, for each pair of methods compared, the values of  $R^+$ ,  $R^-$ , and the *p*-value of z. The comparison considering a CPU time limit of 10 seconds shows that ILS-RN is worse than the other four methods compared and that the other four methods are equivalent to each other. This coincides with Figure 4, which uses the

average makespan as a measure of comparison. The comparison considering a CPU time limit of 5 minutes shows that all the methods are different. Furthermore, the two-by-two comparison makes it possible to construct a ranking between the methods in which TS-RN is the best of all, followed by SA, ILS-CN, ILS-RN and TS-CN in that order. This ranking also coincides with that shown on the right-hand side of Figure 4, which uses the average makespan as a criterion.

comparison	$10  \mathrm{sec}$	onds of	CPU time limit	5 minu	ites of C	CPU time limit
comparison	$R^+$	$R^{-}$	p-value	$R^+$	$R^{-}$	<i>p</i> -value
ILS-RN versus ILS-CN	804	$7,\!974$	0.000	1,402	$5,\!385$	0.000
ILS-RN versus TS-RN	2,544	$6,\!636$	0.000	1,692	$6,\!437$	0.000
ILS-RN versus TS-CN	3,844	$6,\!887$	0.003	6,311	$4,\!274$	0.044
ILS-RN versus SA	$3,\!579$	7,006	0.001	3,221	$7,\!075$	0.000
ILS-CN versus TS-RN	5,036	4,009	0.254	1,996	$5,\!879$	0.000
ILS-CN versus TS-CN	$5,\!296$	$5,\!289$	0.994	6,777	$3,\!808$	0.003
ILS-CN versus SA	$5,\!624$	4,961	0.513	4,102	$6,\!051$	0.047
TS-RN versus TS-CN	5,015	$5,\!570$	0.584	9,533	$1,\!052$	0.000
TS-RN versus SA	$5,\!623$	4,962	0.514	7,142	$3,\!443$	0.000
TS-CN versus SA	$6,\!452$	4,724	0.102	1,939	$9,\!236$	0.000

Table 8: Details of the Wilcoxon test comparing each pair of methods, when applied to the large-sized instances, to accept or reject the null hypothesis "the difference between the two methods follows a symmetrical distribution around zero".

We close this section by analyzing the behavior of the seven methods in the seven large-sized instances for which proved optimal solutions were reported in [4]. Table 9 shows the results. The table shows the instance name and instance learning rate for the seven instances for which the optimal value  $C_{\max}^{\star}$  is known. Then, for each method, it shows, as in the previous tables, when applicable, the best makespan found over the five runs in each of these instances. It can be seen that ILS-RN, ILS-CN and SA found the optimal solutions in all the seven instances, followed by TS-RN that found six out of the seven optimal solutions. Independently of finding the optimal solutions, appart from TS-CN, the methods found solutions with an average gap to the optimal solutions in all the five runs of each instance. An evidence of this is the line "gap to optimal" that exhibits a 0.0% gap.

#### 4.3 Experiments with the metaheuristics in the small-sized instances

In this section we analyze the behavior of the metaheuristics on the small-sized instances. It is important to note that for all metaheuristics we considered their parameters exactly as defined in the previous section, i.e., with the calibration done for the large-sized instances. Tables A1, A2, and A3 in the Appendix show the results for the instances with learning effect rate  $\alpha \in \{0.1, 0.2, 0.3\}$ , respectively. As in the case of the large-sized instances, a summary consolidating the data of Tables A1, A2, and A3 can be seen in the middle of Table 13. Unlike in the large-sized instances, the ILS-RN, ILS-CN, GRASP-RN, GRASP-CN, GRASP-CN, TS-RN and SA methods stand out in terms of performance, while only TS-CN underperforms. Of partic-

instance	$\alpha$	$C_{\max}^{\star}$	ILS-RN	ILS-CN	GRASP-RN	GRASP-CN	TS-RN	TS-CN	SA
YFJS03	0.1	32,538	32,538	32,538	32,538	32,538	$32,\!538$	$33,\!174$	32,538
YFJS04	0.1	$35,\!883$	$35,\!883$	$35,\!883$	$36,\!946$	$35,\!883$	$35,\!883$	$37,\!340$	35,883
YFJS08	0.1	$32,\!573$	32,573	$32,\!573$	$32,\!623$	$32,\!655$	$32,\!573$	$34,\!452$	32,573
YFJS03	0.2	30,073	30,073	$30,\!073$	30,073	30,073	$30,\!073$	$30,\!073$	30,073
YFJS08	0.2	30,184	30,184	30,184	30,267	30,384	30,267	$32,\!595$	30,184
YFJS03	0.3	$27,\!686$	27,686	$27,\!686$	$27,\!686$	$27,\!686$	$27,\!686$	28,772	27,686
YFJS08	0.3	$28,\!192$	28,192	28,192	$28,\!597$	$28,\!355$	$28,\!192$	$28,\!638$	28,192
#o	ptima	al	7	7	3	4	6	1	7
gap to c	optim	al (%)	0.00	0.00	0.69	0.21	0.04	3.61	0.00
$\overline{\text{gap}}$ to c	optim	al $(\%)$	0.00	0.00	0.73	0.31	0.04	3.61	0.24

Table 9: Performance of the metaheuristics in the seven large-sized instances for which proved optimal solutions are known.

ular interest is the comparison of the performance of the metaheuristics in the 173 small-sized instances, out of a total of 180, for which optimal solutions were reported in [4]. Table 10 shows this comparison. In the table, for each method, we show the number of instances in which the method found an optimal solution (#optimal). We also show the average gap in relation to the optimal solution when, for each method and instance, we consider the best solution of those found in the five runs of that method/instance pair (line "gap to optimal"). Finally, in another line of the table we show the gap in relation to the optimal solution when, for a method/instance pair, we consider the average makespan of the five runs of that pair (line "gap to optimal"). The numbers in the table show that ILS-RN and ILS-CN found optimal solutions in *all* 173 instances and, moreover, in all five runs of each method in each instance. Leaving aside TS-CN, the other methods also perform well, finding a large number of optimal solutions and with average gaps relative to the optimal solution of less than 1%.

#### 4.4 Experiments with classical instances without sequencing flexibility

To the authors' knowledge, no other method has been developed so far that applies to the exact problem considered in this paper. For this reason, in order to be able to relate the developed methods with those existing in the literature, we decided to apply them to a problem that is a particular case of the problem considered. We are referring to the FJS with position-based learning effect but *without* sequencing flexibility. A method that also applies to this problem and minimizes the makespan was developed in [44]. The developed method is a hybrid metaheuristic that mixes genetic algorithms with variable neighborhood search with affinity function, thus named GVNSWAF. This method was chosen because, its careful and detailed description allowed us to reimplement it in C++, the same language in which the introduced methods were implemented. In [44], for lack of a better option, random instances were considered, and the Taguchi's robust design method was used to determine the best method's parameters. In our experiments, we considered the parameters determined in [44]. In that respect, the comparison is fair, since neither method was specifically calibrated for the instances that were considered in this section. Our implementation of GVNSWAF is also available for download at

			ILS-RN	ILS-CN	GRASP-RN	GRASP-CN	TS-RN	TS-CN	SA
		#optimal	30	30	28	29	22	7	27
-	DA-type	gap to optimal $(\%)$	0.00	0.00	0.14	0.13	0.95	2.61	0.10
: 0.1		$\overline{\text{gap}}$ to optimal (%)	0.00	0.00	0.18	0.17	0.95	2.61	0.35
$\alpha =$		#optimal	30	30	28	29	25	10	29
	Y-type	gap to optimal $(\%)$	0.00	0.00	0.03	0.02	0.67	2.92	0.02
		$\overline{\text{gap}}$ to optimal (%)	0.00	0.00	0.39	0.06	0.67	2.92	0.18
		#optimal	28	28	26	27	20	6	26
2	DA-type	gap to optimal $(\%)$	0.00	0.00	0.04	0.03	1.13	2.63	0.02
: 0.2		$\overline{\text{gap}}$ to optimal (%)	0.00	0.00	0.13	0.16	1.13	2.63	0.31
$\alpha =$		#optimal	30	30	29	28	24	7	30
0	Y-type	gap to optimal $(\%)$	0.00	0.00	0.15	0.05	0.54	3.36	0.00
		$\overline{\text{gap}}$ to optimal (%)	0.00	0.00	0.43	0.17	0.54	3.36	0.24
		#optimal	27	27	27	27	19	5	26
3	DA-type	gap to optimal $(\%)$	0.00	0.00	0.00	0.00	0.81	2.99	0.03
: 0.3		$\overline{\text{gap}}$ to optimal (%)	0.00	0.00	0.13	0.11	0.81	2.99	0.48
$\alpha = \alpha$		#optimal	28	28	25	28	25	4	28
	Y-type	gap to optimal $(\%)$	0.00	0.00	0.11	0.00	0.37	3.58	0.00
		$\overline{\text{gap}}$ to optimal (%)	0.00	0.00	0.29	0.14	0.37	3.58	0.13
		#optimal	173	173	163	168	135	39	166
S	ummary	gap to optimal $(\%)$	0.00	0.00	0.08	0.04	0.74	3.01	0.03
		$\overline{\text{gap}}$ to optimal (%)	0.00	0.00	0.26	0.13	0.74	3.01	0.28

Table 10: Behavior of the seven metaheuristics on the 173 small-sized instances for which a proven optimal solution is known.

#### https://github.com/kennedy94/FJS.

In the experiments of this section, we consider 35 instances of the classic FJS from the literature [12, 20], without sequencing flexibility, to which we added the position-based learning effect. As we considered learning effect rates  $\alpha \in \{0.1, 0.2, 0.3\}$ , we have in total 105 instances. On this set of instances, we compared the methods introduced in the present work with the method introduced in [44], which we denote GVNSWAF hereafter. Since the method has random components, it was run five times on each instance, as well as the methods introduced in the present work that contain random components as well. Tables A4, A5, and A6 in the Appendix show the results. A summary of the results from these tables can be seen at the bottom of Table 13. Table 13 shows that the methods that stand out are ILS-RN and ILS-CN. It also shows that the ILS-RN, ILS-CN and SA methods have superior performance to the GVNSWAF method. The GVNSWAF method has a performance similar to the performance of GRASP-RN, GRASP-CN and TS-RN methods and only outperforms the TS-CN methods which already showed the worst performance among all the considered methods. The Wilcoxon test, details of which are shown in the Table 11 shows that, with a CPU time limit of 10 seconds, the performance of GVN-SWAF is equal to the performance of TS-CN, and GVNSWAF is outperformed by all the other six methods. With the CPU time limit of 5 minutes, GVNSWAF outperforms only TS-CN and is equal to GRASP-RN, but is outperformed by all the other five methods.

As a final experiment, we tried to solve with an exact commercial solver models of these classical instances to obtain proven optimal solutions. We were able to obtain proven optimal solutions for 47 instances, out of the total of 105 instances. Table 12 compares the solutions obtained by the eight methods in relation to the known optima on that set of 47 instances. Again, the ILS-RN and ILS-CN methods found all optimal solutions in all five runs of each method/instance pair. The GVNSWAF method also achieved the same result. Apart from TS-CN, all others found solutions with average gap less than 1%.

comparison	10 sec	onds of (	CPU time limit	5 minu	utes of C	CPU time limit
comparison	$R^+$	$R^{-}$	<i>p</i> -value	$R^+$	$R^{-}$	p-value
ILS-RN versus GVNSWAF	2,262	153	0.000	2,004	12	0.000
ILS-CN versus GVNSWAF	2,415	0	0.000	2,016	0	0.000
GRASP-RN versus GVNSWAF	1,792	623	0.000	1,016	1,064	0.872
GRASP-CN versus GVNSWAF	2,193	222	0.000	1,327	689	0.029
TS-RN versus GVNSWAF	2,132	718	0.000	$1,\!628$	787	0.012
TS-CN versus GVNSWAF	1,991	$1,\!412$	0.181	1,081	2,079	0.015
SA versus GVNSWAF	2,187	228	0.000	$1,\!953$	532	0.000

Table 11: Details of the Wilcoxon test comparing each introduced method versus GVNSWAF, when applied to classical instances of the FJS with learning effect but without sequencing flexibility, to accept or reject the null hypothesis "the difference between the two methods follows a symmetrical distribution around zero".

In addition to the tests described above, we tested 168 additional instances of the classical FJS from the literature [7, 17, 28] which, considering  $\alpha \in \{0.1, 0.2, 0.3\}$ , amounted to 504. The results essentially confirmed what we have already shown. For more details, see [3].

## 5 Conclusions

In this paper we introduced a local search and four trajectory metaheuristics for the flexible job shop scheduling problem with sequencing flexibility and position-based learning effect. For the local search, we showed that, in the presence of learning effect, the classical approach of considering reallocations of operations in the critical path only fails to consider potentially better neighbors than the current solution. Consequently, we proposed a new neighborhood reduction that does not eliminate potentially better neighbors and cuts the neighborhood by approximately 50%. We further proposed a neighborhood cutoff that reduces the neighborhood size significantly (by about an order of magnitude) and finds solutions that are at most 1% worse. The introduced local searches and/or neighborhoods were used in the development of four trajectory metaheuristics. We performed extensive numerical experiments and showed that variants of ILS, TS, and SA stands out for its effectiveness and efficiency. As a whole, we build a test suite that can be used in the development of future work. The methods introduced and the solutions found are freely available.

As future work, we intend to consider different learning effects, which do not depend only on the position of the operation in the machine to which it was attributed. We also intend to consider objective functions that take into account the energy consumption (green scheduling).

Instance	$\alpha$	$C_{\max}^{\star}$	ILS-RN	ILS-CN	GRASP-RN	GRASP-CN	TS-RN	TS-CN	SA	GVNSWAF
mfjs01	0.10	45,306	45,306	45,306	45,306	45,306	46,264	46,264	45,306	45,306
mfjs02	0.10	42,986	42,986	42,986	42,986	42,986	42,986	42,986	42,986	42,986
mfjs03	0.10	45,331	45,331	45,331	45,331	45,331	45,331	45,331	45,331	45,331
mfjs04	0.10	52,012	52,012	52,012	52,480	52,012	52,012	54,075	52,630	52,012
mfjs05	0.10	47,630	47,630	47,630	47,630	47,630	47,630	47,630	49,988	47,630
mfjs06	0.10	59,523	59,523	59,523	59,523	59,523	59,523	60,854	60,402	59,523
sfjs01	0.10	6,459	6,459	6,459	6,459	6,459	6,459	6,459	6,459	6,459
sfjs02	0.10	10,271	10,271	10,271	10,271	10,271	10,271	10,271	10,271	10,271
sfjs03	0.10	$20,\!623$	20,623	20,623	20,623	20,623	20,623	21,716	20,623	20,623
sfjs04	0.10	33,429	33,429	33,429	33,429	33,429	33,429	34,483	33,429	33,429
sfjs05	0.10	11,006	11,006	11,006	11,006	11,006	11,006	12,107	11,006	11,006
sfjs06	0.10	29,926	29,926	29,926	29,926	29,926	31,835	32,057	29,926	29,926
sfjs07	0.10	37,824	37,824	37,824	37,824	37,824	37,824	37,824	37,824	37,824
sfjs08	0.10	23,842	23,842	23,842	23,842	23,842	23,842	23,842	23,842	23,842
sfjs09	0.10	19,406	19,406	19,406	19,406	19,406	19,406	19,406	19,406	19,406
sfjs10	0.10	49,368	49,368	49,368	49,368	49,368	49,368	49,368	49,368	49,368
	optima		16	16	15	16	14	9	13	16
gap to			0.00	0.00	0.06	0.00	0.53	2.12	0.48	0.00
$\frac{gap}{gap}$ to			0.00	0.00	0.32	0.18	0.53	2.12	0.69	0.00
0.1p 10	. P. SHITO	(/~)	0.00	0.00	0.02	0.10	0.00		0.00	0.00
Instance	α	$C_{\max}^{\star}$	ILS-RN	ILS-CN	GRASP-RN	GRASP-CN	TS-RN	TS-CN	SA	GVNSWAF
mfjs01	0.20	43,208	43,208	43,208	43,208	43,208	43,208	44,880	43,208	43,208
mfjs02	0.20	43,208 41,273	43,208 41,273	43,208 41,273	43,208 41,273	43,208 41,273	43,208 41,273	44,880 45,208	43,208 41,273	43,208 41,273
mfjs03	0.20	41,275 43,412	41,273 43,412	41,273 43,412	41,275 43,412	41,275 43,412	41,273 43,412	43,208 43,412	41,273 43,412	41,275 43,412
mfjs04	0.20	43,412 47,717	45,412 47,717	45,412 47,717	49,024	43,412 49,024	43,412 47,717	43,412 47,717	43,412 49,921	43,412 47,717
mfjs05	0.20	47,717 45,670	47,717 45,670	47,717 45,670	49,024 45,670	49,024 45,670	47,717 45,670	47,717 45,670	49,921 45,670	47,717 45,670
mfjs06	0.20	45,070 56,743	56,743	$\frac{45,070}{56,743}$	$\frac{45,070}{56,743}$	45,070 57,005	45,070 57,093	45,070 57,889	45,070 57,055	45,070 56,743
	0.20		6,328		6,328	6,328			6,328	6,328
sfjs01		6,328		6,328			6,328	6,328		
sfjs02	0.20	9,872	9,872 19,281	9,872	9,872 19,281	9,872	9,872	9,872 20.027	9,872	9,872
sfjs03	0.20	19,281		19,281 31,553		19,281	19,281 32,472	,	19,281	19,281
sfjs04	0.20	31,553	31,553		31,553	31,553	· ·	32,472	31,553	31,553
sfjs05	0.20	10,198	10,198	10,198	10,198	10,198	10,198	11,209	10,198	10,198
sfjs06	0.20	28,024	28,024	28,024	28,024	28,024	28,024	28,024	28,024	28,024
sfjs07	0.20	36,075	36,075	36,075	36,075	36,075	36,075	36,075	36,075	36,075
sfjs08	0.20	22,515	22,515	22,515	22,515	22,515	22,515	22,515	22,515	22,515
sfjs09	0.20	17,552	17,552	17,552	17,552	17,552	17,552	17,552	17,552	17,552
sfjs10	0.20	47,323	47,323	47,323	47,323	47,323	47,323	47,323	47,323	47,323
	optima		16	16	15	14	14	10	14	16
gap to			0.00	0.00	0.17	0.20	0.22	2.01	0.32	0.00
gap to	optima	մ (%)	0.00	0.00	0.28	0.21	0.22	2.01	0.74	0.00
		<i>a</i> ,	HORE	H G CD-	CD LCD DI	CDACE CT	00.222	mg 33-		01010101
Instance	α	$C_{\max}^{\star}$	ILS-RN	ILS-CN	GRASP-RN	GRASP-CN	TS-RN	TS-CN	SA	GVNSWAF
mfjs01	0.30	40,508	40,508	40,508	40,508	40,508	42,562	41,785	40,508	40,508
mfjs02	0.30	38,996	38,996	38,996	38,996	38,996	38,996	39,834	38,996	38,996
mfjs03	0.30	41,318	41,318	41,318	41,318	41,318	41,318	44,254	41,318	41,318
mfjs04	0.30	44,869	44,869	44,869	44,869	46,048	46,048	46,558	46,048	44,869
mfjs05	0.30	44,376	44,376	44,376	44,376	44,738	44,376	44,738	44,376	44,376
sfjs01	0.30	6,206	6,206	6,206	6,206	6,206	6,206	6,206	6,206	6,206
sfjs02	0.30	9,498	9,498	9,498	9,498	9,498	9,498	$9,\!498$	9,498	9,498
sfjs03	0.30	18,062	18,062	18,062	18,062	18,062	18,062	18,062	18,062	18,062
sfjs04	0.30	29,852	29,852	29,852	29,852	29,852	$30,\!648$	$30,\!648$	29,852	29,852
sfjs05	0.30	9,465	9,465	9,465	9,465	9,465	9,465	10,288	9,465	9,465
sfjs06	0.30	26,281	26,281	26,281	26,281	26,281	26,281	26,281	26,281	26,281
sfjs07	0.30	$34,\!443$	34,443	34,443	34,443	34,443	$34,\!443$	$34,\!443$	34,443	34,443
			21,309	21,309	21,309	21,309	21,715	21,309	21,309	21,309
sfjs08	0.30	21,309	==,000		15 070	15,973	15,973	15,973	15,973	15,973
		21,309 15,973	15,973	15,973	15,973	- ) - · -				
sfjs08 sfjs09 sfjs10	$\begin{array}{c} 0.30 \\ 0.30 \\ 0.30 \end{array}$	15,973 45,450		15,973 45,450	15,973 45,450	45,450	$45,\!450$	$45,\!450$	45,450	$45,\!450$
sfjs08 sfjs09 sfjs10 #	0.30 0.30 0.30 optima	15,973 45,450 1	15,973					45,450 8	45,450 14	45,450 15
sfjs08 sfjs09 sfjs10	0.30 0.30 0.30 optima	15,973 45,450 1	$15,973 \\ 45,450$	$45,\!450$	45,450	45,450	$45,\!450$		,	
sfjs08 sfjs09 sfjs10 #	0.30 0.30 0.30 optima optima	15,973 45,450 1 d (%)	15,973 45,450 15	45,450 15	45,450 15	45,450 13	45,450 11	8	14	15
sfjs08 sfjs09 sfjs10 # gap to	0.30 0.30 0.30 optima optima	15,973 45,450 1 d (%)	$     \begin{array}{r}       15,973 \\       45,450 \\       15 \\       0.00 \\       \end{array} $	45,450 15 0.00	45,450 15 0.00	45,450 13 0.23	$     \begin{array}{r}       45,450 \\       11 \\       0.82     \end{array} $	8 1.89	14 0.18	15 0.00
sfjs08 sfjs09 sfjs10 # gap to gap to	0.30 0.30 0.30 optima optima	15,973 45,450 1 1 (%) 1 (%)	$     \begin{array}{r}       15,973 \\       45,450 \\       15 \\       0.00 \\       \end{array} $	45,450 15 0.00	45,450 15 0.00	45,450 13 0.23	$     \begin{array}{r}       45,450 \\       11 \\       0.82     \end{array} $	8 1.89	14 0.18	15 0.00
sfjs08 sfjs09 sfjs10 gap to gap to	0.30 0.30 0.30 optima optima optima	15,973 45,450 1 1 (%) 1 (%) 1	$ \begin{array}{r} 15,973\\ 45,450\\ 15\\ 0.00\\ 0.00\\ \end{array} $	$     \begin{array}{r}       45,450 \\       15 \\       0.00 \\       0.00     \end{array} $	45,450 15 0.00 0.18	45,450 13 0.23 0.26	$   \begin{array}{r}     45,450 \\     11 \\     0.82 \\     0.82   \end{array} $	8 1.89 1.89	14 0.18 0.33	15     0.00     0.00
sfjs08 sfjs09 sfjs10 # gap to gap to #	0.30 0.30 0.30 optima optima optima optima	15,973 45,450 1 1 (%) 1 (%) 1 1 1 (%)	$ \begin{array}{r} 15,973\\ 45,450\\ 15\\ 0.00\\ 0.00\\ 47\\ \end{array} $	45,450 15 0.00 0.00 47	45,450 15 0.00 0.18 45	45,450 13 0.23 0.26 43	45,450 11 0.82 0.82 39	8 1.89 1.89 27	14 0.18 0.33 41	15 0.00 0.00 47

Table 12: Performance of the metaheuristics and GVNSWAF in the 47 classical instances for which proved optimal solutions are known.

instance group	metric	ILS-RN	ILS-CN	GRASP-RN	GRASP-CN	TS-RN	TS-CN	SA	GVNSWAF
	$\bar{C}_{\max}$	48,458.93	48,319.72	50,206.70	50,327.07	48,125.00	49,446.14	47,907.31	-
large-sized	#best	59	58	9	7	55	10	71	—
large-sized	gap(%)	1.80	1.55	4.96	5.10	1.02	3.39	0.66	—
	$\overline{\mathrm{gap}}(\%)$	2.33	1.95	5.80	5.73	1.02	3.39	1.51	_
	$\bar{C}_{\max}$	26,756.48	26,756.48	26,783.73	26,778.00	26,977.45	$27,\!570.54$	26,768.89	_
small-sized	#best	180	180	168	170	140	39	169	_
sman-sized	gap(%)	0.00	0.00	0.11	0.09	0.75	2.99	0.05	_
	$\overline{\mathrm{gap}}(\%)$	0.00	0.00	0.30	0.19	0.75	2.99	0.32	_
	$\bar{C}_{\max}$	31,989.65	31,915.34	32,565.66	$32,\!480.55$	32,362.34	32,975.85	32,122.78	32,288.28
classical	#best	64	88	49	46	52	30	63	53
ciassical	gap(%)	0.40	0.15	2.10	1.88	1.81	3.78	0.54	1.78
	$\overline{\mathrm{gap}}(\%)$	0.74	0.31	2.63	2.26	1.81	3.78	1.06	2.97

Table 13: Summary of the performance of the seven methods analyzed on the 150 large-sized instances, the 180 small-sized instances, and the 105 classical instances from the literature, the latter without sequencing flexibility.

**Conflict of interest statement:** On behalf of all authors, the corresponding author states that there is no conflict of interest.

Author contributions: All authors contributed equally to all phases of the development of this work.

**Data availability:** The datasets generated during and/or analysed during the current study are available in the GitHub repository, https://github.com/kennedy94/FJS.

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# Appendix

instance	ILS-I		ILS-0		GRASI		GRASI		TS-F		TS-0		SA	
	$C_{\text{max}}$	Time	$C_{\text{max}}$	Time	$C_{\text{max}}$	Time	$C_{\text{max}}$	Time	$C_{\text{max}}$	Time	Cmax	Time	$C_{\text{max}}$	Time
miniDAFJS01	22,875	0.01	22,875	0.05	22,875	8.09	22,875	16.21	22,875	0.00	23,264	0.00	22,875	0.40
miniDAFJS02	22,708	0.00	22,708	0.00	22,708	0.03	22,708	0.04	22,708	0.00	23,242	0.00	22,708	0.14
miniDAFJS03	18,363	0.00	18,363	0.00	18,363	0.00	18,363	0.00	18,363	0.00	18,363	0.00	18,363	0.00
miniDAFJS04	20,498	0.00	20,498	0.00	20,498	0.00	20,498	0.00	20,498	0.00	21,172	0.00	20,498	0.10
miniDAFJS05	20,593	0.01	20,593	0.00	20,593	2.01	20,593	6.26	20,593	0.01	21,324	0.00	20,593	0.32
miniDAFJS06	22,867	0.01	22,867	0.00	22,867	0.69	22,867	1.04	23,370	0.00	23,370	0.00	22,867	0.33
miniDAFJS07	25,715	0.01	25,715	0.01	25,715	0.15	25,715	0.31	25,715	0.00	26,978	0.00	25,715	0.18
miniDAFJS08	19,878	0.00	19,878	0.00	19,878	0.00	19,878	0.00	19,878	0.00	19,878	0.00	19,878	0.00
miniDAFJS09	24,267	0.03	24,267	0.16	24,267	1.30	24,267	8.19	24,267	0.00	24,304	0.00	24,267	0.41
miniDAFJS10	20,336	0.00	20,336	0.00	20,336	0.00	20,336	0.00	20,359	0.00	20,873	0.00	20,336	0.24
miniDAFJS11	29,968	0.01	29,968	0.02	29,968	1.11	29,968	0.00	33.263	0.00	33.689	0.00	29,968	0.42
miniDAFJS12	18,670	0.01	18,670	0.01	18,670	0.00	18,670	2.87	20,222	0.00	20,342	0.00	18,670	0.26
miniDAFJS13	16,313	0.00	16,313	0.00	16,313	0.00	16,313	0.00	16,313	0.00	17,091	0.00	16,313	0.01
miniDAFJS14	23,140	0.00	23,140	0.00	23,140	0.00	23,140	3.36	23,140	0.00	23,140	0.00	23,140	0.30
miniDAFJS15	21,715	0.00	21,715	0.00	21,715	0.00	21,715	0.24	21,715	0.00	21,882	0.00	21,715	0.16
miniDAFJS16	25,426	0.00	25,426	0.00	25,426	0.00	25,426	0.00	25,426	0.00	25,691	0.00	25,426	0.26
miniDAFJS17	20,155	0.00	20,155	0.00	20,155	0.00	20,155	0.00	20,155	0.00	20,155	0.00	20,155	0.19
miniDAFJS18	18,135	0.00	18,135	0.00	18,135	0.00	18,135	0.00	18,135	0.00	18,445	0.00	18,135	0.25
miniDAFJS19	20,945	0.00	20,945	0.00	20,945	0.00	20,945	0.00	20,945	0.00	21,293	0.00	20,945	0.18
miniDAFJS20	21,838	0.02	21,838	0.01	21,838	12.83	21,838	0.60	21,838	0.00	22,675	0.00	21,838	0.30
miniDAFJS21	23,344	0.60	23,344	0.14	23,344	50.28	23,344	74.78	23,456	0.02	24,554	0.00	23,563	35.44
miniDAFJS22	25,923	0.00	25,923	0.00	25,923	0.00	25,923	0.03	25,923	0.00	25,923	0.00	25,923	0.41
miniDAFJS23	24,038	3.23	24,038	0.85	24,998	0.03	24,998	0.01	24,585	0.11	24,438	0.00	24,438	0.49
miniDAFJS24	24,579	0.04	24,579	0.01	24,579	0.01	24,579	0.02	25,521	0.01	25,694	0.00	24,579	0.43
miniDAFJS25	21,143	0.01	21,143	0.00	21,143	23.97	21,143	0.00	21,143	0.00	22,682	0.00	21,143	0.33
miniDAFJS26	21,120	0.16	21,120	0.11	21,120	42.71	21,120	43.64	21,120	0.00	21,468	0.00	21,120	0.57
miniDAFJS27	22,050	0.14	22,050	0.20	22,106	0.12	22,050	0.24	22,106	0.03	22,106	0.00	22,106	0.41
miniDAFJS28	22,708	0.03	22,708	0.02	22,708	0.00	22,708	0.00	22,708	0.00	23,120	0.00	22,708	0.33
miniDAFJS29	20,278	0.01	20,278	0.01	20,278	0.01	20,278	0.00	20,278	0.00	20,278	0.00	20,278	0.33
miniDAFJS30	23,558	0.05	23,558	0.03	23,558	33.60	23,558	48.64	23,558	0.09	23,558	0.01	23,558	0.44
- C <sub>max</sub>	22,104		22,104		22,138		22,13		22,33		22,69		22,12	
#best	30		30		28		29		22		7		27	
gap(%)	0.0		0.0		0.1		0.1		0.9		2.6	1	0.1	
$\overline{\text{gap}}(\%)$	0.0		0.0		0.1		0.1		0.9		2.6		0.3	
						-				-	1			
ingtongo	ILS-I	RN	ILS-0	CN	GRASI		GRASI		TS-I		TS-0	CN	SA	<u> </u>
instance	ILS-I C <sub>max</sub>	RN Time	ILS-0	CN Time	-						TS-0	CN Time	SA C <sub>max</sub>	Time
instance miniYFJS01					GRASI	P-RN	GRASI	P-CN	TS-F	RN Time				
miniYFJS01	C <sub>max</sub> 35,046	Time 0.00	C <sub>max</sub> 35,046	Time 0.00	GRASI C <sub>max</sub> 35,046	P-RN Time 0.00	GRASI C <sub>max</sub> 35,046	P-CN Time 0.00	TS-F C <sub>max</sub> 35,046	RN Time 0.00	C <sub>max</sub> 35,243	Time 0.00	C <sub>max</sub> 35,046	Time 0.20
	$C_{\max}$	Time	$C_{\max}$	Time	GRASI C <sub>max</sub>	P-RN Time	GRASI C <sub>max</sub>	P-CN Time	TS-F C <sub>max</sub>	RN Time	C <sub>max</sub>	Time	$C_{\max}$	Time
miniYFJS01 miniYFJS02 miniYFJS03	C <sub>max</sub> 35,046 24,359	Time 0.00 0.01	C <sub>max</sub> 35,046 24,359 47,391	Time 0.00 0.01	GRASI C <sub>max</sub> 35,046 24,359	P-RN Time 0.00 0.00 0.00	GRASI C <sub>max</sub> 35,046 24,359 47,391	P-CN Time 0.00 0.00 0.14	TS-F C <sub>max</sub> <b>35,046</b> <b>24,359</b> 52,098	RN Time 0.00 0.00	$C_{\text{max}}$ 35,243 25,654 53,381	Time 0.00 0.00 0.00	C <sub>max</sub> 35,046 24,359 47,391	Time 0.20 0.29
miniYFJS01 miniYFJS02	C <sub>max</sub> 35,046 24,359 47,391	Time 0.00 0.01 0.00	C <sub>max</sub> 35,046 24,359	Time 0.00 0.01 0.01	GRASI C <sub>max</sub> 35,046 24,359 47,391	P-RN Time 0.00 0.00	GRASI C <sub>max</sub> 35,046 24,359	P-CN Time 0.00 0.00	TS-F C <sub>max</sub> 35,046 24,359	RN Time 0.00 0.00 0.00	C <sub>max</sub> 35,243 25,654	Time 0.00 0.00	C <sub>max</sub> 35,046 24,359	Time 0.20 0.29 0.35
miniYFJS01 miniYFJS02 miniYFJS03 miniYFJS04	$\begin{array}{c} \hline C_{\rm max} \\ 35,046 \\ 24,359 \\ 47,391 \\ 25,394 \end{array}$	Time 0.00 0.01 0.00 0.00	$\begin{array}{c} C_{\rm max} \\ {\bf 35,046} \\ {\bf 24,359} \\ {\bf 47,391} \\ {\bf 25,394} \end{array}$	Time 0.00 0.01 0.01 0.00	GRASI C <sub>max</sub> 35,046 24,359 47,391 25,394	P-RN Time 0.00 0.00 0.00 0.00	GRASI C <sub>max</sub> 35,046 24,359 47,391 25,394	P-CN Time 0.00 0.00 0.14 0.00	TS-F C <sub>max</sub> <b>35,046</b> <b>24,359</b> 52,098 <b>25,394</b>	RN Time 0.00 0.00 0.00 0.00	C <sub>max</sub> 35,243 25,654 53,381 <b>25,394</b>	Time 0.00 0.00 0.00 0.00	C <sub>max</sub> 35,046 24,359 47,391 25,394	Time 0.20 0.29 0.35 0.00
miniYFJS01 miniYFJS02 miniYFJS03 miniYFJS04 miniYFJS05	C <sub>max</sub> 35,046 24,359 47,391 25,394 23,985	Time 0.00 0.01 0.00 0.00 0.00	$\begin{array}{c} C_{\rm max} \\ {\bf 35,046} \\ {\bf 24,359} \\ {\bf 47,391} \\ {\bf 25,394} \\ {\bf 23,985} \end{array}$	Time 0.00 0.01 0.01 0.00 0.00	GRASI C <sub>max</sub> 35,046 24,359 47,391 25,394 23,985	P-RN Time 0.00 0.00 0.00 0.00 0.00	GRASI C <sub>max</sub> 35,046 24,359 47,391 25,394 23,985	P-CN Time 0.00 0.00 0.14 0.00 0.00	TS-F C <sub>max</sub> <b>35,046</b> <b>24,359</b> 52,098 <b>25,394</b> <b>23,985</b>	RN Time 0.00 0.00 0.00 0.00 0.00	C <sub>max</sub> 35,243 25,654 53,381 <b>25,394</b> 26,371	Time 0.00 0.00 0.00 0.00 0.00	C <sub>max</sub> 35,046 24,359 47,391 25,394 23,985	Time 0.20 0.29 0.35 0.00 0.24
miniYFJS01 miniYFJS02 miniYFJS03 miniYFJS04 miniYFJS05 miniYFJS06	$\begin{array}{r} \hline C_{\rm max} \\ 35,046 \\ 24,359 \\ 47,391 \\ 25,394 \\ 23,985 \\ 29,469 \end{array}$	Time 0.00 0.01 0.00 0.00 0.00 0.01	$\begin{array}{r} \hline C_{\rm max} \\ 35,046 \\ 24,359 \\ 47,391 \\ 25,394 \\ 23,985 \\ 29,469 \end{array}$	Time 0.00 0.01 0.01 0.00 0.00 0.01	$\begin{array}{c} {\rm GRASI}\\ \hline C_{\rm max}\\ 35,046\\ 24,359\\ 47,391\\ 25,394\\ 23,985\\ 29,469\\ \end{array}$	P-RN Time 0.00 0.00 0.00 0.00 0.00 0.35	$\begin{array}{c} {\rm GRASI}\\ \hline C_{\rm max}\\ {\bf 35,046}\\ {\bf 24,359}\\ {\bf 47,391}\\ {\bf 25,394}\\ {\bf 23,985}\\ {\bf 29,469} \end{array}$	P-CN Time 0.00 0.00 0.14 0.00 0.00 0.25	TS-I C <sub>max</sub> <b>35,046</b> <b>24,359</b> 52,098 <b>25,394</b> <b>23,985</b> 30,508	RN Time 0.00 0.00 0.00 0.00 0.00 0.00	$\begin{array}{c} C_{\rm max} \\ 35,243 \\ 25,654 \\ 53,381 \\ \textbf{25,394} \\ 26,371 \\ 30,952 \end{array}$	Time 0.00 0.00 0.00 0.00 0.00 0.00	$\begin{array}{r} \hline C_{\rm max} \\ 35,046 \\ 24,359 \\ 47,391 \\ 25,394 \\ 23,985 \\ 29,469 \end{array}$	Time 0.20 0.29 0.35 0.00 0.24 0.30
miniYFJS01 miniYFJS02 miniYFJS03 miniYFJS05 miniYFJS06 miniYFJS07	$\frac{C_{\max}}{35,046}$ 24,359 47,391 25,394 23,985 29,469 45,705	Time 0.00 0.01 0.00 0.00 0.00 0.01 0.01	$\begin{array}{c} C_{\rm max} \\ \textbf{35,046} \\ \textbf{24,359} \\ \textbf{47,391} \\ \textbf{25,394} \\ \textbf{23,985} \\ \textbf{29,469} \\ \textbf{45,705} \end{array}$	Time 0.00 0.01 0.01 0.00 0.00 0.01 0.05	$\begin{array}{c} {\rm GRASI}\\ \hline C_{\rm max}\\ 35,046\\ 24,359\\ 47,391\\ 25,394\\ 23,985\\ 29,469\\ 45,705\\ \end{array}$	P-RN Time 0.00 0.00 0.00 0.00 0.35 0.01	$\begin{array}{c} {\rm GRASI}\\ \hline C_{\rm max}\\ 35,046\\ 24,359\\ 47,391\\ 25,394\\ 23,985\\ 29,469\\ 45,705\\ \end{array}$	P-CN Time 0.00 0.00 0.14 0.00 0.25 14.81	TS-F C <sub>max</sub> <b>35,046</b> <b>24,359</b> 52,098 <b>25,394</b> <b>23,985</b> 30,508 <b>45,705</b>	RN Time 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.01	$\begin{array}{c} C_{\max} \\ 35,243 \\ 25,654 \\ 53,381 \\ \textbf{25,394} \\ 26,371 \\ 30,952 \\ 47,524 \end{array}$	Time 0.00 0.00 0.00 0.00 0.00 0.00 0.00	$\frac{C_{\max}}{35,046}$ 24,359 47,391 25,394 23,985 29,469 45,705	Time 0.20 0.29 0.35 0.00 0.24 0.30 0.43
miniYFJS01 miniYFJS02 miniYFJS03 miniYFJS04 miniYFJS05 miniYFJS06 miniYFJS07 miniYFJS08	$\frac{C_{\rm max}}{35,046}$ 24,359 47,391 25,394 23,985 29,469 45,705 33,829	Time 0.00 0.01 0.00 0.00 0.00 0.01 0.01 0.0	$\begin{array}{c} C_{\rm max} \\ \textbf{35,046} \\ \textbf{24,359} \\ \textbf{47,391} \\ \textbf{25,394} \\ \textbf{23,985} \\ \textbf{29,469} \\ \textbf{45,705} \\ \textbf{33,829} \end{array}$	Time 0.00 0.01 0.01 0.00 0.00 0.01 0.05 0.03	$\begin{array}{c} {\rm GRASI} \\ \hline C_{\rm max} \\ \hline 35,046 \\ 24,359 \\ 47,391 \\ 25,394 \\ 23,985 \\ 29,469 \\ 45,705 \\ 33,829 \\ \end{array}$	P-RN Time 0.00 0.00 0.00 0.00 0.00 0.35 0.01 0.00	$\begin{array}{c} {\rm GRASI}\\ \hline C_{\rm max}\\ \hline 35,046\\ 24,359\\ 47,391\\ 25,394\\ 23,985\\ 29,469\\ 45,705\\ 33,829\\ \end{array}$	P-CN Time 0.00 0.00 0.14 0.00 0.25 14.81 0.16	TS-F C <sub>max</sub> <b>35,046</b> <b>24,359</b> 52,098 <b>25,394</b> <b>23,985</b> 30,508 <b>45,705</b> 33,883	Time           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00	$\begin{array}{c} C_{\rm max} \\ 35,243 \\ 25,654 \\ 53,381 \\ \textbf{25,394} \\ 26,371 \\ 30,952 \\ 47,524 \\ 34,338 \end{array}$	Time 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	$\begin{array}{c} C_{\max} \\ \textbf{35,046} \\ \textbf{24,359} \\ \textbf{47,391} \\ \textbf{25,394} \\ \textbf{23,985} \\ \textbf{29,469} \\ \textbf{45,705} \\ \textbf{33,829} \end{array}$	Time 0.20 0.29 0.35 0.00 0.24 0.30 0.43 0.38
miniYFJS01 miniYFJS02 miniYFJS03 miniYFJS04 miniYFJS05 miniYFJS07 miniYFJS08 miniYFJS09	$\begin{array}{c} C_{\rm max} \\ \textbf{35,046} \\ \textbf{24,359} \\ \textbf{47,391} \\ \textbf{25,394} \\ \textbf{23,985} \\ \textbf{29,469} \\ \textbf{45,705} \\ \textbf{33,829} \\ \textbf{37,049} \end{array}$	Time 0.00 0.01 0.00 0.00 0.01 0.01 0.01 0.0	$\begin{array}{c} C_{\rm max} \\ \textbf{35,046} \\ \textbf{24,359} \\ \textbf{47,391} \\ \textbf{25,394} \\ \textbf{23,985} \\ \textbf{29,469} \\ \textbf{45,705} \\ \textbf{33,829} \\ \textbf{37,049} \end{array}$	Time 0.00 0.01 0.01 0.00 0.00 0.01 0.05 0.03 0.00	GRASI C <sub>max</sub> 35,046 24,359 47,391 25,394 23,985 29,469 45,705 33,829 37,049	P-RN Time 0.00 0.00 0.00 0.00 0.00 0.35 0.01 0.00 0.00	$\begin{array}{c} {\rm GRASI}\\ \hline C_{\rm max}\\ \hline 35,046\\ 24,359\\ 47,391\\ 25,394\\ 23,985\\ 29,469\\ 45,705\\ 33,829\\ 37,049\\ \end{array}$	P-CN Time 0.00 0.00 0.14 0.00 0.25 14.81 0.16 0.00	TS-F C <sub>max</sub> <b>35,046</b> <b>24,359</b> 52,098 <b>25,394</b> <b>23,985</b> 30,508 <b>45,705</b> 33,883 <b>37,049</b>	Time           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.01           0.00           0.00	$\begin{array}{c} C_{\rm max} \\ 35,243 \\ 25,654 \\ 53,381 \\ \textbf{25,394} \\ 26,371 \\ 30,952 \\ 47,524 \\ 34,338 \\ 37,354 \end{array}$	Time 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	$\begin{array}{c} C_{\rm max} \\ 35,046 \\ 24,359 \\ 47,391 \\ 25,394 \\ 23,985 \\ 29,469 \\ 45,705 \\ 33,829 \\ 37,049 \end{array}$	Time 0.20 0.29 0.35 0.00 0.24 0.30 0.43 0.38 0.30
miniYFJS01 miniYFJS02 miniYFJS03 miniYFJS04 miniYFJS05 miniYFJS06 miniYFJS08 miniYFJS09 miniYFJS10	$\begin{array}{c} C_{\rm max} \\ 35,046 \\ 24,359 \\ 47,391 \\ 25,394 \\ 23,985 \\ 29,469 \\ 45,705 \\ 33,829 \\ 37,049 \\ 27,310 \end{array}$	Time 0.00 0.01 0.00 0.00 0.01 0.01 0.01 0.0	$\begin{array}{c} C_{\max} \\ \hline 35,046 \\ 24,359 \\ 47,391 \\ 25,394 \\ 23,985 \\ 29,469 \\ 45,705 \\ 33,829 \\ 37,049 \\ 27,310 \end{array}$	Time 0.00 0.01 0.00 0.00 0.01 0.05 0.03 0.00 0.00	$\begin{array}{r} {\rm GRASI} \\ \hline C_{\rm max} \\ \hline 35,046 \\ 24,359 \\ 47,391 \\ 25,394 \\ 23,985 \\ 29,469 \\ 45,705 \\ 33,829 \\ 37,049 \\ 27,310 \\ \end{array}$	P-RN Time 0.00 0.00 0.00 0.00 0.00 0.35 0.01 0.00 0.00 0.00 0.01	$\begin{array}{r} {\rm GRASI} \\ \hline C_{\rm max} \\ \hline 35,046 \\ 24,359 \\ 47,391 \\ 25,394 \\ 23,985 \\ 29,469 \\ 45,705 \\ 33,829 \\ 37,049 \\ 27,310 \\ \end{array}$	P-CN Time 0.00 0.00 0.14 0.00 0.25 14.81 0.16 0.00 0.00 0.00	TS-I C <sub>max</sub> 35,046 24,359 52,098 25,394 23,985 30,508 45,705 33,883 37,049 27,310	Time           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.01           0.00           0.00           0.00	$\begin{array}{c} C_{\max} \\ 35,243 \\ 25,654 \\ 53,381 \\ \textbf{25,394} \\ 26,371 \\ 30,952 \\ 47,524 \\ 34,338 \\ 37,354 \\ \textbf{27,310} \end{array}$	Time 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	$\begin{array}{c} C_{\rm max} \\ 35,046 \\ 24,359 \\ 47,391 \\ 25,394 \\ 23,985 \\ 29,469 \\ 45,705 \\ 33,829 \\ 37,049 \\ 27,310 \end{array}$	Time 0.20 0.29 0.35 0.00 0.24 0.30 0.43 0.38 0.30 0.33
miniYFJS01 miniYFJS02 miniYFJS03 miniYFJS05 miniYFJS05 miniYFJS07 miniYFJS08 miniYFJS09 miniYFJS10 miniYFJS11	$\begin{array}{c} C_{\rm max} \\ 35,046 \\ 24,359 \\ 47,391 \\ 25,394 \\ 23,985 \\ 29,469 \\ 45,705 \\ 33,829 \\ 37,049 \\ 27,310 \\ 41,300 \end{array}$	Time 0.00 0.01 0.00 0.00 0.00 0.01 0.01 0.00 0.01 0.00 0.00	$\begin{array}{c} C_{\rm max} \\ 35,046 \\ 24,359 \\ 47,391 \\ 25,394 \\ 23,985 \\ 29,469 \\ 45,705 \\ 33,829 \\ 37,049 \\ 27,310 \\ 41,300 \end{array}$	Time 0.00 0.01 0.01 0.00 0.00 0.01 0.05 0.03 0.00 0.00 0.01	GRASI C <sub>max</sub> 35,046 24,359 47,391 25,394 23,985 29,469 45,705 33,829 37,049 27,310 41,300	P-RN Time 0.00 0.00 0.00 0.00 0.00 0.35 0.01 0.00 0.00 0.00 0.01 0.00	GRASI C <sub>max</sub> 35,046 24,359 47,391 25,394 23,985 29,469 45,705 33,829 37,049 27,310 41,300	P-CN Time 0.00 0.14 0.00 0.25 14.81 0.16 0.00 0.00 0.05	TS-F C <sub>max</sub> 35,046 24,359 52,098 25,394 23,985 30,508 45,705 33,883 37,049 27,310 41,300	Time           0.00	$\begin{array}{c} C_{\max} \\ 35,243 \\ 25,654 \\ 53,381 \\ \textbf{25,394} \\ 26,371 \\ 30,952 \\ 47,524 \\ 34,338 \\ 37,354 \\ \textbf{27,310} \\ 41,423 \end{array}$	Time 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	$\begin{array}{c} C_{\max} \\ 35,046 \\ 24,359 \\ 47,391 \\ 25,394 \\ 23,985 \\ 29,469 \\ 45,705 \\ 33,829 \\ 37,049 \\ 27,310 \\ 41,300 \end{array}$	Time           0.20           0.29           0.35           0.00           0.24           0.30           0.43           0.38           0.30           0.33           0.33
miniYFJS01 miniYFJS02 miniYFJS03 miniYFJS05 miniYFJS05 miniYFJS06 miniYFJS07 miniYFJS08 miniYFJS09 miniYFJS10 miniYFJS11	$\begin{array}{c} C_{\max} \\ \hline & \\ 35,046 \\ 24,359 \\ 47,391 \\ 25,394 \\ 23,985 \\ 29,469 \\ 45,705 \\ 33,829 \\ 37,049 \\ 27,310 \\ 41,300 \\ 30,145 \end{array}$	Time 0.00 0.01 0.00 0.00 0.00 0.01 0.01 0.00 0.01 0.00 0.11	$\begin{array}{c} C_{\max} \\ \hline & \\ 35,046 \\ 24,359 \\ 47,391 \\ 25,394 \\ 23,985 \\ 29,469 \\ 45,705 \\ 33,829 \\ 35,049 \\ 27,310 \\ 41,300 \\ 30,145 \end{array}$	Time 0.00 0.01 0.01 0.00 0.00 0.01 0.05 0.03 0.00 0.00 0.01 0.06	GRASI Cmax 35,046 24,359 25,394 25,394 23,985 29,469 45,705 33,829 37,049 27,310 41,300 30,145 30,962 31,398	P-RN Time 0.00 0.00 0.00 0.00 0.00 0.35 0.01 0.00 0.00 0.00 0.00 0.00 55.26	GRASI Cmax 35,046 24,359 47,391 25,394 23,985 29,469 45,705 33,829 37,049 27,310 30,145	P-CN Time 0.00 0.14 0.00 0.25 14.81 0.16 0.00 0.00 0.05 64.48	TS-F Cmax 35,046 24,359 52,098 25,398 25,398 30,508 45,705 33,883 37,049 27,310 30,145	Time           0.00           0.03	$\begin{array}{c} C_{\max} \\ \hline \\ 35,243 \\ 25,654 \\ 53,381 \\ \textbf{25,394} \\ 26,371 \\ 30,952 \\ 47,524 \\ 34,338 \\ 37,354 \\ \textbf{27,310} \\ 41,423 \\ 33,329 \end{array}$	Time 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	$\begin{array}{c} C_{\max} \\ \hline & \\ 35,046 \\ 24,359 \\ 47,391 \\ 25,394 \\ 23,985 \\ 29,469 \\ 45,705 \\ 33,829 \\ 37,049 \\ 27,310 \\ 41,300 \\ 30,145 \end{array}$	Time           0.20           0.35           0.00           0.24           0.30           0.43           0.38           0.30           0.33           0.39           0.54
miniYFJS01 miniYFJS02 miniYFJS03 miniYFJS05 miniYFJS06 miniYFJS06 miniYFJS09 miniYFJS09 miniYFJS10 miniYFJS11 miniYFJS12	$\frac{C_{\rm max}}{35,046}$ $\frac{35,046}{24,359}$ $\frac{47,391}{25,394}$ $\frac{23,985}{29,469}$ $\frac{45,705}{33,829}$ $\frac{37,049}{27,310}$ $\frac{27,310}{30,145}$ $\frac{30,145}{30,962}$	Time           0.00           0.01           0.00           0.00           0.00           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.01	$\begin{array}{c} C_{max} \\ 35,046 \\ 24,359 \\ 47,391 \\ 25,394 \\ 23,985 \\ 29,469 \\ 45,705 \\ 33,829 \\ 37,049 \\ 27,310 \\ 41,300 \\ 30,145 \\ 30,962 \end{array}$	Time           0.00           0.01           0.00           0.01           0.00           0.01           0.05           0.03           0.00           0.01           0.00           0.01           0.05           0.03           0.00           0.01           0.00           0.01           0.06           0.00	$\begin{array}{c} {\rm GRASI}\\ \hline C_{\rm max} & 35,046\\ 24,359\\ 47,391\\ 25,394\\ 23,985\\ 29,469\\ 45,705\\ 33,829\\ 37,049\\ 27,310\\ 30,145\\ 30,962\\ 31,398\\ 31,398\\ 45,442 \end{array}$	P-RN Time 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.01 0.00 55.26 0.00	GRASI C <sub>max</sub> 35,046 24,359 47,391 25,394 45,705 33,829 37,049 27,310 41,300 30,145 30,962	P-CN Time 0.00 0.14 0.00 0.25 14.81 0.16 0.00 0.00 0.05 64.48 0.01	$\begin{array}{c} {\rm TS-F}\\ \hline C_{\rm max} \\ {\rm 35,046}\\ {\rm 24,359}\\ {\rm 52,098}\\ {\rm 25,394}\\ {\rm 23,985}\\ {\rm 30,508}\\ {\rm 45,705}\\ {\rm 33,883}\\ {\rm 37,049}\\ {\rm 27,310}\\ {\rm 30,145}\\ {\rm 30,962}\\ {\rm 31,398}\\ {\rm 31,398}\\ {\rm 45,442} \end{array}$	Time           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.01           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.01	$\begin{array}{c} C_{max} \\ 35,243 \\ 25,654 \\ 53,381 \\ \textbf{25,394} \\ 26,371 \\ 30,952 \\ 47,524 \\ 34,338 \\ 37,354 \\ \textbf{27,310} \\ \textbf{41,423} \\ 33,329 \\ \textbf{30,962} \end{array}$	Time 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00	$\frac{C_{\rm max}}{35,046}$ $\frac{35,046}{24,359}$ $\frac{47,391}{25,394}$ $\frac{23,985}{29,469}$ $\frac{45,705}{33,829}$ $\frac{37,049}{27,310}$ $\frac{27,310}{30,145}$ $\frac{30,145}{30,962}$	Time           0.20           0.29           0.35           0.00           0.24           0.30           0.43           0.38           0.30           0.33           0.39           0.54           0.35
miniYFJS01 miniYFJS02 miniYFJS03 miniYFJS05 miniYFJS05 miniYFJS06 miniYFJS08 miniYFJS08 miniYFJS10 miniYFJS11 miniYFJS11 miniYFJS13 miniYFJS14	$\frac{C_{\rm max}}{35,046}$ $\frac{35,046}{24,359}$ $\frac{47,391}{23,985}$ $\frac{23,985}{23,945}$ $\frac{23,985}{33,829}$ $\frac{37,049}{27,310}$ $\frac{41,300}{30,145}$ $\frac{30,962}{31,398}$ $\frac{31,398}{45,442}$ $\frac{45,442}{33,791}$	Time           0.00           0.01           0.00           0.00           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.01	$\frac{C_{\rm max}}{35,046}$ $\frac{35,046}{24,359}$ $\frac{47,391}{25,394}$ $\frac{23,985}{29,469}$ $\frac{29,469}{37,049}$ $\frac{27,310}{30,145}$ $\frac{41,300}{30,962}$ $\frac{31,398}{31,398}$	Time           0.00           0.01           0.00           0.01           0.00           0.01           0.05           0.03           0.00           0.01           0.00           0.01           0.05           0.03           0.00           0.01           0.00           0.01           0.06           0.00           0.01	GRASI Cmax 35,046 24,359 23,985 29,469 37,049 27,310 45,705 33,829 37,049 27,310 41,300 41,300 41,300 30,145 30,962 31,398 45,442 33,791	P-RN Time 0.00	$\begin{array}{c} {\rm GRASI}\\ \hline C_{\rm max} \\ 35,046 \\ 24,359 \\ 25,394 \\ 23,985 \\ 29,469 \\ 45,705 \\ 33,829 \\ 37,049 \\ 27,310 \\ 41,300 \\ 30,145 \\ 30,962 \\ 31,398 \end{array}$	P-CN Time 0.00 0.00 0.14 0.00 0.25 14.81 0.16 0.00 0.00 0.05 64.48 0.01 0.00	TS-F           Cmax           35,046           24,359           52,098           25,394           23,985           30,508           37,049           27,310           41,300           30,145           30,962           31,398           45,442           33,791	Time           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.01           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.01           0.00	Cmax           35,243           25,654           53,381           25,394           26,371           30,952           47,524           34,338           37,354           27,310           41,423           33,329           30,962           31,398	Time 0.00	$\frac{C_{\rm max}}{35,046}$ $\frac{35,046}{24,359}$ $\frac{47,391}{25,394}$ $\frac{23,985}{29,469}$ $\frac{45,705}{33,829}$ $\frac{37,049}{27,310}$ $\frac{41,300}{30,145}$ $\frac{30,962}{31,398}$	Time           0.20           0.29           0.35           0.00           0.24           0.30           0.43           0.38           0.30           0.33           0.33           0.39           0.54           0.35           0.38
miniYFJS01 miniYFJS02 miniYFJS03 miniYFJS05 miniYFJS05 miniYFJS06 miniYFJS07 miniYFJS09 miniYFJS09 miniYFJS11 miniYFJS11 miniYFJS12 miniYFJS13 miniYFJS14	$\frac{C_{\rm max}}{35,046}$ $\frac{35,046}{24,359}$ $\frac{47,391}{225,394}$ $\frac{25,394}{23,985}$ $\frac{29,469}{45,705}$ $\frac{45,705}{33,829}$ $\frac{33,829}{37,049}$ $\frac{27,310}{30,104}$ $\frac{41,300}{30,145}$ $\frac{30,962}{31,398}$ $\frac{45,442}{33,791}$ $\frac{33,791}{42,838}$	Time           0.00           0.01           0.00           0.00           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.00           0.11           0.01           0.01           0.01           0.01           0.01	$\frac{C_{\rm max}}{35,046}$ $\frac{35,046}{24,359}$ $\frac{47,391}{25,394}$ $\frac{23,985}{29,469}$ $\frac{45,705}{33,829}$ $\frac{37,049}{27,310}$ $\frac{41,300}{30,145}$ $\frac{30,962}{31,398}$ $\frac{31,398}{45,442}$	Time           0.00           0.01           0.00           0.00           0.00           0.00           0.01           0.05           0.03           0.00           0.01           0.05           0.03           0.00           0.01           0.06           0.00           0.01           0.06           0.00           0.01           0.02           0.02	$\begin{array}{c} {\rm GRASI}\\ \hline C_{\rm max} & 35,046\\ 24,359\\ 47,391\\ 25,394\\ 23,985\\ 29,469\\ 45,705\\ 33,829\\ 37,049\\ 27,310\\ 41,300\\ 30,145\\ 30,962\\ 31,398\\ 45,442\\ 33,791\\ 42,838\\ \end{array}$	P-RN Time 0.00 0.00 0.00 0.00 0.00 0.35 0.01 0.00 0.00 0.00 55.26 0.00 0.00 0.00 0.00 0.00	$\begin{array}{c} {\rm GRASI} \\ \hline C_{\rm max} \\ 35,046 \\ 24,359 \\ 47,391 \\ 25,394 \\ 23,985 \\ 29,469 \\ 45,705 \\ 33,829 \\ 37,049 \\ 27,310 \\ 27,310 \\ 30,145 \\ 30,962 \\ 31,398 \\ 31,398 \\ 45,442 \end{array}$	P-CN Time 0.00 0.14 0.00 0.25 14.81 0.16 0.00 0.00 64.48 0.01 0.00 0.00 0.00	$\begin{array}{c} {\rm TS-F}\\ \hline C_{\rm max} \\ {\rm 35,046}\\ {\rm 24,359}\\ {\rm 52,098}\\ {\rm 25,394}\\ {\rm 23,985}\\ {\rm 30,508}\\ {\rm 45,705}\\ {\rm 33,883}\\ {\rm 30,508}\\ {\rm 45,705}\\ {\rm 33,883}\\ {\rm 37,049}\\ {\rm 27,310}\\ {\rm 41,300}\\ {\rm 30,145}\\ {\rm 30,962}\\ {\rm 31,398}\\ {\rm 45,442}\\ {\rm 33,791}\\ {\rm 42,838}\\ {\rm 75,110}\\ {\rm 10,110}\\ {\rm 10,110}\\$	Time           0.00           0.01           0.00           0.00           0.00	$\begin{array}{c} C_{max} \\ 35,243 \\ 25,654 \\ 53,381 \\ \textbf{25,394} \\ \textbf{26,371} \\ 30,952 \\ 47,524 \\ 37,354 \\ \textbf{37,354} \\ \textbf{37,354} \\ \textbf{27,310} \\ 41,423 \\ \textbf{33,329} \\ \textbf{30,962} \\ \textbf{31,398} \\ \textbf{45,442} \end{array}$	Time 0.00	$\frac{C_{\rm max}}{35,046}$ $\frac{35,046}{24,359}$ $\frac{47,391}{25,394}$ $\frac{23,985}{29,469}$ $\frac{29,469}{37,049}$ $\frac{27,310}{30,145}$ $\frac{30,962}{31,398}$ $\frac{45,442}{45,442}$	Time           0.20           0.29           0.35           0.00           0.24           0.30           0.43           0.38           0.30           0.33           0.39           0.54           0.35           0.38           0.39           0.54           0.35           0.38           0.39
miniYFJS01 miniYFJS02 miniYFJS03 miniYFJS05 miniYFJS06 miniYFJS06 miniYFJS09 miniYFJS09 miniYFJS10 miniYFJS12 miniYFJS12 miniYFJS13 miniYFJS13 miniYFJS13 miniYFJS15 miniYFJS16	$\frac{C_{\rm max}}{35,046}$ $\frac{35,046}{24,359}$ $\frac{47,391}{23,985}$ $\frac{23,985}{23,945}$ $\frac{29,469}{45,705}$ $\frac{45,705}{33,829}$ $\frac{37,049}{27,310}$ $\frac{41,300}{30,145}$ $\frac{30,962}{31,398}$ $\frac{31,398}{45,442}$ $\frac{45,442}{33,791}$	Time           0.00           0.01           0.00           0.00           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.00           0.00	$\begin{array}{c} C_{\rm max} \\ 35,046 \\ 24,359 \\ 47,391 \\ 25,394 \\ 23,985 \\ 29,469 \\ 45,705 \\ 33,829 \\ 37,049 \\ 27,310 \\ 41,300 \\ 30,145 \\ 30,962 \\ 31,398 \\ 45,442 \\ 33,791 \end{array}$	Time           0.00           0.01           0.00           0.01           0.00           0.01           0.05           0.03           0.00           0.01           0.00           0.01           0.00           0.01           0.00           0.01           0.06           0.00           0.01           0.00           0.01           0.02	GRASI Cmax 35,046 24,359 23,985 29,469 37,049 27,310 45,705 33,829 37,049 27,310 41,300 41,300 41,300 30,145 30,962 31,398 45,442 33,791	P-RN Time 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 55.26 0.00	$\begin{array}{c} {\rm GRASI}\\ \hline C_{\rm max} \\ 35,046 \\ 24,359 \\ 23,985 \\ 29,469 \\ 23,985 \\ 29,469 \\ 23,985 \\ 32,049 \\ 27,310 \\ 33,829 \\ 37,049 \\ 27,310 \\ 30,145 \\ 30,962 \\ 31,398 \\ 45,442 \\ 33,791 \end{array}$	P-CN Time 0.00 0.00 0.14 0.00 0.25 14.81 0.16 0.00 0.00 0.00 0.05 64.48 0.01 0.00 0.00 19.85	TS-F           Cmax           35,046           24,359           52,098           25,394           23,985           30,508           37,049           27,310           41,300           30,145           30,962           31,398           45,442           33,791	Time           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.01           0.00           0.01           0.00           0.00           0.00           0.00           0.00	$\begin{array}{c} C_{max} \\ 35,243 \\ 25,654 \\ 53,381 \\ 25,394 \\ 26,371 \\ 30,952 \\ 47,524 \\ 34,338 \\ 37,354 \\ 47,524 \\ 33,329 \\ 33,329 \\ 33,329 \\ 33,329 \\ 33,329 \\ 33,329 \\ 33,329 \\ 33,329 \\ 33,329 \\ 33,396 \\ 23,391 \\ \end{array}$	Time           0.00	$\frac{C_{\rm max}}{35,046}$ $\frac{35,046}{24,359}$ $\frac{47,391}{25,394}$ $\frac{23,985}{29,469}$ $\frac{45,705}{33,829}$ $\frac{37,049}{37,049}$ $\frac{41,300}{30,145}$ $\frac{30,962}{31,398}$ $\frac{31,398}{45,442}$ $\frac{33,791}{33,791}$	$\begin{array}{c} \text{Time} \\ \hline 0.20 \\ 0.29 \\ 0.35 \\ 0.00 \\ 0.24 \\ 0.30 \\ 0.43 \\ 0.38 \\ 0.30 \\ 0.33 \\ 0.39 \\ 0.54 \\ 0.35 \\ 0.38 \\ 0.39 \\ 0.41 \\ \end{array}$
miniYFJS01 miniYFJS02 miniYFJS03 miniYFJS05 miniYFJS06 miniYFJS06 miniYFJS07 miniYFJS08 miniYFJS10 miniYFJS11 miniYFJS12 miniYFJS12 miniYFJS15 miniYFJS15 miniYFJS15	$\frac{C_{\rm max}}{35,046}$ $\frac{35,046}{24,359}$ $\frac{47,391}{225,394}$ $\frac{25,394}{23,985}$ $\frac{29,469}{45,705}$ $\frac{45,705}{33,829}$ $\frac{33,829}{37,049}$ $\frac{27,310}{30,104}$ $\frac{41,300}{30,145}$ $\frac{30,962}{31,398}$ $\frac{45,442}{33,791}$ $\frac{33,791}{42,838}$	Time 0.00 0.01 0.00 0.00 0.00 0.01 0.01 0.00 0.01 0.00 0.11 0.01 0.01 0.00 0.01 0.00 0.01 0.01 0.00 0.01 0.00 0.01 0.00 0.01 0.00 0.01 0.00 0.01 0.00 0.00 0.01 0.00 0.00 0.01 0.00 0.00 0.01 0.00 0.00 0.01 0.00 0.00 0.01 0.00 0.00 0.01 0.00 0.00 0.00 0.00 0.00 0.01 0.00	$\begin{array}{c} C_{\rm max} \\ 35,046 \\ 24,359 \\ 47,391 \\ 25,394 \\ 23,985 \\ 29,469 \\ 45,705 \\ 33,829 \\ 37,049 \\ 27,310 \\ 41,300 \\ 30,145 \\ 30,962 \\ 31,398 \\ 45,442 \\ 33,791 \\ 33,791 \\ 33,793 \\ 33,791 \\ 33$	Time           0.00           0.01           0.00           0.00           0.00           0.00           0.01           0.05           0.03           0.00           0.01           0.05           0.03           0.00           0.01           0.06           0.00           0.01           0.06           0.00           0.01           0.02           0.02	$\begin{array}{c} {\rm GRASI}\\ \hline C_{\rm max} & 35,046\\ 24,359\\ 47,391\\ 25,394\\ 23,985\\ 29,469\\ 45,705\\ 33,829\\ 37,049\\ 27,310\\ 41,300\\ 30,145\\ 30,962\\ 31,398\\ 45,442\\ 33,791\\ 42,838\\ \end{array}$	P-RN Time 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 55.26 0.00	$\begin{array}{c} {\rm GRASI}\\ \hline C_{\rm max} \\ \hline 35,046 \\ 24,359 \\ 47,391 \\ 25,394 \\ 23,985 \\ 29,469 \\ 45,705 \\ 33,829 \\ 37,049 \\ 27,310 \\ 41,300 \\ 30,145 \\ 30,962 \\ 31,398 \\ 45,442 \\ 33,791 \\ 33,791 \\ 33,791 \\ \end{array}$	P-CN Time 0.00 0.00 0.14 0.00 0.25 14.81 0.16 0.00 0.00 0.05 64.48 0.01 0.00 0.00 19.85 13.56	$\begin{array}{c} {\rm TS-F}\\ \hline C_{\rm max} \\ {\rm 35,046}\\ {\rm 24,359}\\ {\rm 52,098}\\ {\rm 25,394}\\ {\rm 23,985}\\ {\rm 30,508}\\ {\rm 45,705}\\ {\rm 33,883}\\ {\rm 30,508}\\ {\rm 45,705}\\ {\rm 33,883}\\ {\rm 37,049}\\ {\rm 27,310}\\ {\rm 41,300}\\ {\rm 30,145}\\ {\rm 30,962}\\ {\rm 31,398}\\ {\rm 45,442}\\ {\rm 33,791}\\ {\rm 42,838}\\ {\rm 75,110}\\ {\rm 10,110}\\ {\rm 10,110}\\$	Time           0.00	$\begin{array}{c} C_{max} \\ 35,243 \\ 25,654 \\ 53,381 \\ 25,394 \\ 26,371 \\ 30,952 \\ 47,524 \\ 34,338 \\ 37,354 \\ 27,310 \\ 41,423 \\ 33,329 \\ 30,962 \\ 31,398 \\ 45,442 \\ 33,391 \\ 33,991 \\ 33,991 \\ 33,7$	Time 0.00	$\frac{C_{\rm max}}{35,046}$ $\frac{35,046}{24,359}$ $\frac{47,391}{225,394}$ $\frac{25,394}{23,985}$ $\frac{29,469}{45,705}$ $\frac{45,705}{33,829}$ $\frac{37,049}{27,310}$ $\frac{27,310}{30,145}$ $\frac{30,145}{30,962}$ $\frac{31,398}{33,791}$ $\frac{42,838}{42,838}$	$\begin{array}{c} \text{Time} \\ \hline 0.20 \\ 0.29 \\ 0.35 \\ 0.00 \\ 0.24 \\ 0.30 \\ 0.43 \\ 0.38 \\ 0.30 \\ 0.33 \\ 0.39 \\ 0.54 \\ 0.35 \\ 0.38 \\ 0.39 \\ 0.41 \\ 0.46 \end{array}$
miniYFJS01 miniYFJS02 miniYFJS03 miniYFJS05 miniYFJS05 miniYFJS06 miniYFJS07 miniYFJS07 miniYFJS09 miniYFJS10 miniYFJS11 miniYFJS12 miniYFJS14 miniYFJS15 miniYFJS15 miniYFJS18	$\frac{C_{\rm max}}{35,046}$ $\frac{35,046}{24,359}$ $\frac{47,391}{25,394}$ $\frac{25,394}{33,829}$ $\frac{45,705}{33,829}$ $\frac{37,049}{27,310}$ $\frac{41,300}{30,145}$ $\frac{30,962}{31,398}$ $\frac{45,442}{33,791}$ $\frac{42,838}{42,838}$	Time           0.00           0.01           0.00           0.00           0.00           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.00           0.11           0.01           0.01           0.01           0.00           0.00           0.02           0.01	$\frac{C_{\rm max}}{35,046}$ $\frac{35,046}{24,359}$ $\frac{47,391}{225,394}$ $\frac{25,394}{23,985}$ $\frac{29,469}{45,705}$ $\frac{45,705}{33,829}$ $\frac{37,049}{27,310}$ $\frac{41,300}{30,145}$ $\frac{30,962}{31,398}$ $\frac{45,442}{33,791}$ $\frac{42,838}{428,247}$	Time           0.00           0.01           0.00           0.01           0.00           0.01           0.00           0.01           0.03           0.00           0.01           0.03           0.00           0.01           0.06           0.00           0.01           0.06           0.00           0.01           0.02           0.02           0.01	$\begin{array}{c} {\rm GRASI} \\ {\rm C}_{\rm max} \\ {\rm 35,046} \\ {\rm 24,359} \\ {\rm 47,391} \\ {\rm 25,394} \\ {\rm 25,394} \\ {\rm 25,394} \\ {\rm 45,705} \\ {\rm 33,829} \\ {\rm 37,049} \\ {\rm 27,310} \\ {\rm 41,300} \\ {\rm 30,145} \\ {\rm 30,962} \\ {\rm 31,398} \\ {\rm 31,398} \\ {\rm 31,398} \\ {\rm 45,442} \\ {\rm 33,791} \\ {\rm 42,838} \\ {\rm 28,247} \end{array}$	P-RN Time 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 55.26 0.000 0.00	$\begin{array}{c} {\rm GRASI}\\ {\rm C}_{\rm max} \\ {\rm 35,046}\\ {\rm 24,359}\\ {\rm 47,391}\\ {\rm 25,394}\\ {\rm 25,394}\\ {\rm 25,394}\\ {\rm 45,705}\\ {\rm 33,829}\\ {\rm 37,049}\\ {\rm 27,310}\\ {\rm 41,300}\\ {\rm 30,145}\\ {\rm 30,962}\\ {\rm 31,398}\\ {\rm 31,398}\\ {\rm 31,398}\\ {\rm 45,442}\\ {\rm 33,791}\\ {\rm 42,8347} \end{array}$	$\begin{array}{c} \begin{array}{c} \text{P-CN} \\ \hline \text{Time} \\ \hline 0.00 \\ 0.00 \\ 0.14 \\ 0.00 \\ 0.25 \\ 14.81 \\ 0.16 \\ 0.00 \\ 0.05 \\ 64.48 \\ 0.01 \\ 0.00 \\ 0.00 \\ 19.85 \\ 13.56 \\ 0.00 \end{array}$	$\begin{array}{c} {\rm TS-I-}\\ \hline C_{\rm max} \\ {\rm 35,046} \\ {\rm 24,359} \\ {\rm 52,098} \\ {\rm 25,394} \\ {\rm 25,394} \\ {\rm 30,508} \\ {\rm 45,705} \\ {\rm 33,883} \\ {\rm 37,049} \\ {\rm 27,310} \\ {\rm 41,300} \\ {\rm 30,145} \\ {\rm 30,962} \\ {\rm 31,398} \\ {\rm 31,398} \\ {\rm 33,791} \\ {\rm 42,833,791} \\ {\rm 42,833,791} \\ {\rm 28,247} \end{array}$	Time           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.01           0.00           0.01           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00	Cmax           35,243           25,654           53,381           25,394           26,371           30,952           47,524           34,338           37,354           27,310           41,423           30,962           31,398           45,442           33,791           44,181           28,247	Time           0.00	$\frac{C_{\rm max}}{35,046}$ $\frac{35,046}{24,359}$ $\frac{47,391}{225,394}$ $\frac{25,394}{23,985}$ $\frac{29,469}{45,705}$ $\frac{45,705}{33,829}$ $\frac{37,049}{27,310}$ $\frac{41,300}{30,145}$ $\frac{30,962}{31,398}$ $\frac{45,442}{33,791}$ $\frac{42,838}{42,834}$	$\begin{array}{c} \hline \text{Time} \\ \hline 0.20 \\ 0.29 \\ 0.35 \\ 0.00 \\ 0.24 \\ 0.30 \\ 0.43 \\ 0.38 \\ 0.30 \\ 0.33 \\ 0.39 \\ 0.54 \\ 0.35 \\ 0.38 \\ 0.39 \\ 0.41 \\ 0.46 \\ 0.41 \\ \end{array}$
miniYFJS01 miniYFJS02 miniYFJS03 miniYFJS05 miniYFJS06 miniYFJS06 miniYFJS08 miniYFJS09 miniYFJS09 miniYFJS10 miniYFJS12 miniYFJS12 miniYFJS13 miniYFJS15 miniYFJS16 miniYFJS18 miniYFJS19	$\frac{C_{\rm max}}{35,046}$ $\frac{35,046}{24,359}$ $\frac{47,391}{47,391}$ $\frac{25,394}{23,985}$ $\frac{29,469}{33,829}$ $\frac{37,049}{27,310}$ $\frac{27,310}{30,145}$ $\frac{30,962}{31,398}$ $\frac{31,398}{45,442}$ $\frac{31,396}{33,791}$ $\frac{42,824}{42,8247}$ $\frac{28,247}{33,601}$	Time           0.00           0.01           0.00           0.00           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.02           0.01           0.02           0.01           0.02	$\frac{C_{\rm max}}{35,046}$ $\frac{35,046}{24,359}$ $\frac{47,391}{25,394}$ $\frac{25,394}{23,985}$ $\frac{29,469}{45,705}$ $\frac{45,705}{33,829}$ $\frac{37,049}{27,310}$ $\frac{27,310}{30,145}$ $\frac{30,962}{31,396}$ $\frac{31,396}{45,442}$ $\frac{33,791}{42,8247}$ $\frac{42,8247}{33,601}$	Time           0.00           0.01           0.00           0.01           0.00           0.01           0.05           0.03           0.00           0.01           0.05           0.03           0.00           0.01           0.02           0.01           0.05	$\begin{array}{c} {\rm GRASI}\\ \hline C_{\rm max} \\ 35,046 \\ 24,359 \\ 47,391 \\ 25,394 \\ 23,985 \\ 29,469 \\ 45,705 \\ 33,829 \\ 37,049 \\ 27,310 \\ 41,300 \\ 30,145 \\ 30,962 \\ 31,398 \\ 45,442 \\ 33,791 \\ 42,838 \\ 28,247 \\ 33,601 \\ \end{array}$	P-RN Time 0.00 0.00 0.00 0.00 0.00 0.35 0.01 0.00 0.01 0.00 55.26 0.00	$\begin{array}{c} {\rm GRASI}\\ \hline C_{\rm max} \\ 35,046 \\ 35,047 \\ 35,046 \\ 24,359 \\ 47,391 \\ 25,394 \\ 23,985 \\ 29,469 \\ 45,705 \\ 33,829 \\ 37,049 \\ 27,310 \\ 41,300 \\ 30,145 \\ 30,962 \\ 31,398 \\ 45,442 \\ 33,791 \\ 42,838 \\ 28,247 \\ 33,601 \\ \end{array}$	$\begin{array}{c} \text{P-CN} \\ \hline \text{Time} \\ \hline 0.00 \\ 0.00 \\ 0.00 \\ 0.14 \\ 0.00 \\ 0.25 \\ 14.81 \\ 0.16 \\ 0.00 \\ 0.00 \\ 0.05 \\ 64.48 \\ 0.01 \\ 0.00 \\ 0.00 \\ 19.85 \\ 13.56 \\ 0.00 \\ 0.01 \\ \end{array}$	$\begin{array}{c} {\rm TS-I-}\\ \hline C_{\rm max} \\ 35,046 \\ 24,359 \\ 52,098 \\ 25,394 \\ 23,985 \\ 30,508 \\ 45,705 \\ 33,883 \\ 37,049 \\ 27,310 \\ 41,300 \\ 30,145 \\ 30,962 \\ 31,398 \\ 45,442 \\ 33,791 \\ 42,838 \\ 28,247 \\ 33,601 \end{array}$	Time           0.00           0.01	$\begin{array}{c} C_{max} \\ 35,243 \\ 25,654 \\ 53,381 \\ \textbf{25},394 \\ 26,371 \\ 30,952 \\ 47,524 \\ 34,338 \\ 37,354 \\ \textbf{27,310} \\ \textbf{27,310} \\ \textbf{33,329} \\ \textbf{30,962} \\ \textbf{31,398} \\ \textbf{30,962} \\ \textbf{31,398} \\ \textbf{33,791} \\ \textbf{45,442} \\ \textbf{33,791} \\ \textbf{44,181} \\ \textbf{28,247} \end{array}$	Time 0.00	$\frac{C_{\rm max}}{35,046}$ $\frac{35,046}{24,359}$ $\frac{47,391}{47,391}$ $\frac{25,394}{23,985}$ $\frac{29,469}{33,829}$ $\frac{37,049}{27,310}$ $\frac{27,310}{30,145}$ $\frac{30,962}{31,398}$ $\frac{31,398}{45,442}$ $\frac{31,396}{33,791}$ $\frac{42,8247}{42,8247}$ $\frac{28,247}{33,601}$	$\begin{array}{c} \text{Time} \\ \hline 0.20 \\ 0.29 \\ 0.35 \\ 0.00 \\ 0.24 \\ 0.30 \\ 0.43 \\ 0.30 \\ 0.33 \\ 0.39 \\ 0.54 \\ 0.35 \\ 0.38 \\ 0.39 \\ 0.41 \\ 0.45 \\ 0.41 \\ 0.45 \\ \end{array}$
miniYFJS01 miniYFJS02 miniYFJS03 miniYFJS05 miniYFJS06 miniYFJS07 miniYFJS07 miniYFJS10 miniYFJS10 miniYFJS12 miniYFJS12 miniYFJS13 miniYFJS15 miniYFJS15 miniYFJS18 miniYFJS18 miniYFJS18 miniYFJS18 miniYFJS18	$\frac{C_{\rm max}}{35,046}$ $\frac{35,046}{24,359}$ $\frac{24,359}{47,391}$ $\frac{25,394}{23,985}$ $\frac{29,469}{37,049}$ $\frac{27,310}{41,300}$ $\frac{45,705}{33,829}$ $\frac{37,049}{27,310}$ $\frac{27,310}{41,300}$ $\frac{45,442}{33,791}$ $\frac{33,791}{33,681}$	Time 0.00 0.01 0.00 0.00 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.00	$\frac{C_{\rm max}}{35,046}$ $\frac{35,046}{24,359}$ $\frac{24,359}{47,391}$ $\frac{25,394}{23,985}$ $\frac{29,469}{33,829}$ $\frac{37,049}{27,310}$ $\frac{27,310}{41,300}$ $\frac{30,145}{30,962}$ $\frac{31,398}{45,442}$ $\frac{45,442}{33,791}$ $\frac{33,791}{33,681}$	Time 0.00 0.01 0.00 0.00 0.00 0.05 0.03 0.00 0.00 0.01 0.06 0.00 0.01 0.06 0.00 0.01 0.02 0.02 0.02 0.02 0.03 0.00	$\begin{array}{c} {\rm GRASI}\\ {\rm GRASI}\\ {\rm C}_{{\rm max}}\\ {\rm 35,046}\\ {\rm 24,359}\\ {\rm 47,391}\\ {\rm 25,394}\\ {\rm 23,985}\\ {\rm 29,469}\\ {\rm 45,705}\\ {\rm 33,829}\\ {\rm 37,049}\\ {\rm 27,310}\\ {\rm 41,300}\\ {\rm 30,145}\\ {\rm 30,964}\\ {\rm 31,398}\\ {\rm 45,442}\\ {\rm 33,791}\\ {\rm 33,791}\\ {\rm 33,601}\\ {\rm 30,837}\\ {\rm 30,837}\\ {\rm 30,637}\\ {\rm 30,637}\\ {\rm 30,637}\\ {\rm 30,837}\\ {\rm 10,100}\\ {\rm 10,10$	P-RN Time 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 55.26 0.000 0.00	$\begin{array}{c} {\rm GRASI} \\ {\rm GRASI} \\ {\rm C}_{max} \\ {\rm 35,046} \\ {\rm 24,359} \\ {\rm 47,391} \\ {\rm 25,394} \\ {\rm 23,985} \\ {\rm 29,469} \\ {\rm 45,705} \\ {\rm 33,829} \\ {\rm 37,049} \\ {\rm 27,310} \\ {\rm 30,145} \\ {\rm 30,963} \\ {\rm 31,398} \\ {\rm 45,442} \\ {\rm 33,791} \\ {\rm 33,398} \\ {\rm 45,888} \\ {\rm 28,247} \\ {\rm 33,601} \\ {\rm 30,837} \end{array}$	$\begin{array}{c} \text{P-CN}\\\hline \hline \text{Time}\\\hline 0.00\\ 0.00\\ 0.00\\ 0.14\\ 0.00\\ 0.25\\ 14.81\\ 0.16\\ 0.00\\ 0.00\\ 0.05\\ 64.48\\ 0.01\\ 0.00\\ 0.05\\ 64.48\\ 0.01\\ 0.00\\ 19.85\\ 13.56\\ 0.00\\ 0.01\\ 0.00\\ \end{array}$	$\begin{array}{c} {\rm TS-I-}\\ \hline C_{\rm max} \\ 35,046 \\ 24,359 \\ 52,098 \\ 25,394 \\ 23,985 \\ 30,508 \\ 45,705 \\ 33,883 \\ 37,049 \\ 27,310 \\ 27,310 \\ 30,145 \\ 30,963 \\ 143,308 \\ 45,442 \\ 33,791 \\ 33,398 \\ 45,842 \\ 33,791 \\ 33,601 \\ 30,837 \\ 30,837 \\ \end{array}$	RN           Time           0.00           0.01           0.02	Cmax           35,243           25,654           53,381           25,394           26,371           30,952           47,524           34,338           37,354           27,310           41,423           33,329           30,962           31,398           45,442           33,791           33,791           33,797           33,796           33,796           33,385	Time 0.00	$\frac{C_{\rm max}}{35,046}$ $\frac{35,046}{24,359}$ $\frac{24,359}{47,391}$ $\frac{25,394}{23,985}$ $\frac{29,469}{33,829}$ $\frac{37,049}{27,310}$ $\frac{27,310}{41,300}$ $\frac{30,962}{31,398}$ $\frac{45,442}{33,791}$ $\frac{33,791}{33,681}$	$\begin{array}{c} \text{Time} \\ \hline 0.20 \\ 0.29 \\ 0.35 \\ 0.00 \\ 0.24 \\ 0.30 \\ 0.43 \\ 0.38 \\ 0.30 \\ 0.33 \\ 0.39 \\ 0.54 \\ 0.35 \\ 0.38 \\ 0.39 \\ 0.41 \\ 0.46 \\ 0.41 \\ 0.45 \\ 0.41 \\ \end{array}$
miniYFJS01 miniYFJS02 miniYFJS03 miniYFJS05 miniYFJS05 miniYFJS06 miniYFJS07 miniYFJS07 miniYFJS09 miniYFJS10 miniYFJS12 miniYFJS12 miniYFJS15 miniYFJS15 miniYFJS15 miniYFJS18 miniYFJS18 miniYFJS18 miniYFJS18 miniYFJS19 miniYFJS20	$\frac{C_{\rm max}}{35,046}$ $\frac{35,046}{24,359}$ $\frac{23,985}{29,469}$ $\frac{23,985}{37,049}$ $\frac{37,049}{27,310}$ $\frac{37,049}{30,145}$ $\frac{30,145}{30,962}$ $\frac{31,398}{45,442}$ $\frac{31,398}{33,791}$ $\frac{42,838}{42,838}$ $\frac{82,247}{33,601}$ $\frac{30,837}{37,096}$	Time           0.00           0.01           0.00           0.00           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.00           0.02           0.01           0.00           0.74	$\frac{C_{\rm max}}{35,046}$ $\frac{35,046}{24,359}$ $\frac{23,985}{29,469}$ $\frac{23,985}{37,049}$ $\frac{37,049}{27,310}$ $\frac{37,049}{30,145}$ $\frac{30,145}{30,962}$ $\frac{31,398}{45,442}$ $\frac{31,398}{33,791}$ $\frac{42,838}{42,838}$ $\frac{82,247}{33,601}$ $\frac{30,837}{37,096}$	Time           0.00           0.01           0.00           0.01           0.00           0.01           0.05           0.03           0.00           0.01           0.05           0.03           0.00           0.01           0.06           0.00           0.01           0.06           0.00           0.01           0.02           0.02           0.01           0.02           0.01           0.02           0.01           0.02           0.01           0.034	$\begin{array}{c} {\rm GRASI}\\ {\rm C}_{\rm max} \\ {\rm 35,046}\\ {\rm 24,359}\\ {\rm 47,391}\\ {\rm 25,394}\\ {\rm 23,985}\\ {\rm 29,469}\\ {\rm 45,705}\\ {\rm 33,829}\\ {\rm 37,049}\\ {\rm 27,310}\\ {\rm 41,300}\\ {\rm 30,145}\\ {\rm 30,962}\\ {\rm 31,398}\\ {\rm 45,442}\\ {\rm 33,791}\\ {\rm 42,838}\\ {\rm 45,442}\\ {\rm 33,791}\\ {\rm 42,838}\\ {\rm 45,442}\\ {\rm 33,791}\\ {\rm 42,838}\\ {\rm 45,442}\\ {\rm 33,791}\\ {\rm 30,837}\\ {\rm 37,308}\\ \end{array}$	P-RN Time 0.00	$\begin{array}{c} {\rm GRASI}\\ {\rm C}_{\rm max} \\ {\rm 35,046}\\ {\rm 24,359}\\ {\rm 47,391}\\ {\rm 25,394}\\ {\rm 23,985}\\ {\rm 29,469}\\ {\rm 45,705}\\ {\rm 33,829}\\ {\rm 37,049}\\ {\rm 27,310}\\ {\rm 41,300}\\ {\rm 30,145}\\ {\rm 30,962}\\ {\rm 31,398}\\ {\rm 45,442}\\ {\rm 33,791}\\ {\rm 42,838}\\ {\rm 42,838}\\ {\rm 42,8348}\\ {\rm 28,247}\\ {\rm 33,601}\\ {\rm 30,837}\\ {\rm 37,275} \end{array}$	$\begin{array}{c} \begin{array}{c} \text{P-CN} \\ \hline \text{Time} \\ \hline 0.00 \\ 0.00 \\ 0.14 \\ 0.00 \\ 0.25 \\ 14.81 \\ 0.16 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 19.85 \\ 0.01 \\ 0.00 \\ 0.00 \\ 13.56 \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.23 \end{array}$	$\begin{array}{c} {\rm TS-I-}\\ \hline C_{\rm max} \\ 35,046 \\ 24,359 \\ 52,098 \\ 25,394 \\ 23,985 \\ 30,508 \\ 45,705 \\ 33,883 \\ 37,049 \\ 27,310 \\ 41,300 \\ 30,145 \\ 30,962 \\ 31,398 \\ 45,442 \\ 33,791 \\ 42,838 \\ 45,442 \\ 33,791 \\ 42,838 \\ 45,442 \\ 33,601 \\ 30,837 \\ 37,096 \\ 31,000 \\ 37,096 $	Image: Normal Stress           0.00           0.01           0.02           0.41	Cmax           35,243           25,654           53,381           25,394           26,371           30,952           47,524           37,354           27,310           41,423           33,329           30,962           31,398           45,442           33,791           44,181           28,247           36,706           33,385           37,275	Time 0.00	$\frac{C_{\rm max}}{35,046}$ $\frac{35,046}{24,359}$ $\frac{23,985}{29,469}$ $\frac{23,985}{37,049}$ $\frac{27,310}{30,145}$ $\frac{30,962}{31,398}$ $\frac{45,442}{33,791}$ $\frac{42,838}{42,838}$ $\frac{28,247}{33,601}$ $\frac{37,308}{37,308}$	$\begin{array}{c} \text{Time} \\ \hline 0.20 \\ 0.29 \\ 0.30 \\ 0.00 \\ 0.24 \\ 0.30 \\ 0.33 \\ 0.38 \\ 0.30 \\ 0.33 \\ 0.39 \\ 0.54 \\ 0.35 \\ 0.38 \\ 0.39 \\ 0.54 \\ 0.41 \\ 0.46 \\ 0.41 \\ 0.41 \\ 70.41 \end{array}$
miniYFJS01 miniYFJS03 miniYFJS03 miniYFJS05 miniYFJS05 miniYFJS05 miniYFJS08 miniYFJS08 miniYFJS10 miniYFJS10 miniYFJS12 miniYFJS13 miniYFJS13 miniYFJS15 miniYFJS16 miniYFJS16 miniYFJS18 miniYFJS18 miniYFJS18 miniYFJS19 miniYFJS20	$\frac{C_{\rm max}}{35,046}$ $\frac{35,046}{24,359}$ $\frac{24,359}{23,985}$ $\frac{23,985}{229,469}$ $\frac{45,705}{33,829}$ $\frac{37,049}{27,310}$ $\frac{41,300}{30,145}$ $\frac{30,962}{31,398}$ $\frac{45,442}{33,791}$ $\frac{42,838}{28,247}$ $\frac{28,248}{33,601}$ $\frac{30,837}{37,086}$ $\frac{34,282}{34,282}$	Time           0.00           0.01           0.00           0.00           0.00           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.02           0.01           0.02           0.01           0.02           0.01           0.02           0.03	$\frac{C_{\rm max}}{35,046}$ 24,359 47,391 25,394 23,985 23,985 23,985 23,985 23,704 41,300 30,145 30,145 30,962 31,398 45,442 33,791 42,838 28,247 33,791 42,838 28,247 33,601 30,837 37,096	Time 0.00 0.01 0.01 0.00 0.00 0.01 0.05 0.00 0.01 0.00 0.01 0.00 0.01 0.00 0.01 0.00 0.01 0.00 0.01 0.00 0.01 0.00 0.01 0.00 0.01 0.00 0.01 0.00 0.00 0.01 0.00 0.02 0.03	$\begin{array}{c} {\rm GRASI} \\ {\rm GRASI} \\ {\rm C}_{max} \\ {\rm 35,046} \\ {\rm 24,359} \\ {\rm 47,391} \\ {\rm 23,985} \\ {\rm 29,469} \\ {\rm 33,829} \\ {\rm 37,049} \\ {\rm 27,310} \\ {\rm 41,300} \\ {\rm 30,962} \\ {\rm 27,310} \\ {\rm 41,300} \\ {\rm 30,145} \\ {\rm 30,962} \\ {\rm 31,398} \\ {\rm 45,442} \\ {\rm 33,791} \\ {\rm 42,838} \\ {\rm 28,247} \\ {\rm 33,601} \\ {\rm 30,837} \\ {\rm 37,308} \\ {\rm 34,282} \end{array}$	P-RN Time 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.01 0.00 0.00 0.01 0.00	$\begin{array}{c} {\rm GRASI} \\ {\rm Grass} \\ {\rm C}_{max} \\ {\rm 35,046} \\ {\rm 24,359} \\ {\rm 47,391} \\ {\rm 25,394} \\ {\rm 25,394} \\ {\rm 23,985} \\ {\rm 29,469} \\ {\rm 23,985} \\ {\rm 29,469} \\ {\rm 33,829} \\ {\rm 37,049} \\ {\rm 27,310} \\ {\rm 41,300} \\ {\rm 30,145} \\ {\rm 30,962} \\ {\rm 31,398} \\ {\rm 45,442} \\ {\rm 33,791} \\ {\rm 42,838} \\ {\rm 28,247} \\ {\rm 33,601} \\ {\rm 30,837} \\ {\rm 37,275} \\ {\rm 34,282} \end{array}$	P-CN Time 0.00 0.14 0.00 0.25 14.81 0.06 0.00 0.05 64.48 0.01 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.02 14.81 0.00 0.00 0.00 0.00 0.00 0.25 14.81 0.00 0.00 0.00 0.00 0.25 14.81 0.00 0.00 0.00 0.00 0.25 14.81 0.00 0.00 0.00 0.00 0.05 14.81 0.00	$\begin{array}{c} {\rm TS-I}\\ \hline \\ C_{\rm max}\\ 35,046\\ 24,359\\ 52,098\\ 25,394\\ 23,985\\ 30,508\\ 45,705\\ 33,883\\ 37,049\\ 27,310\\ 41,300\\ 30,145\\ 30,962\\ 27,310\\ 41,300\\ 30,145\\ 30,962\\ 31,398\\ 45,442\\ 33,791\\ 42,838\\ 28,247\\ 33,601\\ 30,837\\ 37,096\\ 31,282\\ 24,282\\ 33,601\\ 30,837\\ 37,096\\ 34,282$	RN           Time           0.00           0.01           0.02           0.041           0.00	Cmax           35,243           25,654           53,381           25,394           26,371           30,952           47,524           37,354           27,310           41,423           33,329           30,962           31,398           45,442           36,706           36,706           33,855           37,275	Time 0.00	$\frac{C_{\rm max}}{35,046}$ $\frac{35,046}{24,359}$ $\frac{24,359}{23,985}$ $\frac{29,469}{45,705}$ $\frac{33,829}{37,049}$ $\frac{37,049}{27,310}$ $\frac{41,300}{30,145}$ $\frac{30,962}{31,398}$ $\frac{45,442}{33,791}$ $\frac{42,838}{28,247}$ $\frac{28,286}{33,601}$ $\frac{30,837}{37,308}$ $\frac{34,282}{34,282}$	$\begin{array}{c} \text{Time} \\ \hline 0.20 \\ 0.29 \\ 0.35 \\ 0.00 \\ 0.24 \\ 0.30 \\ 0.33 \\ 0.38 \\ 0.30 \\ 0.33 \\ 0.39 \\ 0.54 \\ 0.35 \\ 0.38 \\ 0.39 \\ 0.41 \\ 0.46 \\ 0.41 \\ 0.45 \\ 0.41 \\ 0.48 \\ \end{array}$
miniYFJS01 miniYFJS02 miniYFJS03 miniYFJS05 miniYFJS06 miniYFJS06 miniYFJS07 miniYFJS08 miniYFJS10 miniYFJS10 miniYFJS11 miniYFJS12 miniYFJS15 miniYFJS15 miniYFJS15 miniYFJS18 miniYFJS18 miniYFJS17 miniYFJS18 miniYFJS19 miniYFJS20 miniYFJS20 miniYFJS21	$\frac{C_{\rm max}}{35,046}$ $\frac{35,046}{24,359}$ $\frac{24,359}{47,391}$ $\frac{25,394}{23,995}$ $\frac{29,469}{37,049}$ $\frac{27,310}{37,049}$ $\frac{27,310}{41,300}$ $\frac{30,962}{31,398}$ $\frac{45,442}{42,079}$ $\frac{34,282}{42,079}$	$\begin{array}{c} {\rm Time} \\ \hline 0.00 \\ 0.01 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.01 \\ 0.01 \\ 0.01 \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.11 \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.00 \\ 0.02 \\ 0.01 \\ 0.00 \\ 0.02 \\ 0.01 \\ 0.00 \\ 0.02 \\ 0.01 \\ 0.04 \\ 0.03 \\ 0.04 \\ 0.03 \\ 0.04 \\ \end{array}$	$\frac{C_{\rm max}}{35,046}$ $\frac{35,046}{24,359}$ $\frac{47,391}{25,394}$ $\frac{23,995}{23,985}$ $\frac{29,469}{37,049}$ $\frac{27,310}{37,049}$ $\frac{27,310}{41,300}$ $\frac{30,962}{31,398}$ $\frac{45,442}{42,838}$ $\frac{28,247}{33,691}$ $\frac{30,887}{37,096}$ $\frac{34,282}{42,079}$	Time           0.00           0.01           0.01           0.01           0.01           0.00           0.01           0.02           0.03           0.00           0.01           0.05           0.03           0.00           0.01           0.02           0.02           0.03           0.04           0.05           0.04           0.03           0.04           0.05           0.04           0.05           0.04           0.05           0.04	$\begin{array}{c} {\rm GRASI}\\ {\rm C}_{{\rm max}}\\ {\rm 35,046}\\ {\rm 24,359}\\ {\rm 47,391}\\ {\rm 25,394}\\ {\rm 23,985}\\ {\rm 29,469}\\ {\rm 45,705}\\ {\rm 33,829}\\ {\rm 37,049}\\ {\rm 27,310}\\ {\rm 41,300}\\ {\rm 30,145}\\ {\rm 30,962}\\ {\rm 31,398}\\ {\rm 45,442}\\ {\rm 33,791}\\ {\rm 31,398}\\ {\rm 45,838}\\ {\rm 28,247}\\ {\rm 33,601}\\ {\rm 30,837}\\ {\rm 37,308}\\ {\rm 34,282}\\ {\rm 42,079}\\ {\rm 42,079}\\ {\rm 42,079}\\ {\rm 10,120}\\ {\rm 10,1$	P-RN Time 0.00	$\begin{array}{c} \text{GRASI}\\ \hline \\ C_{\text{max}}\\ \hline \\ 35,046\\ 24,359\\ 47,391\\ 25,394\\ 23,985\\ 29,469\\ 45,705\\ 33,829\\ 37,049\\ 27,310\\ 41,300\\ 30,145\\ 30,962\\ 31,398\\ 45,442\\ 33,791\\ 31,398\\ 45,442\\ 33,791\\ 31,398\\ 45,828\\ 28,247\\ 33,601\\ 30,837\\ 37,275\\ 34,282\\ 42,079\\ \end{array}$	P-CN Time 0.00 0.14 0.00 0.25 14.81 0.16 0.00 0.00 0.05 64.48 0.01 0.00 0.00 13.56 0.00 0.0	$\begin{array}{c} {\rm TS-I-}\\ \hline C_{\rm max} \\ 35,046 \\ 24,359 \\ 52,098 \\ 25,394 \\ 23,985 \\ 30,508 \\ 45,705 \\ 33,883 \\ 37,049 \\ 27,310 \\ 41,300 \\ 30,145 \\ 30,962 \\ 31,398 \\ 45,442 \\ 33,791 \\ 42,838 \\ 28,247 \\ 33,601 \\ 30,837 \\ 37,096 \\ 34,282 \\ 42,079 \\ 34,282 \\ 42,079 \\ \end{array}$	RN           Time           0.00           0.01	Cmax           35,243           25,654           53,381           25,394           26,371           30,952           47,524           34,338           37,354           27,310           41,423           33,329           30,962           31,398           45,422           33,791           44,181           28,247           36,385           37,275           34,917	Time 0.00	$\frac{C_{\rm max}}{35,046}$ $\frac{35,046}{24,359}$ $\frac{24,359}{23,985}$ $\frac{23,995}{29,469}$ $\frac{29,469}{37,049}$ $\frac{27,310}{37,049}$ $\frac{45,705}{33,7049}$ $\frac{37,049}{27,310}$ $\frac{31,398}{45,442}$ $\frac{45,442}{33,791}$ $\frac{33,791}{42,838}$ $\frac{28,247}{33,0837}$ $\frac{37,308}{34,282}$ $\frac{42,079}{42,079}$	$\begin{array}{c} \text{Time} \\ \hline 0.20 \\ 0.29 \\ 0.30 \\ 0.00 \\ 0.24 \\ 0.30 \\ 0.43 \\ 0.38 \\ 0.30 \\ 0.33 \\ 0.39 \\ 0.54 \\ 0.35 \\ 0.39 \\ 0.54 \\ 0.35 \\ 0.39 \\ 0.41 \\ 0.46 \\ 0.41 \\ 0.45 \\ 0.41 \\ 70.41 \\ 0.48 \\ 0.51 \\ \end{array}$
miniYFJS01 miniYFJS02 miniYFJS03 miniYFJS05 miniYFJS05 miniYFJS06 miniYFJS07 miniYFJS07 miniYFJS07 miniYFJS10 miniYFJS11 miniYFJS11 miniYFJS12 miniYFJS15 miniYFJS15 miniYFJS15 miniYFJS18 miniYFJS18 miniYFJS20 miniYFJS22 miniYFJS22	$\frac{C_{\rm max}}{35,046}$ $\frac{35,046}{24,359}$ $\frac{47,391}{25,394}$ $\frac{23,985}{33,829}$ $\frac{45,705}{33,829}$ $\frac{37,049}{27,310}$ $\frac{41,300}{30,145}$ $\frac{30,962}{31,398}$ $\frac{31,398}{45,442}$ $\frac{45,442}{33,791}$ $\frac{45,442}{33,791}$ $\frac{45,442}{33,791}$ $\frac{45,442}{33,791}$ $\frac{45,442}{33,791}$ $\frac{45,442}{33,791}$ $\frac{45,442}{33,791}$ $\frac{45,442}{33,601}$ $\frac{30,955}{30,905}$	Time           0.00           0.11           0.00           0.01           0.00           0.00           0.01           0.00           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.00           0.02           0.01           0.04           0.04           0.04           0.04           0.04           0.04	Cmax           35,046           24,359           47,391           25,394           23,985           29,469           45,705           33,829           37,049           27,310           41,300           30,145           30,962           31,398           28,247           33,601           30,837           37,096           34,282           42,095	Time           0.00           0.01           0.01           0.01           0.01           0.01           0.01           0.02           0.03           0.00           0.01           0.03           0.00           0.01           0.06           0.00           0.01           0.02           0.02           0.05           0.05           0.04           0.03           0.04           0.05           0.02           0.03           0.04           0.05           0.05           0.05           0.02           0.03	$\begin{array}{c} {\rm GRASI}\\ {\rm C}_{\rm max}\\ {\rm 35,046}\\ {\rm 24,359}\\ {\rm 47,391}\\ {\rm 25,394}\\ {\rm 23,985}\\ {\rm 29,469}\\ {\rm 45,705}\\ {\rm 33,829}\\ {\rm 37,049}\\ {\rm 27,310}\\ {\rm 30,145}\\ {\rm 30,962}\\ {\rm 31,398}\\ {\rm 45,442}\\ {\rm 33,791}\\ {\rm 42,838}\\ {\rm 82,247}\\ {\rm 33,601}\\ {\rm 30,837}\\ {\rm 37,308}\\ {\rm 34,282}\\ {\rm 42,079}\\ {\rm 30,965}\\ {\rm 30,967}\\ {\rm 30,967$	P-RN Time 0.00	$\begin{array}{c} {\rm GRASI}\\ {\rm C}_{\rm max} \\ {\rm 35,046}\\ {\rm 24,359}\\ {\rm 47,391}\\ {\rm 25,394}\\ {\rm 23,985}\\ {\rm 29,469}\\ {\rm 45,705}\\ {\rm 33,829}\\ {\rm 37,049}\\ {\rm 27,310}\\ {\rm 30,145}\\ {\rm 30,962}\\ {\rm 31,398}\\ {\rm 45,442}\\ {\rm 33,791}\\ {\rm 42,838}\\ {\rm 82,247}\\ {\rm 33,601}\\ {\rm 30,837}\\ {\rm 37,275}\\ {\rm 34,282}\\ {\rm 42,079}\\ {\rm 30,905} \end{array}$	P-CN Time 0.00 0.00 0.00 0.00 0.00 0.00 0.00 14.81 0.00 0.00 0.05 64.48 0.01 0.00 0.00 0.05 13.56 0.00 0.0	$\begin{array}{c} {\rm TS-I-}\\ \hline C_{\rm max} \\ 35,046 \\ 24,359 \\ 52,098 \\ 25,394 \\ 23,985 \\ 30,508 \\ 45,705 \\ 33,883 \\ 37,049 \\ 27,310 \\ 41,300 \\ 30,145 \\ 30,962 \\ 31,398 \\ 45,442 \\ 33,791 \\ 42,838 \\ 28,247 \\ 33,601 \\ 30,837 \\ 7,966 \\ 34,282 \\ 42,079 \\ 30,905 \end{array}$	RN           Time           0.00           0.01           0.02           0.41	Cmax           35,243           25,654           53,381           26,371           30,952           47,524           37,354           37,354           27,310           41,423           33,329           30,962           31,398           33,354           26,706           33,355           37,275           34,917           42,079           33,144	Time 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	$\frac{C_{\rm max}}{35,046}$ $\frac{35,046}{24,359}$ $\frac{47,391}{25,394}$ $\frac{23,985}{33,829}$ $\frac{45,705}{33,829}$ $\frac{37,049}{27,310}$ $\frac{41,300}{30,145}$ $\frac{30,962}{31,398}$ $\frac{31,398}{45,442}$ $\frac{45,442}{33,791}$ $\frac{45,442}{33,791}$ $\frac{42,832}{45,442}$ $\frac{33,601}{30,837}$ $\frac{34,282}{42,079}$ $\frac{42,079}{30,905}$	$\begin{array}{c} \text{Time} \\ \hline 0.20 \\ 0.29 \\ 0.35 \\ 0.00 \\ 0.24 \\ 0.30 \\ 0.43 \\ 0.38 \\ 0.33 \\ 0.33 \\ 0.39 \\ 0.54 \\ 0.35 \\ 0.38 \\ 0.39 \\ 0.41 \\ 0.46 \\ 0.41 \\ 0.41 \\ 0.48 \\ 0.56 \\ 0.56 \\ \end{array}$
miniYFJS01 miniYFJS03 miniYFJS03 miniYFJS05 miniYFJS06 miniYFJS06 miniYFJS08 miniYFJS08 miniYFJS11 miniYFJS11 miniYFJS13 miniYFJS13 miniYFJS16 miniYFJS16 miniYFJS18 miniYFJS18 miniYFJS19 miniYFJS21 miniYFJS23 miniYFJS23 miniYFJS23	$\frac{C_{\rm max}}{35,046}$ $\frac{35,046}{24,359}$ $\frac{24,359}{23,985}$ $\frac{29,469}{27,310}$ $\frac{47,391}{45,705}$ $\frac{37,049}{27,310}$ $\frac{41,300}{30,145}$ $\frac{30,145}{30,962}$ $\frac{31,398}{33,791}$ $\frac{42,838}{45,442}$ $\frac{28,287}{33,601}$ $\frac{30,837}{37,096}$ $\frac{31,282}{42,079}$ $\frac{36,170}{36,917}$	Time           0.00           0.01           0.00           0.00           0.00           0.00           0.00           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.00           0.01           0.02           0.01           0.04           0.03           0.474           0.03           0.04           0.10	$\begin{array}{c} C_{\rm max} \\ 35,046 \\ 24,359 \\ 47,391 \\ 25,394 \\ 23,985 \\ 23,985 \\ 23,985 \\ 23,985 \\ 33,829 \\ 37,049 \\ 27,310 \\ 41,300 \\ 30,145 \\ 30,962 \\ 31,398 \\ 45,442 \\ 30,145 \\ 30,962 \\ 31,398 \\ 45,442 \\ 42,838 \\ 28,247 \\ 33,601 \\ 30,837 \\ 37,096 \\ 42,838 \\ 28,247 \\ 42,079 \\ 30,905 \\ 36,170 \end{array}$	Time           0.00           0.01           0.00           0.01           0.00           0.01           0.00           0.01           0.05           0.03           0.00           0.01           0.02           0.02           0.01           0.05           0.03           0.02           0.01           0.05           0.03           0.02           0.03           0.03           0.02           0.03           0.03           0.04           0.03	$\begin{array}{c} {\rm GRASI} \\ {\rm GRASI} \\ {\rm C}_{max} \\ {\rm 35,046} \\ {\rm 24,359} \\ {\rm 47,391} \\ {\rm 23,985} \\ {\rm 29,469} \\ {\rm 23,985} \\ {\rm 29,469} \\ {\rm 23,985} \\ {\rm 29,469} \\ {\rm 33,829} \\ {\rm 37,049} \\ {\rm 27,310} \\ {\rm 41,300} \\ {\rm 30,962} \\ {\rm 31,398} \\ {\rm 45,442} \\ {\rm 33,791} \\ {\rm 42,838} \\ {\rm 28,247} \\ {\rm 33,601} \\ {\rm 30,837} \\ {\rm 37,308} \\ {\rm 34,282} \\ {\rm 42,079} \\ {\rm 30,965} \\ {\rm 36,170} \end{array}$	P-RN Time 0.00	$\begin{array}{c} {\rm GRASI} \\ {\rm Grax} \\ {\rm Z}_{max} \\ {\rm Z}_{5,394} \\ {\rm 2}_{3,985} \\ {\rm 2}_{9,469} \\ {\rm 2}_{3,985} \\ {\rm 2}_{9,469} \\ {\rm 2}_{3,985} \\ {\rm 2}_{9,369} \\ {\rm 3}_{7,394} \\ {\rm 4}_{5,705} \\ {\rm 3}_{3,829} \\ {\rm 3}_{7,049} \\ {\rm 2}_{7,310} \\ {\rm 4}_{1,300} \\ {\rm 3}_{0,145} \\ {\rm 3}_{0,962} \\ {\rm 3}_{1,398} \\ {\rm 4}_{5,442} \\ {\rm 3}_{3,791} \\ {\rm 4}_{2,838} \\ {\rm 2}_{8,247} \\ {\rm 3}_{3,601} \\ {\rm 3}_{0,837} \\ {\rm 3}_{7,275} \\ {\rm 3}_{4,282} \\ {\rm 4}_{2,079} \\ {\rm 3}_{0,905} \\ {\rm 3}_{6,170} \end{array}$	P-CN Time 0.00 0.00 0.00 0.00 0.00 0.00 0.00 14.81 0.06 0.00 0.05 64.48 0.01 13.56 64.48 0.00 19.85 13.56 0.00 0.00 0.00 0.00 0.00 13.55 53.76 1.25	$\begin{array}{c} {\rm TS-I}\\ \hline \\ C_{\rm max}\\ 35,046\\ 24,359\\ 52,098\\ 25,394\\ 23,985\\ 30,508\\ 45,705\\ 33,883\\ 37,049\\ 27,310\\ 41,300\\ 30,145\\ 30,962\\ 27,310\\ 41,300\\ 30,145\\ 30,962\\ 31,398\\ 45,442\\ 33,791\\ 42,838\\ 28,247\\ 33,601\\ 30,837\\ 37,096\\ 33,601\\ 30,837\\ 37,096\\ 34,282\\ 42,079\\ 30,905\\ 36,170\\ \end{array}$	RN           Time           0.00           0.01           0.02           0.03	Cmax           35,243           25,654           53,381           25,394           26,371           30,952           47,524           37,354           27,310           41,423           33,329           30,962           31,398           45,442           36,706           33,385           37,275           34,917           42,079           33,124	Time           0.00	$\frac{C_{\rm max}}{35,046}$ $\frac{35,046}{24,359}$ $\frac{47,391}{25,394}$ $\frac{23,985}{229,469}$ $\frac{45,705}{33,829}$ $\frac{37,049}{27,310}$ $\frac{41,300}{30,145}$ $\frac{30,145}{30,962}$ $\frac{31,398}{33,791}$ $\frac{42,838}{42,838}$ $\frac{28,247}{37,308}$ $\frac{42,079}{30,905}$ $\frac{36,170}{36,170}$	$\begin{array}{c} \hline {\rm Time} \\ \hline 0.20 \\ 0.29 \\ 0.35 \\ 0.00 \\ 0.41 \\ 0.38 \\ 0.30 \\ 0.43 \\ 0.38 \\ 0.30 \\ 0.43 \\ 0.33 \\ 0.54 \\ 0.39 \\ 0.54 \\ 0.39 \\ 0.54 \\ 0.39 \\ 0.46 \\ 0.41 \\ 0.45 \\ 0.41 \\ 0.45 \\ 0.41 \\ 0.45 \\ 0.41 \\ 0.45 \\ 0.41 \\ 0.45 \\ 0.41 \\ 0.45 \\ 0.41 \\ 0.45 \\ 0.41 \\ 0.45 \\ 0.41 \\ 0.45 \\ 0.41 \\ 0.45 \\ 0.41 \\ 0.45 \\ 0.56 \\ 0.94 \\ 0$
miniYFJS01 miniYFJS02 miniYFJS03 miniYFJS05 miniYFJS06 miniYFJS07 miniYFJS08 miniYFJS08 miniYFJS10 miniYFJS12 miniYFJS12 miniYFJS13 miniYFJS15 miniYFJS15 miniYFJS15 miniYFJS15 miniYFJS15 miniYFJS12 miniYFJS12 miniYFJS20 miniYFJS21 miniYFJS23 miniYFJS23 miniYFJS24 miniYFJS24 miniYFJS26	$\frac{C_{\rm max}}{35,046}$ $\frac{35,046}{24,359}$ $\frac{47,391}{25,394}$ $\frac{23,985}{23,985}$ $\frac{29,469}{45,705}$ $\frac{37,049}{37,049}$ $\frac{37,049}{30,145}$ $\frac{30,962}{31,398}$ $\frac{45,442}{42,838}$ $\frac{28,247}{33,601}$ $\frac{33,601}{30,837}$ $\frac{37,096}{34,282}$ $\frac{34,282}{42,079}$ $\frac{30,905}{36,1705}$ $\frac{36,170}{51,466}$	$\begin{array}{c} \hline {\rm Time} \\ \hline 0.00 \\ 0.01 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.01 \\ 0.01 \\ 0.01 \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.02 \\ 0.01 \\ 0.00 \\ 0.04 \\ 0.04 \\ 0.11 \\ 0.10 \\ 0.01 \\ 0.00 \\ 0.01 \\ 0.01 \\ 0.01 \\ 0.01 \\ 0.01 \\ 0.01 \\ 0.00 \\ 0.01 \\ 0.01 \\ 0.00 \\ 0.01 \\ 0.01 \\ 0.01 \\ 0.01 \\ 0.01 \\ 0.01 \\ 0.01 \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.00 \\ 0.01 \\ 0.00 \\ 0$	$\frac{C_{\rm max}}{35,046}$ $\frac{35,046}{24,359}$ $\frac{23,985}{23,985}$ $\frac{23,985}{23,985}$ $\frac{23,985}{33,829}$ $\frac{37,049}{37,049}$ $\frac{45,705}{33,829}$ $\frac{37,049}{31,300}$ $\frac{41,300}{30,145}$ $\frac{30,962}{33,7911}$ $\frac{42,838}{28,247}$ $\frac{33,601}{30,837}$ $\frac{37,096}{34,282}$ $\frac{34,282}{42,079}$ $\frac{30,905}{36,170}$ $\frac{36,170}{51,466}$	Time           0.00           0.01           0.00           0.01           0.00           0.01           0.00           0.01           0.00           0.01           0.05           0.03           0.00           0.01           0.02           0.01           0.02           0.03           0.04           0.05           0.03           0.04           0.03           0.04           0.03           0.04           0.05           0.03           0.04           0.05           0.03           0.04           0.05           0.05           0.04           0.05           0.13           0.02	$\begin{array}{c} {\rm GRASI}\\ {\rm \hline GRASI}\\ {\rm \hline C_{max}}\\ {\rm \hline 35,046}\\ {\rm 24,359}\\ {\rm 47,391}\\ {\rm 25,394}\\ {\rm 23,985}\\ {\rm 29,469}\\ {\rm 45,705}\\ {\rm 33,829}\\ {\rm 37,049}\\ {\rm 27,310}\\ {\rm 41,300}\\ {\rm 30,145}\\ {\rm 30,962}\\ {\rm 33,791}\\ {\rm 30,837}\\ {\rm 37,308}\\ {\rm 34,282}\\ {\rm 42,079}\\ {\rm 30,965}\\ {\rm 36,170}\\ {\rm 51,466}\\ {\rm 51,466}\\ {\rm 71,016}\\ {\rm 10,100}\\ {\rm 10,$	P-RN Time 0.00 0.00 0.00 0.00 0.00 0.00 0.01 0.00	$\begin{array}{c} {\rm GRASI}\\ {\rm C}_{{\rm max}}\\ {\rm 35,046}\\ {\rm 24,359}\\ {\rm 47,391}\\ {\rm 25,394}\\ {\rm 23,985}\\ {\rm 29,469}\\ {\rm 45,705}\\ {\rm 33,829}\\ {\rm 37,049}\\ {\rm 27,310}\\ {\rm 41,300}\\ {\rm 30,145}\\ {\rm 30,962}\\ {\rm 31,398}\\ {\rm 45,442}\\ {\rm 33,791}\\ {\rm 31,398}\\ {\rm 45,442}\\ {\rm 33,791}\\ {\rm 33,601}\\ {\rm 30,837}\\ {\rm 37,275}\\ {\rm 34,282}\\ {\rm 42,079}\\ {\rm 30,905}\\ {\rm 36,170}\\ {\rm 51,466}\\ {\rm 75,166}\\ {\rm 75,1466}\\ {\rm 75,166}\\ {\rm 75,1466}\\ {\rm 75,166}\\ {\rm 75,1466}\\ {\rm 75,166}\\ {\rm 75,166}\\ {\rm 75,166}\\ {\rm 75,166}\\ {\rm 75,166}\\ {\rm 75,166}\\ {\rm 15,1466}\\ {\rm 75,166}\\ {\rm $	$\begin{array}{c} \text{P-CN} \\ \hline \text{Time} \\ 0.00 \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.025 \\ 14.81 \\ 0.16 \\ 0.00 \\ 0.05 \\ 64.48 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.03 \\ 88.95 \\ 53.76 \\ 1.25 \\ 53.76 \\ 1.23 \end{array}$	$\begin{array}{c} {\rm TS-I-}\\ \hline C_{\rm max} \\ 35,046 \\ 24,359 \\ 52,098 \\ 25,394 \\ 23,985 \\ 30,508 \\ 45,705 \\ 33,883 \\ 37,049 \\ 27,310 \\ 41,300 \\ 30,145 \\ 30,962 \\ 31,398 \\ 45,442 \\ 33,791 \\ 31,398 \\ 45,442 \\ 33,791 \\ 31,398 \\ 45,442 \\ 33,791 \\ 31,398 \\ 45,442 \\ 33,791 \\ 30,965 \\ 36,170 \\ 54,534 \\ \end{array}$	RN           Time           0.00           0.01           0.01           0.14           0.13	Cmax           35,243           25,654           33,821           25,394           26,371           30,952           47,524           34,338           37,354           27,310           41,423           30,962           31,398           45,442           33,791           44,181           28,247           36,706           33,385           37,275           34,414           31,297           33,144           37,251           51,793	Time           0.00	$\frac{C_{\rm max}}{35,046}$ $\frac{35,046}{24,359}$ $\frac{24,359}{23,985}$ $\frac{23,985}{23,985}$ $\frac{29,469}{45,705}$ $\frac{33,829}{37,049}$ $\frac{37,049}{27,310}$ $\frac{41,300}{30,145}$ $\frac{30,962}{31,398}$ $\frac{45,442}{42,838}$ $\frac{28,247}{33,601}$ $\frac{33,601}{30,837}$ $\frac{37,308}{34,282}$ $\frac{34,282}{42,079}$ $\frac{30,905}{36,170}$ $\frac{36,170}{51,466}$	$\begin{array}{c} \hline {\rm Time} \\ \hline 0.29 \\ 0.29 \\ 0.35 \\ 0.00 \\ 0.36 \\ 0.30 \\ 0.30 \\ 0.30 \\ 0.30 \\ 0.30 \\ 0.30 \\ 0.30 \\ 0.30 \\ 0.30 \\ 0.30 \\ 0.30 \\ 0.30 \\ 0.30 \\ 0.30 \\ 0.30 \\ 0.41 \\ 0.46 \\ 0.41 \\ 0.45 \\ 0.41 \\ 0.45 \\ 0.41 \\ 0.45 \\ 0.41 \\ 0.45 \\ 0.41 \\ 0.48 \\ 0.48 \\ 0.49 \\ 0.49 \\ 0.49 \\ 0.49 \\ 0.49 \\ 0.49 \\ 0.49 \\ 0.49 \\ 0.49 \\ 0.49 \\ 0.49 \\ 0.40 \\ 0$
miniYFJS01 miniYFJS02 miniYFJS03 miniYFJS05 miniYFJS06 miniYFJS06 miniYFJS07 miniYFJS07 miniYFJS10 miniYFJS10 miniYFJS12 miniYFJS12 miniYFJS13 miniYFJS15 miniYFJS15 miniYFJS15 miniYFJS15 miniYFJS12 miniYFJS12 miniYFJS12 miniYFJS20 miniYFJS23 miniYFJS23 miniYFJS24 miniYFJS26 miniYFJS27 miniYFJS27 miniYFJS27	$\frac{C_{\rm max}}{35,046}$ $\frac{35,046}{24,359}$ $\frac{24,359}{47,391}$ $\frac{25,394}{23,985}$ $\frac{23,985}{29,469}$ $\frac{45,705}{33,829}$ $\frac{37,049}{27,310}$ $\frac{41,300}{30,145}$ $\frac{30,962}{31,398}$ $\frac{45,442}{42,838}$ $\frac{28,247}{33,601}$ $\frac{33,601}{30,837}$ $\frac{37,056}{34,282}$ $\frac{42,079}{30,905}$ $\frac{34,282}{36,170}$ $\frac{42,079}{30,905}$ $\frac{34,282}{36,170}$ $\frac{42,079}{30,905}$ $\frac{36,170}{36,719}$ $\frac{38,798}{39,788}$	$\begin{array}{c} \hline {\rm Time} \\ \hline 0.00 \\ 0.01 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.01 \\ 0.01 \\ 0.01 \\ 0.01 \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.00 \\ 0.02 \\ 0.01 \\ 0.00 \\ 0.04 \\ 0.00 \\ 0.04 \\ 0.01 \\ 0.01 \\ 0.01 \\ 0.01 \\ 0.01 \\ 0.01 \\ 0.01 \\ 0.06 \\ \end{array}$	$\frac{C_{\rm max}}{35,046}$ $\frac{35,046}{24,359}$ $\frac{23,985}{23,985}$ $\frac{23,985}{23,985}$ $\frac{23,985}{33,829}$ $\frac{37,049}{27,310}$ $\frac{41,300}{30,145}$ $\frac{30,962}{31,398}$ $\frac{45,442}{42,838}$ $\frac{28,247}{33,601}$ $\frac{33,601}{30,837}$ $\frac{37,056}{34,282}$ $\frac{42,079}{30,905}$ $\frac{34,282}{36,170}$ $\frac{36,170}{34,509}$ $\frac{39,798}{39,798}$	$\begin{array}{c} \hline {\rm Time} \\ \hline {\rm 0.00} \\ 0.01 \\ 0.01 \\ 0.00 \\ 0.01 \\ 0.00$	$\begin{array}{c} {\rm GRASI}\\ {\rm \hline $G_{\rm max}$}\\ {\rm \hline $S_{\rm rotax}$}\\ {\rm \hline $35,046$}\\ {\rm 24,359}\\ {\rm 47,391}\\ {\rm 25,394}\\ {\rm 23,985}\\ {\rm 29,469}\\ {\rm 45,705}\\ {\rm 33,829}\\ {\rm 37,049}\\ {\rm 27,310}\\ {\rm 41,300}\\ {\rm 30,145}\\ {\rm 30,962}\\ {\rm 31,398}\\ {\rm 45,442}\\ {\rm 33,791}\\ {\rm 33,611}\\ {\rm 30,837}\\ {\rm 37,308}\\ {\rm 34,282}\\ {\rm 42,079}\\ {\rm 30,965}\\ {\rm 36,170}\\ {\rm 36,170}\\ {\rm 34,509}\\ {\rm 39,798}\\ {\rm 39,798} \end{array}$	P-RN Time 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.01 0.00 0.03	$\begin{array}{c} {\rm GRASI}\\ {\rm C}_{{\rm max}}\\ {\rm 35,046}\\ {\rm 24,359}\\ {\rm 47,391}\\ {\rm 25,394}\\ {\rm 23,985}\\ {\rm 29,469}\\ {\rm 45,705}\\ {\rm 33,829}\\ {\rm 37,049}\\ {\rm 27,310}\\ {\rm 41,300}\\ {\rm 30,145}\\ {\rm 30,962}\\ {\rm 31,398}\\ {\rm 45,442}\\ {\rm 33,791}\\ {\rm 31,398}\\ {\rm 45,442}\\ {\rm 33,791}\\ {\rm 33,601}\\ {\rm 30,837}\\ {\rm 37,275}\\ {\rm 34,282}\\ {\rm 42,079}\\ {\rm 30,905}\\ {\rm 36,170}\\ {\rm 51,466}\\ {\rm 36,719}\\ {\rm 34,509}\\ {\rm 39,798}\\ \end{array}$	$\begin{array}{c} \text{P-CN} \\ \hline \text{Time} \\ 0.00 \\ 0.00 \\ 0.14 \\ 0.14 \\ 0.15 \\ 0.15 \\ 0.00 \\ 0.05 \\ 0.00 \\ 0.05 \\ 0.01 \\ 0.00 \\ 0$	$\begin{array}{c} {\rm TS-I-}\\ \hline C_{\rm max} \\ 35,046 \\ 24,359 \\ 52,098 \\ 25,394 \\ 23,985 \\ 30,508 \\ 45,705 \\ 33,883 \\ 37,049 \\ 27,310 \\ 41,300 \\ 30,145 \\ 30,962 \\ 31,398 \\ 45,442 \\ 33,791 \\ 31,398 \\ 45,442 \\ 33,791 \\ 33,601 \\ 30,837 \\ 37,096 \\ 34,288 \\ 28,247 \\ 33,601 \\ 30,837 \\ 37,096 \\ 34,288 \\ 28,247 \\ 30,905 \\ 34,509 \\ 30,905 \\ 36,170 \\ 34,509 \\ 39,949 \\ 54,534 \\ 36,719 \\ 34,509 \\ 39,949 \\ 54,534 \\ 36,719 \\ 34,509 \\ 39,949 \\ 54,534 \\ 36,719 \\ 34,509 \\ 39,949 \\ 54,534 \\ 36,719 \\ 34,509 \\ 39,949 \\ 54,534 \\ 36,719 \\ 34,509 \\ 39,949 \\ 54,534 \\ 54,544 \\ 54,544 \\ 54,544 \\ 54,544 $	RN           Time           0.00           0.01           0.02           0.01           0.14           0.03           0.01           0.02           0.01	Cmax           35,243           25,654           33,821           25,394           26,371           30,952           47,524           34,338           37,354           27,310           41,423           30,962           31,398           45,442           33,791           44,181           28,247           36,706           33,385           37,251           34,917           51,793           36,823           34,968           40,891	Time           0.00	$\frac{C_{\rm max}}{35,046}$ $\frac{35,046}{24,359}$ $\frac{24,359}{47,391}$ $\frac{25,394}{23,985}$ $\frac{29,469}{45,705}$ $\frac{37,049}{37,049}$ $\frac{27,310}{41,300}$ $\frac{41,300}{30,145}$ $\frac{30,962}{31,398}$ $\frac{45,442}{42,838}$ $\frac{28,247}{33,3601}$ $\frac{33,791}{30,962}$ $\frac{33,791}{30,905}$ $\frac{34,282}{36,170}$ $\frac{34,282}{51,466}$ $\frac{36,719}{34,509}$ $\frac{39,798}{39,798}$	$\begin{array}{c} \hline {\rm Time} \\ \hline 0.29 \\ 0.29 \\ 0.35 \\ 0.00 \\ 0.35 \\ 0.00 \\ 0.41 \\ 0.30 \\ 0.30 \\ 0.30 \\ 0.30 \\ 0.33 \\ 0.39 \\ 0.51 \\ 0.41 \\ 0.45 \\ 0.41 \\ 0.45 \\ 0.41 \\ 0.45 \\ 0.41 \\ 0.45 \\ 0.41 \\ 0.45 \\ 0.41 \\ 0.45 \\ 0.41 \\ 0.45 \\ 0.41 \\ 0.41 \\ 0.45 \\ 0.41 \\ 0.45 \\ 0.41 \\ 0.45 \\ 0.41 \\ 0.45 \\ 0.41 \\ 0.41 \\ 0.45 \\ 0.41 \\ 0.41 \\ 0.45 \\ 0.41 \\ 0.41 \\ 0.42 \\ 0.41 \\ 0.42 \\ 0.41 \\ 0.42 \\ 0$
miniYFJS01 miniYFJS03 miniYFJS03 miniYFJS05 miniYFJS05 miniYFJS06 miniYFJS08 miniYFJS08 miniYFJS11 miniYFJS11 miniYFJS13 miniYFJS13 miniYFJS15 miniYFJS15 miniYFJS18 miniYFJS19 miniYFJS19 miniYFJS19 miniYFJS21 miniYFJS22 miniYFJS22 miniYFJS23 miniYFJS25 miniYFJS26 miniYFJS26	$\frac{C_{\rm max}}{35,046}$ $\frac{35,046}{24,359}$ $\frac{24,359}{23,985}$ $\frac{29,469}{27,310}$ $\frac{47,391}{45,705}$ $\frac{37,049}{37,049}$ $\frac{27,310}{30,145}$ $\frac{41,300}{30,145}$ $\frac{30,962}{31,398}$ $\frac{45,442}{33,791}$ $\frac{45,442}{33,791}$ $\frac{45,442}{33,791}$ $\frac{45,442}{33,791}$ $\frac{45,442}{33,791}$ $\frac{45,442}{33,791}$ $\frac{45,442}{33,601}$ $\frac{36,170}{51,466}$ $\frac{36,719}{34,509}$	Time           0.00           0.01           0.00           0.00           0.00           0.00           0.00           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.00           0.00           0.01           0.02           0.03           0.04           0.01           0.01           0.01           0.01           0.02	$\frac{C_{\rm max}}{35,046}$	$\begin{array}{c} \hline {\rm Time} \\ \hline 0.00 \\ 0.01 \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.03 \\ 0.02 \\ 0.03 \\ 0.02 \\ 0.01 \\ 0.03 \\ 0.02 \\ 0.01 \\ 0.03 \\ 0.02 \\ 0.01 \\ 0.03 \\ 0$	$\begin{array}{c} {\rm GRASI} \\ {\rm GRASI} \\ {\rm C}_{max} \\ {\rm 35,046} \\ {\rm 24,359} \\ {\rm 47,391} \\ {\rm 23,985} \\ {\rm 29,469} \\ {\rm 33,829} \\ {\rm 37,049} \\ {\rm 27,310} \\ {\rm 41,300} \\ {\rm 30,145} \\ {\rm 30,962} \\ {\rm 31,398} \\ {\rm 45,442} \\ {\rm 33,791} \\ {\rm 42,838} \\ {\rm 28,247} \\ {\rm 33,601} \\ {\rm 30,837} \\ {\rm 37,308} \\ {\rm 34,282} \\ {\rm 42,079} \\ {\rm 30,965} \\ {\rm 36,170} \\ {\rm 51,466} \\ {\rm 36,719} \\ {\rm 34,509} \end{array}$	P-RN Time 0.00	$\begin{array}{c} {\rm GRASI} \\ {\rm Grass} \\ {\rm C}_{max} \\ {\rm 35,046} \\ {\rm 24,359} \\ {\rm 47,391} \\ {\rm 25,394} \\ {\rm 23,985} \\ {\rm 29,469} \\ {\rm 23,985} \\ {\rm 29,469} \\ {\rm 23,985} \\ {\rm 29,469} \\ {\rm 33,829} \\ {\rm 37,049} \\ {\rm 27,310} \\ {\rm 41,300} \\ {\rm 30,145} \\ {\rm 30,962} \\ {\rm 31,398} \\ {\rm 45,442} \\ {\rm 33,791} \\ {\rm 42,838} \\ {\rm 28,247} \\ {\rm 33,601} \\ {\rm 33,3791} \\ {\rm 42,838} \\ {\rm 28,247} \\ {\rm 33,601} \\ {\rm 30,837} \\ {\rm 37,275} \\ {\rm 34,282} \\ {\rm 42,079} \\ {\rm 30,905} \\ {\rm 56,170} \\ {\rm 51,466} \\ {\rm 36,719} \\ {\rm 34,509} \end{array}$	$\begin{array}{c} \text{P-CN} \\ \hline \text{Time} \\ 0.00 \\ 0.00 \\ 0.14 \\ 0.00 \\ 0.025 \\ 14.81 \\ 0.16 \\ 0.00 \\ 0.05 \\ 64.48 \\ 0.01 \\ 0.00 \\ 19.85 \\ 13.56 \\ 0.00 \\ 19.85 \\ 53.76 \\ 1.25 \\ 1.23 \\ 0.02 \\ 0.08 \\ 0.38.95 \\ 53.76 \\ 1.25 \\ 1.23 \\ 0.02 \\ 0.08 \\ 0.01 \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.01 \\ 0.00$	$\begin{array}{r} TS-I\\ C_{max}\\ 35,046\\ 24,359\\ 52,098\\ 25,394\\ 23,985\\ 30,508\\ 45,705\\ 33,883\\ 37,049\\ 27,310\\ 41,300\\ 30,145\\ 30,962\\ 27,310\\ 41,300\\ 30,145\\ 30,962\\ 31,398\\ 45,442\\ 33,791\\ 42,838\\ 28,247\\ 33,601\\ 30,837\\ 37,096\\ 33,7091\\ 42,838\\ 28,247\\ 33,601\\ 54,534\\ 36,170\\ 54,534\\ 36,719\\ 34,509\\ \end{array}$	RN           Time           0.00           0.01           0.02           0.01           0.11           0.03           0.01           0.03           0.04	Cmax           35,243           25,654           53,381           25,394           26,371           30,952           47,524           37,354           27,310           41,423           33,329           30,962           31,398           45,442           36,706           33,385           37,275           34,917           42,079           33,144           51,793           36,823           34,503	Time           0.00	$\frac{C_{\rm max}}{35,046}$ $\frac{35,046}{24,359}$ $\frac{24,359}{23,985}$ $\frac{29,469}{27,310}$ $\frac{47,391}{45,705}$ $\frac{37,049}{37,049}$ $\frac{27,310}{30,145}$ $\frac{41,300}{30,145}$ $\frac{30,962}{31,398}$ $\frac{45,442}{33,791}$ $\frac{45,442}{33,791}$ $\frac{45,442}{33,791}$ $\frac{45,442}{33,601}$ $\frac{36,170}{51,466}$ $\frac{36,719}{34,509}$	$\begin{array}{c} \hline {\rm Time} \\ 0.20 \\ 0.29 \\ 0.35 \\ 0.00 \\ 0.41 \\ 0.30 \\ 0.30 \\ 0.30 \\ 0.30 \\ 0.30 \\ 0.30 \\ 0.33 \\ 0.39 \\ 0.41 \\ 0.45 \\ 0.41 \\ 0.45 \\ 0.41 \\ 0.45 \\ 0.41 \\ 0.45 \\ 0.41 \\ 0.45 \\ 0.41 \\ 0.45 \\ 0.41 \\ 0.56 \\ 0.94 \\ 0.47 \\ 0.31.22 \\ \end{array}$
miniYFJS01 miniYFJS02 miniYFJS03 miniYFJS05 miniYFJS06 miniYFJS06 miniYFJS07 miniYFJS07 miniYFJS10 miniYFJS10 miniYFJS12 miniYFJS12 miniYFJS13 miniYFJS15 miniYFJS15 miniYFJS15 miniYFJS15 miniYFJS12 miniYFJS12 miniYFJS12 miniYFJS20 miniYFJS23 miniYFJS23 miniYFJS24 miniYFJS26 miniYFJS27 miniYFJS27 miniYFJS27	$\frac{C_{\rm max}}{35,046}$ $\frac{35,046}{24,359}$ $\frac{24,359}{47,391}$ $\frac{25,394}{23,985}$ $\frac{23,985}{29,469}$ $\frac{45,705}{33,829}$ $\frac{37,049}{27,310}$ $\frac{41,300}{30,145}$ $\frac{30,962}{31,398}$ $\frac{45,442}{42,838}$ $\frac{28,247}{33,601}$ $\frac{33,601}{30,837}$ $\frac{37,056}{34,282}$ $\frac{42,079}{30,905}$ $\frac{34,282}{36,170}$ $\frac{42,079}{30,905}$ $\frac{34,282}{36,170}$ $\frac{42,079}{30,905}$ $\frac{36,170}{36,719}$ $\frac{38,798}{39,788}$	$\begin{array}{c} \hline {\rm Time} \\ \hline 0.00 \\ 0.01 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.01 \\ 0.01 \\ 0.01 \\ 0.01 \\ 0.01 \\ 0.01 \\ 0.01 \\ 0.01 \\ 0.01 \\ 0.00 \\ 0.02 \\ 0.01 \\ 0.04 \\ 0.03 \\ 0.04 \\ 0.01 \\ 0.01 \\ 0.01 \\ 0.01 \\ 0.01 \\ 0.01 \\ 0.01 \\ 0.03 \\ 0.04 \\ 0.05 \\ 0.03 \\ 0.03 \\ 0.04 \\ 0.05 \\ 0.03 \\ 0.04 \\ 0.05 \\ 0.03 \\ 0.04 \\ 0.05 \\ 0.03 \\ 0.05 \\ 0$	$\frac{C_{\rm max}}{35,046}$ $\frac{35,046}{24,359}$ $\frac{23,985}{23,985}$ $\frac{23,985}{23,985}$ $\frac{23,985}{33,829}$ $\frac{37,049}{27,310}$ $\frac{41,300}{30,145}$ $\frac{30,962}{31,398}$ $\frac{45,442}{42,838}$ $\frac{28,247}{33,601}$ $\frac{33,601}{30,837}$ $\frac{37,056}{34,282}$ $\frac{42,079}{30,905}$ $\frac{34,282}{36,170}$ $\frac{36,170}{34,509}$ $\frac{39,798}{39,798}$	$\begin{array}{c} \hline {\rm Time} \\ \hline 0.00 \\ 0.01 \\ 0.01 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.01 \\ 0.05 \\ 0.00 \\ 0.034 \\ 0.03 \\ 0.02 \\ 0.01 \\ 0.03 \\ 0.02 \\ 0.01 \\ 0.03 \\ 0.02 \\ 0.01 \\ 0.03 \\ 0.01 \\ 0.01 \\ 0.01 \\ 0.01 \\ 0.01 \\ 0.06 \\ 0.06 \\ 0.06 \\ 0.06 \\ 0.00 \\ 0.00 \\ 0.06 \\ 0.00 \\ $	$\begin{array}{c} {\rm GRASI}\\ {\rm \hline $G_{\rm max}$}\\ {\rm \hline $S_{\rm rotax}$}\\ {\rm \hline $35,046$}\\ {\rm 24,359}\\ {\rm 47,391}\\ {\rm 25,394}\\ {\rm 23,985}\\ {\rm 29,469}\\ {\rm 45,705}\\ {\rm 33,829}\\ {\rm 37,049}\\ {\rm 27,310}\\ {\rm 41,300}\\ {\rm 30,145}\\ {\rm 30,962}\\ {\rm 31,398}\\ {\rm 45,442}\\ {\rm 33,791}\\ {\rm 33,611}\\ {\rm 30,837}\\ {\rm 37,308}\\ {\rm 34,2838}\\ {\rm 42,079}\\ {\rm 30,965}\\ {\rm 36,170}\\ {\rm 36,170}\\ {\rm 34,509}\\ {\rm 39,798}\\ {\rm 39,798} \end{array}$	P-RN Time 0.00	$\begin{array}{c} {\rm GRASI} \\ \hline C_{\rm max} \\ 35,046 \\ 24,359 \\ 47,391 \\ 25,394 \\ 23,985 \\ 29,469 \\ 45,705 \\ 33,829 \\ 37,049 \\ 27,310 \\ 41,300 \\ 30,145 \\ 30,962 \\ 31,398 \\ 45,442 \\ 33,791 \\ 31,398 \\ 45,442 \\ 33,791 \\ 33,601 \\ 30,965 \\ 34,262 \\ 42,079 \\ 30,905 \\ 36,170 \\ 51,466 \\ 36,719 \\ 34,509 \\ 39,798 \end{array}$	P-CN Time 0.00 0.00 0.14 0.00 0.02 14.81 0.00 0.05 64.48 0.01 19.85 13.56 13.56 0.00 0.00 0.00 0.03 0.00 0.05 53.76 1.23 0.02 52.00 0.02 50.02 0.08	$\begin{array}{c} {\rm TS-I}\\ \hline C_{\rm max}\\ 35,046\\ 24,359\\ 52,098\\ 25,394\\ 23,985\\ 30,508\\ 45,705\\ 33,883\\ 37,049\\ 27,310\\ 41,300\\ 30,145\\ 30,962\\ 31,398\\ 45,442\\ 33,791\\ 41,300\\ 31,145\\ 30,962\\ 31,398\\ 45,442\\ 33,791\\ 33,601\\ 30,837\\ 37,096\\ 34,289\\ 42,079\\ 30,905\\ 36,170\\ 54,534\\ 36,719\\ 34,509\\ 39,949\\ \end{array}$	RN           Time           0.00           0.01           0.12	Cmax           35,243           25,654           33,821           25,394           26,371           30,952           47,524           34,338           37,354           27,310           41,423           30,962           31,398           45,442           33,791           44,181           28,247           36,706           33,385           37,251           34,917           51,793           36,823           34,968           40,891	Time           0.00	$\frac{C_{\rm max}}{35,046}$ $\frac{35,046}{24,359}$ $\frac{24,359}{47,391}$ $\frac{25,394}{23,985}$ $\frac{29,469}{45,705}$ $\frac{37,049}{37,049}$ $\frac{27,310}{41,300}$ $\frac{41,300}{30,145}$ $\frac{30,962}{31,398}$ $\frac{45,442}{42,838}$ $\frac{28,247}{33,3601}$ $\frac{33,791}{30,962}$ $\frac{33,791}{30,905}$ $\frac{34,282}{36,170}$ $\frac{34,282}{51,466}$ $\frac{36,719}{34,509}$ $\frac{39,798}{39,798}$	$\begin{tabular}{lllllllllllllllllllllllllllllllllll$
miniYFJS01 miniYFJS03 miniYFJS03 miniYFJS05 miniYFJS05 miniYFJS05 miniYFJS07 miniYFJS08 miniYFJS08 miniYFJS12 miniYFJS11 miniYFJS11 miniYFJS15 miniYFJS15 miniYFJS15 miniYFJS18 miniYFJS21 miniYFJS23 miniYFJS23 miniYFJS23 miniYFJS24 miniYFJS26 miniYFJS27 miniYFJS27 miniYFJS29	$\frac{C_{\rm max}}{35,046}$ $\frac{35,046}{24,359}$ $\frac{24,359}{47,391}$ $\frac{25,394}{23,985}$ $\frac{29,469}{45,705}$ $\frac{33,829}{37,049}$ $\frac{37,049}{27,310}$ $\frac{41,300}{30,142}$ $\frac{30,962}{31,398}$ $\frac{45,442}{42,838}$ $\frac{28,247}{33,601}$ $\frac{33,701}{30,905}$ $\frac{34,282}{42,079}$ $\frac{34,282}{30,905}$ $\frac{36,170}{51,466}$ $\frac{36,719}{30,905}$ $\frac{34,282}{35,163}$ $\frac{33,974}{35,163}$	Time           0.00           0.01           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.01           0.01           0.01           0.01           0.00           0.01           0.01           0.01           0.01           0.01           0.00           0.01           0.02           0.03           0.04           0.00           0.01           0.01           0.02           0.03           0.04           0.01           0.01           0.01           0.01           0.02           0.03           0.04           0.06           0.03           0.04           0.06           0.03           0.04	$\frac{C_{\rm max}}{35,046}$ $\frac{35,046}{24,359}$ $\frac{23,985}{23,985}$ $\frac{23,985}{23,985}$ $\frac{23,985}{33,829}$ $\frac{37,049}{27,310}$ $\frac{41,300}{30,142}$ $\frac{30,962}{31,398}$ $\frac{45,442}{42,838}$ $\frac{28,247}{33,601}$ $\frac{33,701}{30,905}$ $\frac{34,282}{42,079}$ $\frac{34,282}{30,905}$ $\frac{34,282}{36,170}$ $\frac{51,466}{36,719}$ $\frac{36,770}{51,466}$ $\frac{36,719}{30,978}$ $\frac{33,974}{35,163}$	Time           0.00           0.01           0.00           0.01           0.00           0.01           0.00           0.01           0.00           0.00           0.01           0.05           0.03           0.00           0.01           0.02           0.02           0.02           0.03           0.03           0.03           0.03           0.03           0.13           0.03           0.14           0.05	$\begin{array}{c} {\rm GRASI} \\ {\rm GRASI} \\ {\rm C}_{max} \\ {\rm 35,046} \\ {\rm 24,359} \\ {\rm 47,391} \\ {\rm 25,394} \\ {\rm 23,985} \\ {\rm 29,469} \\ {\rm 45,705} \\ {\rm 33,829} \\ {\rm 37,049} \\ {\rm 27,310} \\ {\rm 41,300} \\ {\rm 30,145} \\ {\rm 30,962} \\ {\rm 31,398} \\ {\rm 45,442} \\ {\rm 33,791} \\ {\rm 42,838} \\ {\rm 28,247} \\ {\rm 30,837} \\ {\rm 33,791} \\ {\rm 42,838} \\ {\rm 28,247} \\ {\rm 30,837} \\ {\rm 33,601} \\ {\rm 30,837} \\ {\rm 33,791} \\ {\rm 30,965} \\ {\rm 36,170} \\ {\rm 30,9758} \\ {\rm 33,9748} \\ {\rm 33,974} \\ {\rm 35,177} \\ {\rm 32,174} \\ {\rm 32,174} \\ {\rm 35,177} \\ {\rm 35,177}$	P-RN Time 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.01 0.00 0.03 0.00 0.03 0.00 0.03 0.00 0.03 0.05 8.93 8.93 8.93	$\begin{array}{c} {\rm GRASI} \\ {\rm GRASI} \\ {\rm C}_{max} \\ {\rm 35,046} \\ {\rm 24,359} \\ {\rm 47,391} \\ {\rm 25,394} \\ {\rm 23,985} \\ {\rm 29,469} \\ {\rm 45,705} \\ {\rm 33,829} \\ {\rm 37,049} \\ {\rm 27,310} \\ {\rm 41,300} \\ {\rm 30,145} \\ {\rm 30,962} \\ {\rm 31,398} \\ {\rm 45,442} \\ {\rm 33,791} \\ {\rm 42,838} \\ {\rm 28,247} \\ {\rm 33,601} \\ {\rm 30,837} \\ {\rm 37,275} \\ {\rm 34,282} \\ {\rm 42,079} \\ {\rm 30,905} \\ {\rm 36,170} \\ {\rm 39,798} \\ {\rm 33,974} \\ {\rm 35,174} \\$	$\begin{array}{c} \text{P-CN} \\ \hline \text{Time} \\ 0.00 \\ 0.00 \\ 0.14 \\ 0.14 \\ 0.15 \\ 0.00 \\ 0.25 \\ 14.81 \\ 0.16 \\ 0.00 \\ 0.05 \\ 64.48 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 19.85 \\ 13.56 \\ 0.00$	$\begin{array}{r} {\rm TS-I}\\ \hline C_{\rm max}\\ 35,046\\ 24,359\\ 52,098\\ 25,394\\ 23,985\\ 30,508\\ 45,705\\ 33,883\\ 37,049\\ 27,310\\ 41,300\\ 30,145\\ 30,962\\ 31,398\\ 45,442\\ 33,791\\ 42,838\\ 28,247\\ 33,601\\ 42,838\\ 28,247\\ 33,601\\ 42,838\\ 28,247\\ 33,601\\ 42,838\\ 28,247\\ 33,601\\ 42,838\\ 28,247\\ 33,601\\ 54,534\\ 36,719\\ 30,905\\ 36,170\\ 30,949\\ 33,974\\ 35,470\\ 255\\ 35,470\\ 255\\ 35,470\\ 255\\ 35,470\\ 3$	RN           Time           0.00           0.01           0.02           0.41           0.01           0.04           0.01           0.12	Cmax 35,243 25,654 25,3541 25,394 26,371 30,952 47,524 34,338 37,354 27,310 41,423 33,399 30,962 31,398 45,442 33,329 33,979 33,742 44,181 28,247 36,706 33,385 37,275 34,917 42,079 33,144 37,251 51,793 36,823 34,907 40,891 33,974 36,166 10 0	Time           0.00	$\frac{C_{\rm max}}{35,046}$ $\frac{35,046}{24,359}$ $\frac{24,359}{23,985}$ $\frac{23,985}{23,985}$ $\frac{29,469}{45,705}$ $\frac{33,829}{37,049}$ $\frac{37,049}{27,310}$ $\frac{41,300}{30,142}$ $\frac{30,962}{31,398}$ $\frac{45,442}{42,838}$ $\frac{28,247}{33,601}$ $\frac{33,791}{30,905}$ $\frac{34,282}{42,079}$ $\frac{34,282}{42,079}$ $\frac{34,282}{36,170}$ $\frac{51,466}{36,719}$ $\frac{36,170}{39,9788}$ $\frac{33,974}{35,176}$	Time           0.20           0.23           0.035           0.00           0.24           0.30           0.33           0.30           0.33           0.30           0.33           0.33           0.34           0.35           0.30           0.33           0.34           0.35           0.38           0.39           0.41           0.44           0.45           0.41           0.44           0.45           0.41           0.48           0.51           0.49           0.49           0.49           0.49           0.49           0.49           0.41           0.52           5.93
$\begin{tabular}{lllllllllllllllllllllllllllllllllll$	$\frac{C_{\rm max}}{35,046}$ $\frac{35,046}{24,359}$ $\frac{24,359}{47,391}$ $\frac{25,394}{23,985}$ $\frac{29,469}{27,310}$ $\frac{41,300}{30,145}$ $\frac{30,962}{31,398}$ $\frac{45,442}{33,791}$ $\frac{45,442}{33,791}$ $\frac{45,442}{33,791}$ $\frac{45,842}{33,791}$ $\frac{42,838}{34,282}$ $\frac{42,079}{30,905}$ $\frac{36,170}{51,466}$ $\frac{36,719}{34,509}$ $\frac{35,166}{35,166}$	Time           0.00           0.01           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.01           0.01           0.01           0.01           0.00           0.01           0.01           0.01           0.01           0.01           0.00           0.01           0.02           0.03           0.04           0.00           0.01           0.01           0.02           0.03           0.04           0.01           0.01           0.01           0.01           0.02           0.03           0.04           0.06           0.03           0.04           0.06           0.03           0.04	$\frac{C_{\rm max}}{35,046}$	Time           0.00           0.01           0.00           0.01           0.00           0.01           0.00           0.01           0.00           0.00           0.01           0.05           0.03           0.00           0.01           0.02           0.02           0.02           0.03           0.03           0.03           0.03           0.03           0.13           0.03           0.14           0.05	$\begin{array}{c} {\rm GRASI}\\ {\rm Graas}\\ {\rm C}_{max}\\ {\rm 35,046}\\ {\rm 24,359}\\ {\rm 47,391}\\ {\rm 23,985}\\ {\rm 29,469}\\ {\rm 23,985}\\ {\rm 29,469}\\ {\rm 23,985}\\ {\rm 29,469}\\ {\rm 33,704}\\ {\rm 33,7049}\\ {\rm 37,049}\\ {\rm 27,310}\\ {\rm 41,300}\\ {\rm 30,162}\\ {\rm 30,962}\\ {\rm 33,791}\\ {\rm 42,838}\\ {\rm 42,848}\\ {\rm 45,442}\\ {\rm 33,791}\\ {\rm 42,838}\\ {\rm 82,847}\\ {\rm 33,761}\\ {\rm 42,838}\\ {\rm 33,791}\\ {\rm 42,838}\\ {\rm 33,661}\\ {\rm 30,837}\\ {\rm 33,661}\\ {\rm 30,965}\\ {\rm 36,170}\\ {\rm 51,466}\\ {\rm 36,719}\\ {\rm 39,798}\\ {\rm 33,778}\\ {\rm 35,176}\\ {\rm 35,176}\\$	P-RN Time 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.01 0.00 0.03 0.00 0.03 0.00 0.03 0.00 0.03 0.05 8.93 8.93 8.93	$\begin{array}{c} {\rm GRASI}\\ {\rm Graas}\\ {\rm C}_{max}\\ {\rm 35,046}\\ {\rm 24,359}\\ {\rm 47,391}\\ {\rm 25,394}\\ {\rm 23,985}\\ {\rm 29,469}\\ {\rm 23,985}\\ {\rm 29,469}\\ {\rm 33,7049}\\ {\rm 37,049}\\ {\rm 27,310}\\ {\rm 41,300}\\ {\rm 30,145}\\ {\rm 30,962}\\ {\rm 31,398}\\ {\rm 45,442}\\ {\rm 33,791}\\ {\rm 42,838}\\ {\rm 28,247,310}\\ {\rm 33,791}\\ {\rm 42,838}\\ {\rm 35,177}\\ {\rm 35,1$	$\begin{array}{c} \text{P-CN} \\ \hline \text{Time} \\ 0.00 \\ 0.00 \\ 0.14 \\ 0.14 \\ 0.15 \\ 0.00 \\ 0.25 \\ 14.81 \\ 0.16 \\ 0.00 \\ 0.05 \\ 64.48 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 19.85 \\ 13.56 \\ 0.00$	$\begin{array}{r} {\rm TS-I}\\ \hline \\ C_{\rm max}\\ 35,046\\ 24,359\\ 52,098\\ 25,394\\ 23,985\\ 30,508\\ 33,883\\ 37,049\\ 27,310\\ 41,300\\ 30,145\\ 33,704\\ 41,300\\ 30,145\\ 33,704\\ 41,300\\ 30,145\\ 33,791\\ 42,838\\ 28,247\\ 42,079\\ 33,601\\ 33,617\\ 35,470\\ 36,719\\ 35,470$	RN           Time           0.00           0.01           0.02           0.41           0.01           0.04           0.01           0.12	Cmax 35,243 25,654 25,394 26,371 30,952 47,524 37,354 27,310 41,423 33,329 30,962 31,398 45,442 33,791 44,181 28,247 36,706 33,385 37,275 34,917 42,079 33,144 37,251 51,793 33,6794 40,891 33,974 43,6166 (19,100) (19	Time           0.00	$\frac{C_{\rm max}}{35,046}$ $\frac{35,046}{24,359}$ $\frac{47,391}{25,394}$ $\frac{23,985}{229,469}$ $\frac{45,705}{33,829}$ $\frac{37,049}{27,310}$ $\frac{41,300}{30,145}$ $\frac{30,962}{31,398}$ $\frac{45,442}{45,442}$ $\frac{45,442}{33,791}$ $\frac{42,838}{45,442}$ $\frac{42,838}{34,282}$ $\frac{42,079}{33,601}$ $\frac{30,837}{37,308}$ $\frac{34,282}{42,079}$ $\frac{36,170}{51,466}$ $\frac{36,719}{34,509}$ $\frac{33,978}{35,170}$	Time           0.20           0.23           0.035           0.00           0.24           0.30           0.33           0.30           0.33           0.30           0.33           0.33           0.34           0.35           0.30           0.33           0.34           0.35           0.38           0.39           0.41           0.44           0.45           0.41           0.44           0.45           0.41           0.48           0.51           0.49           0.49           0.49           0.49           0.49           0.49           0.41           0.52           5.93
miniYFJS01 miniYFJS03 miniYFJS05 miniYFJS05 miniYFJS06 miniYFJS07 miniYFJS07 miniYFJS07 miniYFJS10 miniYFJS11 miniYFJS12 miniYFJS13 miniYFJS15 miniYFJS15 miniYFJS15 miniYFJS15 miniYFJS17 miniYFJS18 miniYFJS19 miniYFJS20 miniYFJS21 miniYFJS23 miniYFJS23 miniYFJS23 miniYFJS23 miniYFJS26 miniYFJS28	$\frac{C_{\rm max}}{35,046}$ $\frac{35,046}{24,359}$ $\frac{24,359}{47,391}$ $\frac{25,394}{23,985}$ $\frac{29,469}{45,705}$ $\frac{33,829}{37,049}$ $\frac{37,049}{27,310}$ $\frac{41,300}{30,142}$ $\frac{30,962}{31,398}$ $\frac{45,442}{42,838}$ $\frac{28,247}{33,601}$ $\frac{33,701}{30,905}$ $\frac{34,282}{42,079}$ $\frac{34,282}{30,905}$ $\frac{36,170}{51,466}$ $\frac{36,719}{30,905}$ $\frac{34,282}{35,163}$ $\frac{33,974}{35,163}$	Time           0.00           0.01           0.00           0.00           0.00           0.00           0.00           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.00           0.00           0.01           0.04           0.01           0.04           0.01           0.04           0.01           0.04           0.05           0.03           9.87	$\frac{C_{\rm max}}{35,046}$ $\frac{35,046}{24,359}$ $\frac{23,985}{23,985}$ $\frac{23,985}{23,985}$ $\frac{23,985}{33,829}$ $\frac{37,049}{27,310}$ $\frac{41,300}{30,142}$ $\frac{30,962}{31,398}$ $\frac{45,442}{42,838}$ $\frac{28,247}{33,601}$ $\frac{33,701}{30,905}$ $\frac{34,282}{42,079}$ $\frac{34,282}{30,905}$ $\frac{34,282}{36,170}$ $\frac{51,466}{36,719}$ $\frac{36,770}{51,466}$ $\frac{36,719}{30,978}$ $\frac{33,974}{35,163}$	Time           0.00           0.01           0.00           0.01           0.00           0.01           0.00           0.01           0.00           0.01           0.05           0.03           0.00           0.01           0.02           0.02           0.02           0.02           0.02           0.03           0.04           0.05           0.04           0.05           0.01           0.02           0.02           0.03           0.04           0.05           0.01           0.02           0.01           0.02           0.03           0.04           0.05           0.04           0.05           0.05	$\begin{array}{c} {\rm GRASI} \\ {\rm Cmax} \\ {\rm 35,046} \\ {\rm 24,359} \\ {\rm 47,391} \\ {\rm 25,394} \\ {\rm 23,985} \\ {\rm 29,469} \\ {\rm 45,705} \\ {\rm 33,829} \\ {\rm 37,049} \\ {\rm 27,310} \\ {\rm 41,300} \\ {\rm 30,145} \\ {\rm 30,962} \\ {\rm 31,398} \\ {\rm 45,442} \\ {\rm 33,791} \\ {\rm 42,838} \\ {\rm 28,247} \\ {\rm 33,601} \\ {\rm 30,837} \\ {\rm 37,308} \\ {\rm 34,282} \\ {\rm 42,079} \\ {\rm 30,965} \\ {\rm 36,170} \\ {\rm 30,965} \\ {\rm 36,170} \\ {\rm 34,509} \\ {\rm 39,738} \\ {\rm 33,974} \\ {\rm 35,177} \\ {\rm 32,174} \\ {$	P-RN Time 0.00 0.03 8.33 3.3 3.3 3.3 3.3 3.3 3.3 3	$\begin{array}{c} {\rm GRASI} \\ {\rm GRASI} \\ {\rm C}_{max} \\ {\rm 35,046} \\ {\rm 24,359} \\ {\rm 47,391} \\ {\rm 25,394} \\ {\rm 23,985} \\ {\rm 29,469} \\ {\rm 45,705} \\ {\rm 33,829} \\ {\rm 37,049} \\ {\rm 27,310} \\ {\rm 41,300} \\ {\rm 30,145} \\ {\rm 30,962} \\ {\rm 31,398} \\ {\rm 45,442} \\ {\rm 33,791} \\ {\rm 42,838} \\ {\rm 28,247} \\ {\rm 33,601} \\ {\rm 30,837} \\ {\rm 37,275} \\ {\rm 34,282} \\ {\rm 42,079} \\ {\rm 30,905} \\ {\rm 36,170} \\ {\rm 39,798} \\ {\rm 33,974} \\ {\rm 35,174} \\$	P-CN Time 0.00 0.00 0.14 0.00 0.02 14.81 0.00 0.05 64.48 0.01 0.00 0.05 64.48 0.01 0.00 0.05 64.48 0.01 0.00 0.00 0.05 53.76 1.23 0.02 5.53 0.05 5.53 0.25 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.00 0.05 0.00 0.05 0.00 0.05 0.00 0.05 0.00 0.05 0.00 0.00 0.05 0.00 0.00 0.05 0.00 0.00 0.00 0.00 0.05 0.00 0.05 0	$\begin{array}{r} {\rm TS-I}\\ \hline C_{\rm max}\\ 35,046\\ 24,359\\ 52,098\\ 25,394\\ 23,985\\ 30,508\\ 45,705\\ 33,883\\ 37,049\\ 27,310\\ 41,300\\ 30,145\\ 30,962\\ 31,398\\ 45,442\\ 33,791\\ 42,838\\ 28,247\\ 33,601\\ 42,838\\ 28,247\\ 33,601\\ 42,838\\ 28,247\\ 33,601\\ 42,838\\ 28,247\\ 33,601\\ 42,838\\ 28,247\\ 33,601\\ 54,534\\ 36,719\\ 30,905\\ 36,170\\ 30,949\\ 33,974\\ 35,470\\ 255\\ 35,470\\ 255\\ 35,470\\ 255\\ 35,470\\ 3$	RN           Time           0.00           0.01           0.02           0.01           0.02           0.01           0.02           0.01           0.02           0.01           0.03           0.01           0.02           50           7	Cmax 35,243 25,654 25,3541 25,394 26,371 30,952 47,524 34,338 37,354 27,310 41,423 33,399 30,962 31,398 45,442 33,329 33,979 33,742 44,181 28,247 36,706 33,385 37,275 34,917 42,079 33,144 37,251 51,793 36,823 34,907 40,891 33,974 36,166 10 0	Time           0.00	$\frac{C_{\rm max}}{35,046}$ $\frac{35,046}{24,359}$ $\frac{24,359}{23,985}$ $\frac{23,985}{23,985}$ $\frac{29,469}{45,705}$ $\frac{33,829}{37,049}$ $\frac{37,049}{27,310}$ $\frac{41,300}{30,142}$ $\frac{30,962}{31,398}$ $\frac{45,442}{42,838}$ $\frac{28,247}{33,601}$ $\frac{33,791}{30,905}$ $\frac{34,282}{42,079}$ $\frac{34,282}{42,079}$ $\frac{34,282}{36,170}$ $\frac{51,466}{36,719}$ $\frac{36,170}{39,9788}$ $\frac{33,974}{35,176}$	Time           0.20         0.29           0.35         0.00           0.41         0.30           0.33         0.34           0.33         0.33           0.33         0.33           0.34         0.35           0.35         0.33           0.39         0.44           0.45         0.35           0.34         0.35           0.35         0.34           0.46         0.44           0.46         0.44           0.46         0.44           0.45         0.51           0.56         0.49           0.47         31.22           5.93         0.52           5.93         2

Table A1: Results of applying the metaheuristics to the small-sized instances with learning rate  $\alpha=0.1.$ 

instance	ILS-I		ILS-		GRASI		GRASI	-	TS-F		TS-C		SA	
	C <sub>max</sub>	Time	$C_{\text{max}}$	Time	$C_{\text{max}}$	Time	Cmax	Time	C <sub>max</sub>	Time	$C_{\text{max}}$	Time	$C_{\text{max}}$	Time
miniDAFJS01	21,327	0.02	21,327	0.03	21,327	0.03	21,327	28.07	21,546	0.00	21,546	0.00	21,327	0.33
miniDAFJS02	20,635	0.01	20,635	0.01	20,635	0.05	20,635	0.04	20,635	0.00	22,161	0.00	20,635	0.19
miniDAFJS03	17,972	0.00	17,972	0.00	17,972	0.00	17,972	0.00	17,972	0.00	17,972	0.00	17,972	0.00
miniDAFJS04	19,602	0.00	19,602	0.00	19,602	0.00	19,602	0.00	19,602	0.00	20,691	0.00	19,602	0.11
miniDAFJS05	18,803	0.00	18,803	0.01	18,803	3.57	18,803	4.21	18,803	0.01	18,803	0.00	18,803	0.28
miniDAFJS06	20,568	0.04	20,568	0.04	20,568	0.01	20,568	0.01	20,783	0.00	20,783	0.00	20,568	0.31
miniDAFJS07	24,715	0.00	24,715	0.01	24,715	0.10	24,715	0.63	24,715	0.00	24,715	0.00	24,715	0.22
miniDAFJS08	18,857	0.00	18,857	0.00	18,857	0.00	18,857	0.00	18,857	0.00	18,857	0.00	18,857	0.00
miniDAFJS09	22,660	0.02	22,660	0.05	22,660	4.57	22,660	2.76	22,730	0.01	22,730	0.00	22,660	0.31
miniDAFJS10	18,823	0.00	18,823	0.00	18,823	0.00	18,823	0.00	18,823	0.00	20,180	0.00	18,823	0.18
miniDAFJS11	27,455	0.02	27,455	0.01	27,455	2.05	27,455	0.00	30,550	0.00	30,941	0.00	27,455	0.35
miniDAFJS12	17,874	0.01	17,874	0.01	17,874	0.92	17,874	1.47	19,624	0.00	18,974	0.00	17,874	0.24
miniDAFJS13	15,143	0.00	15,143	0.00	15,143	0.00	15,143	0.00	15,143	0.00	16,593	0.00	15,143	0.01
miniDAFJS14	21,817	0.00	21,817	0.00	21,817	0.00	21,817	3.31	21,817	0.00	21,990	0.00	21,817	0.27
miniDAFJS15	20,236	0.00	20,236	0.00	20,236	0.00	20,236	0.00	20,236	0.00	20,236	0.00	20,236 24,114	0.14
miniDAFJS16	24,114	0.00	24,114	0.00	$24,114 \\ 19,145$	0.00	24,114	0.01	24,114	0.00	24,593	0.00	,	0.27
miniDAFJS17 miniDAFJS18 <sup>+</sup>	19,145	$0.00 \\ 0.00$	19,145 17 270	$0.00 \\ 0.00$		$0.00 \\ 0.00$	19,145	$0.00 \\ 0.00$	19,145	$0.00 \\ 0.00$	19,145 17.066	$0.00 \\ 0.00$	19,145 17.270	0.15 0.25
	17,270	0.00	17,270 19,642		17,270		17,270	0.00	17,270	0.00	17,966	0.00	17,270	
miniDAFJS19	19,642			0.00	19,642	0.00	19,642		19,642		20,107		19,642	0.16
miniDAFJS20 miniDAFJS21	20,086 21,352	0.04 0.21	$20,086 \\ 21,352$	0.01 0.92	20,086 21,433	$24.76 \\ 43.93$	<b>20,086</b> 21,536	1.87 93.99	21,286 21,352	$0.00 \\ 0.04$	20,646 21,783	0.00 0.01	20,086 21,433	0.28 1.51
miniDAFJS21 miniDAFJS22	21,352 23,852	0.21	21,352 23,852	0.92	21,455 23,852	45.95 38.91	21,550 23,852	24.30	21,352	0.04	21,785 24,273	0.01	21,455 23,852	0.41
miniDAFJS22 miniDAFJS23 <sup>+</sup>	23,852	2.60	23,852 22,390	0.02	23,852	0.02	23,852	24.30 0.02	24,273 22,390	0.00	24,273 22,491	0.00	23,852	0.41 0.49
miniDAFJS23	22,390	2.00	22,390	0.82	23,228 22,521	19.38	23,300 22,521	44.36	22,390	0.01	22,491 22,551	0.02	23,120 22,521	0.49
miniDAFJS24 miniDAFJS25	19,809	0.07	19,809	0.07	19,809	38.66	19,809	44.50 0.00	19,913	0.03	22,551 19,913	0.00	22,521 19,809	0.40
miniDAFJS25 miniDAFJS26	19,809	0.01	19,809 19,724	0.03	19,809 19,724	24.84	19,809	48.07	19,913	0.01	19,913	0.00	19,809	0.33
miniDAFJS20	20,245	0.13	20,245	0.03	20,245	0.07	20,245	35.36	20,245	0.00	20,646	0.00	20,245	0.33
miniDAFJS28	20,245	0.13	20,245	0.03	20,245	0.07	20,245	0.00	20,245	0.02	21,693	0.00	20,245	0.38
miniDAFJS28	19,201	0.02	19,201	0.04	19,201	1.39	19,201	0.00	19,201	0.00	19,448	0.00	19,201	0.38
miniDAFJS30	21,552	0.01	21,552	0.00	21,698	46.08	21,552	63.33	21,552	0.15	21,645	0.00	21,552	0.31
	20,600		20,60		20,63		20,63		20,830		21,040		20,629	
#best	30		20,000		20,00		20,00		20,000		6		20,02,	
gap(%)	0.0		0.0		0.1		0.1		1.0		2.6	D	0.1	
$\overline{\text{gap}}(\%)$	0.0		0.0		0.2		0.2		1.0		2.6		0.4	
8°F(/0)	0.0	•	0.0		0	-				*		~	0.12	
· ,	ILS-	RN	ILS-	CN	GRASI	P-RN	GRASI	P-CN	TS-I	RN	TS-0	CN	SA	
instance	ILS-	RN time	ILS-	CN time	GRASI C <sub>max</sub>	P-RN time	GRASI C <sub>max</sub>	P-CN time	TS-I C <sub>max</sub>	RN time	TS-C	CN time	SA C <sub>max</sub>	time
	C <sub>max</sub>	time	$C_{\max}$	time	$C_{\text{max}}$	time	C <sub>max</sub>	time	C <sub>max</sub>	time	$C_{\max}$	time	$C_{\text{max}}$	time
instance miniYFJS01 miniYFJS02	<u> </u>		C <sub>max</sub> 33,132		C <sub>max</sub> 33,132		C <sub>max</sub> 33,132		C <sub>max</sub> 33,132		-		C <sub>max</sub> 33,132	
miniYFJS01 miniYFJS02	C <sub>max</sub> 33,132 23,100	time 0.00 0.00	C <sub>max</sub> 33,132 23,100	time 0.00 0.01	C <sub>max</sub> 33,132 23,100	time 0.00 0.00	C <sub>max</sub> 33,132 23,100	time 4.67 0.00	C <sub>max</sub> 33,132 23,100	time 0.00 0.00	C <sub>max</sub> 34,443 25,032	time 0.00 0.00	C <sub>max</sub> 33,132 23,100	time 0.28 0.30
miniYFJS01	C <sub>max</sub> 33,132	time 0.00	C <sub>max</sub> 33,132	time 0.00	C <sub>max</sub> 33,132	time 0.00	C <sub>max</sub> 33,132	time 4.67	C <sub>max</sub> 33,132	time 0.00	C <sub>max</sub> 34,443	time 0.00	C <sub>max</sub> 33,132	time 0.28
miniYFJS01 miniYFJS02 miniYFJS03	C <sub>max</sub> 33,132 23,100 42,896	time 0.00 0.00 0.00	C <sub>max</sub> 33,132 23,100 42,896	time 0.00 0.01 0.01	C <sub>max</sub> 33,132 23,100 42,896	time 0.00 0.00 0.00	C <sub>max</sub> 33,132 23,100 42,896	time 4.67 0.00 0.01	C <sub>max</sub> 33,132 23,100 46,806	time 0.00 0.00 0.00	$\begin{array}{c} C_{\max} \\ 34,443 \\ 25,032 \\ 49,111 \end{array}$	time 0.00 0.00 0.00	C <sub>max</sub> 33,132 23,100 42,896	time 0.28 0.30 0.34
miniYFJS01 miniYFJS02 miniYFJS03 miniYFJS04	$\begin{array}{c} \hline C_{\rm max} \\ 33,132 \\ 23,100 \\ 42,896 \\ 24,485 \end{array}$	time 0.00 0.00 0.00 0.00	$\begin{array}{c} C_{\rm max} \\ 33,\!132 \\ 23,\!100 \\ 42,\!896 \\ 24,\!485 \end{array}$	time 0.00 0.01 0.01 0.00	$\begin{array}{c} C_{\max} \\ 33,132 \\ 23,100 \\ 42,896 \\ 24,485 \end{array}$	time 0.00 0.00 0.00 0.00	$\begin{array}{c} C_{\max} \\ 33,132 \\ 23,100 \\ 42,896 \\ 24,485 \end{array}$	time 4.67 0.00 0.01 0.00	C <sub>max</sub> 33,132 23,100 46,806 24,485	time 0.00 0.00 0.00 0.00	$\begin{array}{c} C_{\max} \\ 34,443 \\ 25,032 \\ 49,111 \\ \textbf{24,485} \end{array}$	time 0.00 0.00 0.00 0.00	$\begin{array}{c} C_{\max} \\ \textbf{33,132} \\ \textbf{23,100} \\ \textbf{42,896} \\ \textbf{24,485} \end{array}$	time 0.28 0.30 0.34 0.31
miniYFJS01 miniYFJS02 miniYFJS03 miniYFJS04 miniYFJS05	$\begin{array}{r} \hline C_{\rm max} \\ 33,132 \\ 23,100 \\ 42,896 \\ 24,485 \\ 23,597 \end{array}$	time 0.00 0.00 0.00 0.00 0.00	$\begin{array}{c} C_{\rm max} \\ 33,132 \\ 23,100 \\ 42,896 \\ 24,485 \\ 23,597 \end{array}$	time 0.00 0.01 0.01 0.00 0.00	$\begin{array}{c} C_{\rm max} \\ {\bf 33,132} \\ {\bf 23,100} \\ {\bf 42,896} \\ {\bf 24,485} \\ {\bf 23,597} \end{array}$	time 0.00 0.00 0.00 0.00 0.00	$\begin{array}{r} C_{\rm max} \\ 33,132 \\ 23,100 \\ 42,896 \\ 24,485 \\ 23,597 \end{array}$	time 4.67 0.00 0.01 0.00 0.00	Cmax           33,132           23,100           46,806           24,485           23,597	time 0.00 0.00 0.00 0.00 0.00	C <sub>max</sub> 34,443 25,032 49,111 24,485 23,597	time 0.00 0.00 0.00 0.00 0.00	$\begin{array}{c} C_{\rm max} \\ {\bf 33,132} \\ {\bf 23,100} \\ {\bf 42,896} \\ {\bf 24,485} \\ {\bf 23,597} \end{array}$	time 0.28 0.30 0.34 0.31 0.25
miniYFJS01 miniYFJS02 miniYFJS03 miniYFJS04 miniYFJS05 miniYFJS06	$\begin{array}{r} \hline C_{\rm max} \\ \hline 33,132 \\ 23,100 \\ 42,896 \\ 24,485 \\ 23,597 \\ 28,655 \end{array}$	time 0.00 0.00 0.00 0.00 0.00 0.01	$\begin{array}{c} C_{\rm max} \\ 33,132 \\ 23,100 \\ 42,896 \\ 24,485 \\ 23,597 \\ 28,655 \end{array}$	time 0.00 0.01 0.01 0.00 0.00 0.00	$\begin{array}{c} C_{\rm max} \\ 33,132 \\ 23,100 \\ 42,896 \\ 24,485 \\ 23,597 \\ 28,655 \end{array}$	time 0.00 0.00 0.00 0.00 0.00 0.00	$\begin{array}{c} C_{\rm max} \\ 33,132 \\ 23,100 \\ 42,896 \\ 24,485 \\ 23,597 \\ 28,655 \end{array}$	time 4.67 0.00 0.01 0.00 0.00 0.00	$\begin{array}{c} C_{\rm max} \\ \textbf{33,132} \\ \textbf{23,100} \\ 46,806 \\ \textbf{24,485} \\ \textbf{23,597} \\ \textbf{28,655} \end{array}$	time 0.00 0.00 0.00 0.00 0.00 0.01	$\begin{array}{c} C_{\max} \\ 34,443 \\ 25,032 \\ 49,111 \\ \textbf{24,485} \\ \textbf{23,597} \\ 28,750 \end{array}$	time 0.00 0.00 0.00 0.00 0.00 0.01	$\begin{array}{c} C_{\rm max} \\ 33,132 \\ 23,100 \\ 42,896 \\ 24,485 \\ 23,597 \\ 28,655 \end{array}$	time 0.28 0.30 0.34 0.31 0.25 0.32
miniYFJS01 miniYFJS02 miniYFJS03 miniYFJS05 miniYFJS06 miniYFJS07	$\begin{array}{c} \hline C_{\rm max} \\ 33,132 \\ 23,100 \\ 42,896 \\ 24,485 \\ 23,597 \\ 28,655 \\ 42,239 \end{array}$	time 0.00 0.00 0.00 0.00 0.00 0.01 0.00	$\begin{array}{c} C_{\rm max} \\ 33,132 \\ 23,100 \\ 42,896 \\ 24,485 \\ 23,597 \\ 28,655 \\ 42,239 \end{array}$	time 0.00 0.01 0.01 0.00 0.00 0.01 0.05	$\begin{array}{c} C_{\rm max} \\ 33,132 \\ 23,100 \\ 42,896 \\ 24,485 \\ 23,597 \\ 28,655 \\ 42,239 \end{array}$	time 0.00 0.00 0.00 0.00 0.00 0.00 0.01	$\begin{array}{c} C_{\max} \\ 33,132 \\ 23,100 \\ 42,896 \\ 24,485 \\ 23,597 \\ 28,655 \\ 42,239 \end{array}$	time 4.67 0.00 0.01 0.00 0.00 0.00 7.75	$\begin{array}{c} C_{\rm max} \\ 33,132 \\ 23,100 \\ 46,806 \\ 24,485 \\ 23,597 \\ 28,655 \\ 42,239 \end{array}$	time 0.00 0.00 0.00 0.00 0.00 0.01 0.00	C <sub>max</sub> 34,443           25,032           49,111           24,485           23,597           28,750           45,493	time 0.00 0.00 0.00 0.00 0.00 0.01 0.00	$\begin{array}{c} C_{\rm max} \\ 33,132 \\ 23,100 \\ 42,896 \\ 24,485 \\ 23,597 \\ 28,655 \\ 42,239 \end{array}$	time 0.28 0.30 0.34 0.31 0.25 0.32 0.40
miniYFJS01 miniYFJS02 miniYFJS03 miniYFJS05 miniYFJS05 miniYFJS06 miniYFJS07 miniYFJS08	$\begin{array}{c} C_{\max} \\ 33,132 \\ 23,100 \\ 42,896 \\ 24,485 \\ 23,597 \\ 28,655 \\ 42,239 \\ 31,471 \end{array}$	time 0.00 0.00 0.00 0.00 0.00 0.01 0.00 0.02	$\begin{array}{c} C_{\rm max} \\ 33,132 \\ 23,100 \\ 42,896 \\ 24,485 \\ 23,597 \\ 28,655 \\ 42,239 \\ 31,471 \end{array}$	time 0.00 0.01 0.01 0.00 0.00 0.01 0.05 0.15	$\begin{array}{c} C_{\rm max} \\ 33,132 \\ 23,100 \\ 42,896 \\ 24,485 \\ 23,597 \\ 28,655 \\ 42,239 \\ 31,471 \end{array}$	time 0.00 0.00 0.00 0.00 0.00 0.00 0.01 0.00	$\begin{array}{c} C_{\rm max} \\ 33,132 \\ 23,100 \\ 42,896 \\ 24,485 \\ 23,597 \\ 28,655 \\ 42,239 \\ 31,471 \end{array}$	$\begin{array}{c} \text{time} \\ 4.67 \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.00 \\ 0.00 \\ 7.75 \\ 22.11 \end{array}$	Cmax           33,132           23,100           46,806           24,485           23,597           28,655           42,239           31,597	time 0.00 0.00 0.00 0.00 0.00 0.01 0.00 0.00	Cmax           34,443           25,032           49,111           24,485           23,597           28,750           45,493           32,669	time 0.00 0.00 0.00 0.00 0.00 0.01 0.00 0.00	$\begin{array}{c} C_{\max} \\ 33,132 \\ 23,100 \\ 42,896 \\ 24,485 \\ 23,597 \\ 28,655 \\ 42,239 \\ 31,471 \end{array}$	time 0.28 0.30 0.34 0.31 0.25 0.32 0.40 0.42
miniYFJS01 miniYFJS02 miniYFJS03 miniYFJS04 miniYFJS05 miniYFJS07 miniYFJS08 miniYFJS09	$\begin{array}{c} C_{\max} \\ 33,132 \\ 23,100 \\ 42,896 \\ 24,485 \\ 23,597 \\ 28,655 \\ 42,239 \\ 31,471 \\ 35,250 \end{array}$	time 0.00 0.00 0.00 0.00 0.01 0.00 0.02 0.02	$\begin{array}{c} C_{\rm max} \\ 33,132 \\ 23,100 \\ 42,896 \\ 24,485 \\ 23,597 \\ 28,655 \\ 42,239 \\ 31,471 \\ 35,250 \end{array}$	time 0.00 0.01 0.01 0.00 0.00 0.01 0.05 0.15 0.01	$\begin{array}{c} C_{\rm max} \\ 33,132 \\ 23,100 \\ 42,896 \\ 24,485 \\ 23,597 \\ 28,655 \\ 42,239 \\ 31,471 \\ 35,250 \end{array}$	time 0.00 0.00 0.00 0.00 0.00 0.00 0.01 0.00 4.98	$\begin{array}{c} C_{\max} \\ 33,132 \\ 23,100 \\ 42,896 \\ 24,485 \\ 23,597 \\ 28,655 \\ 42,239 \\ 31,471 \\ 35,250 \end{array}$	$\begin{array}{c} \text{time} \\ 4.67 \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.00 \\ 7.75 \\ 22.11 \\ 0.01 \end{array}$	Cmax           33,132           23,100           46,806           24,485           23,597           28,655           42,239           31,597           35,794	time 0.00 0.00 0.00 0.00 0.00 0.01 0.00 0.00 0.00	Cmax           34,443           25,032           49,111           24,485           23,597           28,750           45,493           32,669           36,098	time 0.00 0.00 0.00 0.00 0.00 0.01 0.00 0.00 0.00	$\begin{array}{c} C_{\max} \\ 33,132 \\ 23,100 \\ 42,896 \\ 24,485 \\ 23,597 \\ 28,655 \\ 42,239 \\ 31,471 \\ 35,250 \end{array}$	time 0.28 0.30 0.34 0.31 0.25 0.32 0.40 0.42 0.32
miniYFJS01 miniYFJS02 miniYFJS03 miniYFJS05 miniYFJS05 miniYFJS06 miniYFJS07 miniYFJS09 miniYFJS09	$\begin{array}{c} \hline C_{\max} \\ \hline 33,132 \\ 23,100 \\ 42,896 \\ 24,485 \\ 23,597 \\ 28,655 \\ 42,239 \\ 31,471 \\ 35,250 \\ 26,145 \\ \end{array}$	time 0.00 0.00 0.00 0.00 0.00 0.01 0.00 0.02 0.02 0.01	$\begin{array}{c} C_{\rm max} \\ 33,132 \\ 23,100 \\ 42,896 \\ 24,485 \\ 23,597 \\ 28,655 \\ 42,239 \\ 31,471 \\ 35,250 \\ 26,145 \end{array}$	time 0.00 0.01 0.01 0.00 0.00 0.05 0.15 0.01 0.00	$\begin{array}{c} C_{\max} \\ 33,132 \\ 23,100 \\ 42,896 \\ 24,485 \\ 23,597 \\ 28,655 \\ 42,239 \\ 31,471 \\ 35,250 \\ 26,145 \end{array}$	time 0.00 0.00 0.00 0.00 0.00 0.01 0.00 4.98 5.41	$\begin{array}{c} C_{\max} \\ \hline & C_{33,132} \\ 23,100 \\ 42,896 \\ 24,485 \\ 23,597 \\ 28,655 \\ 42,239 \\ 31,471 \\ 35,250 \\ 26,145 \end{array}$	time 4.67 0.00 0.01 0.00 0.00 7.75 22.11 0.01 0.00	Cmax           33,132           23,100           46,806           24,485           23,597           28,655           42,239           31,597           35,794           26,145	time 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00	$\begin{array}{c} C_{\max} \\ 34,443 \\ 25,032 \\ 49,111 \\ \textbf{24,485} \\ \textbf{23,597} \\ 28,750 \\ 45,493 \\ 32,669 \\ 36,098 \\ \textbf{26,145} \end{array}$	time 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00	$\begin{array}{c} C_{\max} \\ \hline & 33,132 \\ 23,100 \\ 42,896 \\ 24,485 \\ 23,597 \\ 28,655 \\ 42,239 \\ 31,471 \\ 35,250 \\ 26,145 \end{array}$	time 0.28 0.30 0.34 0.31 0.25 0.32 0.40 0.42 0.32 0.32
miniYFJS01 miniYFJS02 miniYFJS03 miniYFJS05 miniYFJS05 miniYFJS06 miniYFJS07 miniYFJS08 miniYFJS09 miniYFJS10 miniYFJS11	$\begin{array}{c} \hline C_{\rm max} \\ \hline 33,132 \\ 23,100 \\ 42,896 \\ 24,485 \\ 23,597 \\ 28,655 \\ 42,239 \\ 31,471 \\ 35,250 \\ 26,145 \\ 38,545 \\ 27,895 \\ 28,120 \\ \end{array}$	time 0.00 0.00 0.00 0.00 0.00 0.01 0.00 0.02 0.02	$\begin{array}{c} \hline C_{max} \\ \hline 33,132 \\ 23,100 \\ 42,896 \\ 24,485 \\ 23,597 \\ 28,655 \\ 42,239 \\ 31,471 \\ 35,250 \\ 26,145 \\ 38,545 \\ 27,895 \\ 28,120 \\ \end{array}$	time 0.00 0.01 0.01 0.00 0.00 0.01 0.05 0.15 0.01 0.00 0.02	$\begin{array}{c} C_{max} \\ 33,132 \\ 23,100 \\ 42,896 \\ 24,485 \\ 23,597 \\ 28,655 \\ 42,239 \\ 31,471 \\ 35,250 \\ 26,145 \\ 38,545 \\ 27,895 \\ 28,120 \end{array}$	$\begin{array}{c} \text{time} \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.01 \\ 0.00 \\ 4.98 \\ 5.41 \\ 3.71 \end{array}$	Cmax           33,132           23,100           42,896           24,485           23,597           28,655           42,239           31,471           35,250           26,145           38,545           28,281           28,120	$\begin{array}{c} \text{time} \\ 4.67 \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.00 \\ 7.75 \\ 22.11 \\ 0.01 \\ 0.00 \\ 7.90 \end{array}$	Cmax           33,132           23,100           46,806           24,485           23,597           28,655           42,239           31,597           35,794           26,145           38,545	time 0.00 0.00 0.00 0.00 0.00 0.01 0.00 0.00 0.00 0.00 0.00	$\frac{C_{max}}{34,443}$ $\frac{34,443}{25,032}$ $\frac{49,111}{24,485}$ $\frac{23,597}{23,597}$ $\frac{28,750}{45,493}$ $\frac{32,669}{36,098}$ $\frac{26,145}{38,756}$ $\frac{30,851}{28,120}$	time 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00	$\frac{C_{\rm max}}{33,132}$ 23,100 42,896 24,485 23,597 28,655 42,239 31,471 35,250 26,145 38,545 27,895 28,120	$\begin{array}{c} \text{time} \\ 0.28 \\ 0.30 \\ 0.34 \\ 0.31 \\ 0.25 \\ 0.32 \\ 0.40 \\ 0.42 \\ 0.32 \\ 0.32 \\ 0.44 \end{array}$
miniYFJS01 miniYFJS02 miniYFJS03 miniYFJS05 miniYFJS05 miniYFJS07 miniYFJS09 miniYFJS09 miniYFJS10 miniYFJS10 miniYFJS11 miniYFJS13 miniYFJS13	$\frac{C_{\rm max}}{33,132}$ $\frac{33,132}{23,100}$ $42,896$ $24,485$ $23,597$ $28,655$ $42,239$ $31,471$ $35,250$ $26,145$ $38,545$ $27,895$ $28,120$ $29,682$	time 0.00 0.00 0.00 0.00 0.00 0.01 0.02 0.02 0.01 0.01 0.01 0.01 0.02	$\begin{array}{c} C_{max} \\ 33,132 \\ 23,100 \\ 42,896 \\ 24,485 \\ 23,597 \\ 28,655 \\ 42,239 \\ 31,471 \\ 35,250 \\ 26,145 \\ 38,545 \\ 27,895 \\ 28,120 \\ 29,682 \end{array}$	time 0.00 0.01 0.01 0.00 0.00 0.01 0.05 0.15 0.01 0.00 0.02 0.09 0.00 0.00	$\frac{C_{\rm max}}{33,132}$ 23,100 42,896 24,485 23,597 28,655 42,239 31,471 35,250 26,145 38,545 27,895 28,120 29,682	$\begin{array}{c} \text{time} \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.01 \\ 0.00 \\ 4.98 \\ 5.41 \\ 3.71 \\ 48.02 \\ 0.00 \\ 0.00 \\ 0.00 \end{array}$	$\begin{array}{c} C_{max} \\ 33,132 \\ 23,100 \\ 42,896 \\ 24,485 \\ 23,597 \\ 28,655 \\ 42,239 \\ 31,471 \\ 35,250 \\ 26,145 \\ 38,545 \\ 28,281 \\ 28,120 \\ 29,682 \end{array}$	$\begin{array}{c} \text{time} \\ \hline 4.67 \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.00 \\ 7.75 \\ 22.11 \\ 0.01 \\ 0.00 \\ 7.90 \\ 0.01 \\ 0.02 \\ 0.00 \end{array}$	$\begin{array}{c} C_{max} \\ \hline 33,132 \\ 23,100 \\ 46,806 \\ 24,485 \\ 23,597 \\ 28,655 \\ 42,239 \\ 31,597 \\ 35,794 \\ 26,145 \\ 38,545 \\ 27,895 \\ 28,120 \\ 29,682 \end{array}$	time 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	$\begin{array}{c} \hline C_{max} \\ \hline 34,443 \\ 25,032 \\ 49,111 \\ \textbf{24,485} \\ \textbf{23,597} \\ \textbf{23,597} \\ \textbf{28,750} \\ 45,493 \\ 32,669 \\ \textbf{36,098} \\ \textbf{26,145} \\ \textbf{38,750} \\ \textbf{30,851} \\ \textbf{28,120} \\ \textbf{29,682} \end{array}$	time 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	$\frac{C_{\rm max}}{33,132}$ $\frac{33,132}{23,100}$ $42,896$ $24,485$ $23,597$ $42,239$ $31,471$ $35,250$ $26,145$ $38,545$ $27,895$ $28,120$ $29,682$	$\begin{array}{c} \text{time} \\ 0.28 \\ 0.30 \\ 0.34 \\ 0.31 \\ 0.25 \\ 0.32 \\ 0.40 \\ 0.42 \\ 0.32 \\ 0.32 \\ 0.44 \\ 7.80 \\ 0.38 \\ 0.37 \end{array}$
miniYFJS01 miniYFJS02 miniYFJS03 miniYFJS05 miniYFJS06 miniYFJS07 miniYFJS08 miniYFJS09 miniYFJS10 miniYFJS11 miniYFJS11 miniYFJS13 miniYFJS14 miniYFJS15	$\begin{array}{c} C_{\rm max} \\ 33,132 \\ 23,100 \\ 42,896 \\ 24,485 \\ 23,597 \\ 28,655 \\ 42,239 \\ 31,471 \\ 35,250 \\ 26,145 \\ 38,545 \\ 27,895 \\ 28,120 \\ 29,682 \\ 41,619 \end{array}$	time 0.00 0.00 0.00 0.00 0.00 0.01 0.00 0.02 0.01 0.01 0.15 0.01 0.02 0.00	$\begin{array}{c} C_{max} \\ 33,132 \\ 23,100 \\ 42,896 \\ 24,485 \\ 23,597 \\ 28,655 \\ 42,239 \\ 31,471 \\ 35,250 \\ 26,145 \\ 38,545 \\ 27,895 \\ 28,120 \\ 29,682 \\ 41,619 \end{array}$	time 0.00 0.01 0.00 0.00 0.00 0.05 0.15 0.01 0.00 0.02 0.09 0.00 0.00 0.00 0.00 0.00	$\begin{array}{c} C_{max} \\ 33,132 \\ 23,100 \\ 42,896 \\ 24,485 \\ 23,597 \\ 28,655 \\ 34,2239 \\ 31,471 \\ 35,250 \\ 26,145 \\ 38,545 \\ 27,895 \\ 28,120 \\ 29,682 \\ 41,619 \end{array}$	$\begin{array}{c} \text{time} \\ \hline 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.01 \\ 0.00 \\ 4.98 \\ 5.41 \\ 3.71 \\ 48.02 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ \end{array}$	$\begin{array}{c} C_{\rm max} \\ 33,132 \\ 23,100 \\ 42,896 \\ 24,485 \\ 23,597 \\ 28,655 \\ 42,239 \\ 31,471 \\ 35,250 \\ 26,145 \\ 38,545 \\ 28,281 \\ 28,120 \\ 29,682 \\ 41,619 \end{array}$	$\begin{array}{c} \text{time} \\ \hline 4.67 \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.00 \\ 7.75 \\ 22.11 \\ 0.01 \\ 0.00 \\ 7.90 \\ 0.01 \\ 0.02 \\ 0.00 \\ 0.01 \\ \end{array}$	$\begin{array}{c} C_{max} \\ 33,132 \\ 23,100 \\ 46,806 \\ 24,485 \\ 23,597 \\ 28,655 \\ 42,239 \\ 31,597 \\ 25,794 \\ 26,145 \\ 38,545 \\ 27,895 \\ 28,120 \\ 29,682 \\ 41,619 \end{array}$	time 0.00	$\begin{array}{c} \hline C_{max} \\ 34,443 \\ 25,032 \\ 49,111 \\ 24,485 \\ 23,597 \\ 28,750 \\ 45,493 \\ 32,669 \\ 36,098 \\ 26,145 \\ 38,756 \\ 30,851 \\ 28,120 \\ 29,682 \\ 42,415 \\ \end{array}$	time 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00	$\begin{array}{c} C_{max} \\ 33,132 \\ 23,100 \\ 42,896 \\ 24,485 \\ 23,597 \\ 28,655 \\ 42,239 \\ 31,471 \\ 35,250 \\ 26,145 \\ 38,545 \\ 27,895 \\ 28,120 \\ 28,682 \\ 41,619 \end{array}$	$\begin{array}{c} \text{time} \\ \hline 0.28 \\ 0.30 \\ 0.34 \\ 0.31 \\ 0.25 \\ 0.32 \\ 0.40 \\ 0.42 \\ 0.32 \\ 0.32 \\ 0.44 \\ 7.80 \\ 0.38 \\ 0.37 \\ 0.41 \end{array}$
miniYFJS01 miniYFJS02 miniYFJS03 miniYFJS05 miniYFJS06 miniYFJS06 miniYFJS08 miniYFJS08 miniYFJS09 miniYFJS10 miniYFJS11 miniYFJS12 miniYFJS13 miniYFJS13 miniYFJS15 miniYFJS16	$\begin{array}{c} C_{\rm max} \\ 33,132 \\ 23,100 \\ 42,896 \\ 24,485 \\ 23,597 \\ 28,655 \\ 42,239 \\ 31,471 \\ 35,250 \\ 26,145 \\ 38,545 \\ 27,895 \\ 28,120 \\ 29,682 \\ 41,619 \\ 31,280 \end{array}$	time 0.00 0.00 0.00 0.00 0.00 0.01 0.00 0.02 0.01 0.01 0.01 0.01 0.01 0.02 0.00 0.02 0.00 0.02	$\begin{array}{c} C_{max} \\ 33,132 \\ 23,100 \\ 42,896 \\ 24,485 \\ 23,597 \\ 28,655 \\ 42,239 \\ 31,471 \\ 35,250 \\ 26,145 \\ 38,545 \\ 27,895 \\ 28,120 \\ 29,682 \\ 41,619 \\ 31,280 \end{array}$	time 0.00 0.01 0.00 0.00 0.00 0.05 0.15 0.01 0.00 0.02 0.00 0.00 0.00 0.00 0.00 0.00	$\begin{array}{c} C_{\rm max} \\ 33,132 \\ 23,100 \\ 42,896 \\ 24,485 \\ 23,597 \\ 28,655 \\ 42,239 \\ 31,471 \\ 35,250 \\ 26,145 \\ 38,545 \\ 27,895 \\ 28,120 \\ 29,682 \\ 41,619 \\ 31,280 \end{array}$	$\begin{array}{c} \text{time} \\ \hline 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.01 \\ 0.00 \\ 4.98 \\ 5.41 \\ 3.71 \\ 48.02 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ \end{array}$	$\begin{array}{c} C_{\rm max} \\ 33,132 \\ 23,100 \\ 42,896 \\ 24,485 \\ 23,597 \\ 28,655 \\ 42,239 \\ 31,471 \\ 35,250 \\ 26,145 \\ 38,545 \\ 28,281 \\ 28,120 \\ 29,682 \\ 41,619 \\ 31,280 \end{array}$	$\begin{array}{c} \text{time} \\ \hline 4.67 \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.00 \\ 7.75 \\ 22.11 \\ 0.01 \\ 0.00 \\ 7.90 \\ 0.01 \\ 0.02 \\ 0.00 \\ 0.01 \\ 0.00 \\ \end{array}$	$\begin{array}{c} C_{max} \\ 33,132 \\ 23,100 \\ 46,806 \\ 24,485 \\ 23,597 \\ 28,655 \\ 42,239 \\ 31,597 \\ 35,794 \\ 26,145 \\ 38,545 \\ 27,895 \\ 28,120 \\ 29,682 \\ 41,619 \\ 31,280 \end{array}$	time 0.00	$\begin{array}{c} C_{max} \\ 34,443 \\ 25,032 \\ 49,111 \\ \textbf{24},485 \\ \textbf{23},597 \\ 28,750 \\ 45,493 \\ 32,669 \\ 36,098 \\ \textbf{26},145 \\ \textbf{38},756 \\ \textbf{30},851 \\ \textbf{28},120 \\ \textbf{29},682 \\ \textbf{42},415 \\ \textbf{32},366 \end{array}$	time 0.00	$\frac{C_{\rm max}}{33,132}$ $\frac{33,132}{23,100}$ $42,896$ $24,485$ $23,597$ $28,655$ $42,239$ $31,471$ $35,256$ $26,145$ $38,545$ $27,895$ $28,120$ $29,682$ $41,619$ $31,280$	$\begin{array}{c} \text{time} \\ \hline 0.28 \\ 0.30 \\ 0.34 \\ 0.31 \\ 0.25 \\ 0.32 \\ 0.40 \\ 0.32 \\ 0.32 \\ 0.32 \\ 0.32 \\ 0.44 \\ 7.80 \\ 0.38 \\ 0.37 \\ 0.41 \\ 0.48 \end{array}$
miniYFJS01 miniYFJS03 miniYFJS03 miniYFJS05 miniYFJS06 miniYFJS06 miniYFJS09 miniYFJS09 miniYFJS10 miniYFJS10 miniYFJS13 miniYFJS13 miniYFJS14 miniYFJS16 miniYFJS17	$\frac{C_{\rm max}}{33,132}$ $\frac{33,132}{23,100}$ $42,896$ $24,485$ $23,597$ $28,655$ $42,239$ $31,471$ $35,250$ $26,145$ $38,545$ $27,895$ $28,120$ $29,682$ $41,619$ $31,280$ $40,388$	time 0.00 0.00 0.00 0.00 0.00 0.00 0.02 0.02 0.01 0.15 0.01 0.02 0.00 0.02 0.00 0.02 0.01 0.01 0.01 0.00	$\begin{array}{c} C_{max} \\ 33,132 \\ 23,100 \\ 42,896 \\ 24,485 \\ 23,597 \\ 28,655 \\ 42,239 \\ 31,471 \\ 35,250 \\ 26,145 \\ 38,545 \\ 27,895 \\ 28,120 \\ 29,682 \\ 41,619 \\ 31,280 \\ 31,2$	time 0.00 0.01 0.00 0.00 0.00 0.05 0.15 0.01 0.00 0.02 0.09 0.00 0.00 0.00 0.00 0.00 0.00 0.00	$\begin{array}{c} C_{\rm max} \\ 33,132 \\ 23,100 \\ 42,896 \\ 24,485 \\ 23,597 \\ 28,655 \\ 42,239 \\ 31,471 \\ 35,250 \\ 26,145 \\ 38,545 \\ 27,895 \\ 28,120 \\ 29,682 \\ 41,619 \\ 31,280 \\ 40,388 \end{array}$	$\begin{array}{c} \text{time} \\ \hline 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.01 \\ 0.00 \\ 4.98 \\ 5.41 \\ 3.71 \\ 48.02 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ \end{array}$	$\begin{array}{c} C_{max} \\ 33,132 \\ 23,100 \\ 42,896 \\ 24,485 \\ 23,597 \\ 28,655 \\ 42,239 \\ 31,471 \\ 35,250 \\ 26,145 \\ 38,545 \\ 28,281 \\ 28,281 \\ 28,281 \\ 28,281 \\ 28,120 \\ 29,682 \\ 41,619 \\ 31,280 \\ 31,2$	$\begin{array}{c} \text{time} \\ \hline 4.67 \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.00 \\ 0.00 \\ 7.75 \\ 22.11 \\ 0.01 \\ 0.00 \\ 7.90 \\ 0.01 \\ 0.02 \\ 0.00 \\ 0.01 \\ 0.00 \\ 10.05 \end{array}$	$\begin{array}{c} C_{max} \\ 33,132 \\ 23,100 \\ 46,806 \\ 24,485 \\ 23,597 \\ 28,655 \\ 42,239 \\ 31,597 \\ 35,794 \\ 26,145 \\ 38,545 \\ 27,895 \\ 28,120 \\ 29,682 \\ 41,619 \\ 31,280 \\ 31,2$	$\begin{array}{c} \text{time} \\ \hline 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.01 \\ \end{array}$	Cmax           34,443           25,032           49,111           24,485           23,597           28,750           45,493           32,669           36,098           26,145           38,750           30,851           29,682           42,415           32,366           41,316	time 0.00	$\frac{C_{\rm max}}{33,132}$ 23,100 42,896 24,485 23,597 28,655 42,239 31,471 35,250 26,145 38,545 27,895 28,120 29,682 41,619 31,280 40,388	$\begin{array}{c} \text{time} \\ \hline 0.28 \\ 0.30 \\ 0.34 \\ 0.31 \\ 0.25 \\ 0.32 \\ 0.40 \\ 0.42 \\ 0.32 \\ 0.42 \\ 0.32 \\ 0.44 \\ 7.80 \\ 0.38 \\ 0.37 \\ 0.41 \\ 0.48 \\ 0.44 \\ \end{array}$
miniYFJS01 miniYFJS02 miniYFJS03 miniYFJS05 miniYFJS06 miniYFJS07 miniYFJS09 miniYFJS09 miniYFJS10 miniYFJS11 miniYFJS13 miniYFJS13 miniYFJS14 miniYFJS15 miniYFJS16 miniYFJS18	$\begin{array}{c} C_{max} \\ \hline \\ 33,132 \\ 23,100 \\ 42,896 \\ 24,485 \\ 23,597 \\ 28,655 \\ 42,239 \\ 31,471 \\ 35,250 \\ 26,145 \\ 38,545 \\ 27,895 \\ 28,120 \\ 29,682 \\ 41,619 \\ 31,280 \\ 40,388 \\ 26,297 \end{array}$	time 0.00 0.00 0.00 0.00 0.00 0.02 0.02 0.01 0.01 0.01 0.01 0.01 0.02 0.00 0.02 0.01 0.02 0.00	$\begin{array}{c} C_{max} \\ 33,132 \\ 23,100 \\ 42,896 \\ 24,485 \\ 23,597 \\ 28,655 \\ 42,239 \\ 31,471 \\ 35,250 \\ 26,145 \\ 33,545 \\ 27,895 \\ 28,120 \\ 29,682 \\ 41,619 \\ 31,280 \\ 40,388 \\ 26,297 \end{array}$	time 0.00 0.01 0.00 0.00 0.00 0.05 0.15 0.01 0.00 0.02 0.09 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.01 0.01 0.01 0.00 0.00 0.00 0.01 0.00 0.01 0.00 0.01 0.00 0.00 0.00 0.00 0.01 0.00 0.01 0.00 0.01 0.00 0.05 0.15 0.01 0.00 0.02 0.00 0.00 0.00 0.02 0.00	$\begin{array}{c} C_{\rm max} \\ 33,132 \\ 23,100 \\ 42,890 \\ 24,485 \\ 23,597 \\ 28,655 \\ 42,239 \\ 31,471 \\ 35,250 \\ 26,145 \\ 38,545 \\ 27,895 \\ 28,120 \\ 29,682 \\ 41,619 \\ 31,280 \\ 40,388 \\ 26,297 \end{array}$	$\begin{array}{c} \text{time} \\ \hline 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.01 \\ 0.00 \\ 4.98 \\ 5.41 \\ 3.71 \\ 48.02 \\ 0.00 \\ 0.0$	$\begin{array}{c} C_{max} \\ 33,132 \\ 23,100 \\ 42,896 \\ 24,485 \\ 23,597 \\ 28,655 \\ 42,239 \\ 31,471 \\ 35,250 \\ 26,145 \\ 38,545 \\ 28,281 \\ 28,120 \\ 29,682 \\ 41,619 \\ 31,280 \\ 40,388 \\ 26,297 \end{array}$	$\begin{array}{c} \text{time} \\ \hline 4.67 \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.00 \\ 7.75 \\ 22.11 \\ 0.01 \\ 0.00 \\ 7.90 \\ 0.01 \\ 0.02 \\ 0.00 \\ 0.01 \\ 0.00 \\ 10.05 \\ 0.01 \end{array}$	$\begin{array}{c} C_{max} \\ \hline \\ 33,132 \\ 23,100 \\ 46,806 \\ 24,485 \\ 23,597 \\ 28,655 \\ 42,239 \\ 31,597 \\ 35,794 \\ 26,145 \\ 27,895 \\ 28,120 \\ 29,682 \\ 41,619 \\ 31,280 \\ 40,388 \\ 40,388 \\ 26,297 \end{array}$	$\begin{array}{c} \text{time} \\ \hline 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.01 \\ 0.01 \end{array}$	Cmax           34,443           25,032           49,111           24,485           23,597           28,750           32,669           36,098           26,145           29,682           29,682           42,415           32,366           41,316           26,297	time 0.00	$\frac{C_{\rm max}}{33,132}$ 23,100 42,896 24,485 23,597 28,655 42,239 31,471 35,250 26,145 27,895 28,120 29,682 41,619 31,288 26,297	$\begin{array}{c} \text{time} \\ \hline 0.28 \\ 0.30 \\ 0.34 \\ 0.32 \\ 0.40 \\ 0.42 \\ 0.32 \\ 0.44 \\ 7.80 \\ 0.38 \\ 0.37 \\ 0.41 \\ 0.48 \\ 0.44 \\ 0.38 \end{array}$
miniYFJS01 miniYFJS02 miniYFJS03 miniYFJS05 miniYFJS06 miniYFJS06 miniYFJS09 miniYFJS09 miniYFJS10 miniYFJS11 miniYFJS11 miniYFJS12 miniYFJS15 miniYFJS15 miniYFJS15 miniYFJS18 miniYFJS18 miniYFJS19	Cmax           33,132           23,100           42,896           24,485           23,597           28,655           42,239           31,471           35,250           26,145           27,895           28,612           29,682           41,619           31,280           40,388           26,2977           30,717	time 0.00 0.00 0.00 0.00 0.00 0.01 0.02 0.02 0.01 0.01 0.02 0.01 0.02 0.00 0.02 0.00 0.02 0.00	$\begin{array}{c} C_{max} \\ \hline \\ 33,132 \\ 23,100 \\ 42,896 \\ 24,485 \\ 23,597 \\ 28,655 \\ 42,239 \\ 31,471 \\ 35,250 \\ 26,145 \\ 38,545 \\ 27,895 \\ 28,120 \\ 29,682 \\ 41,619 \\ 31,280 \\ 40,388 \\ 26,297 \\ 30,717 \end{array}$	$\begin{array}{c} \text{time} \\ \hline 0.00 \\ 0.01 \\ 0.01 \\ 0.00 \\ 0.00 \\ 0.01 \\ 0.05 \\ 0.15 \\ 0.01 \\ 0.00 \\ 0.02 \\ 0.09 \\ 0.00$	$\frac{C_{\rm max}}{33,132}$ $\frac{33,132}{23,100}$ $42,896$ $42,896$ $42,839$ $31,471$ $35,250$ $26,145$ $27,895$ $28,120$ $29,682$ $41,619$ $31,280$ $40,388$ $26,297$ $30,717$	$\begin{array}{c} \text{time} \\ \hline 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.01 \\ 0.00 \\ 4.98 \\ 5.41 \\ 3.71 \\ 48.02 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.01 \\ \end{array}$	Cmax           33,132           23,100           42,896           24,485           23,597           28,655           42,293           31,471           35,250           26,145           28,655           42,239           31,471           35,250           26,145           28,120           29,682           41,619           31,280           40,388           26,2977	$\begin{array}{c} \text{time} \\ \hline 4.67 \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.00 \\ 7.75 \\ 22.11 \\ 0.01 \\ 0.00 \\ 7.90 \\ 0.01 \\ 0.02 \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.01 \\ 0.01 \\ 0.01 \\ \end{array}$	$\begin{array}{c} C_{max} \\ \hline \\ 33,132 \\ 23,100 \\ 46,806 \\ 24,485 \\ 23,597 \\ 28,655 \\ 42,239 \\ 31,597 \\ 35,794 \\ 26,145 \\ 38,545 \\ 27,895 \\ 28,120 \\ 29,682 \\ 41,619 \\ 31,280 \\ 40,388 \\ 26,297 \\ 30,717 \end{array}$	$\begin{array}{c} \text{time} \\ \hline 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.01 \\ 0.01 \\ 0.02 \end{array}$	Cmax           34,443           25,032           49,111           24,485           23,597           28,750           32,669           36,098           26,145           38,756           30,851           22,366           42,415           32,366           42,415           32,366           32,366           32,366           33,965	$\begin{array}{c} \text{time} \\ \hline 0.00 \\ 0.00$	$\frac{C_{\rm max}}{33,132}$ $\frac{33,132}{23,100}$ $42,896$ $42,896$ $42,239$ $31,471$ $35,250$ $26,145$ $27,895$ $28,120$ $29,682$ $41,619$ $31,280$ $40,388$ $26,297$ $20,717$	$\begin{array}{c} \text{time} \\ \hline 0.28 \\ 0.30 \\ 0.34 \\ 0.31 \\ 0.25 \\ 0.32 \\ 0.40 \\ 0.42 \\ 0.32 \\ 0.44 \\ 0.38 \\ 0.37 \\ 0.41 \\ 0.48 \\ 0.44 \\ 0.38 \\ 0.47 \\ \end{array}$
miniYFJS01 miniYFJS02 miniYFJS03 miniYFJS05 miniYFJS06 miniYFJS06 miniYFJS09 miniYFJS09 miniYFJS10 miniYFJS11 miniYFJS12 miniYFJS13 miniYFJS13 miniYFJS15 miniYFJS16 miniYFJS17 miniYFJS19 miniYFJS19 miniYFJS19 miniYFJS20	Cmax           33,132           23,100           42,896           24,485           23,597           28,655           42,239           31,471           35,250           26,145           38,545           28,612           29,682           41,619           31,280           40,388           26,297           30,717           28,822	time 0.00 0.00 0.00 0.00 0.00 0.01 0.00 0.02 0.01 0.01 0.01 0.01 0.01 0.02 0.00 0.02 0.00 0.02 0.00 0.02 0.00	$\begin{array}{c} C_{\rm max} \\ 33,132 \\ 23,100 \\ 42,896 \\ 24,485 \\ 23,597 \\ 28,655 \\ 28,655 \\ 28,655 \\ 28,145 \\ 38,545 \\ 27,895 \\ 28,120 \\ 29,682 \\ 41,619 \\ 31,280 \\ 40,388 \\ 26,297 \\ 30,717 \\ 28,832 \end{array}$	$\begin{array}{c} \text{time} \\ \hline 0.00 \\ 0.01 \\ 0.01 \\ 0.00 \\ 0.00 \\ 0.01 \\ 0.05 \\ 0.15 \\ 0.01 \\ 0.00 \\ 0.02 \\ 0.09 \\ 0.00$	Cmax           33,132           23,100           42,896           24,485           23,597           28,655           28,655           26,145           38,545           28,852           28,120           29,682           41,619           31,280           40,388           26,297           30,717           28,832	$\begin{array}{c} \text{time} \\ \hline 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.01 \\ 0.00 \\ 4.98 \\ 5.41 \\ 3.71 \\ 48.02 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.01 \\ 0.04 \\ \end{array}$	Cmax           33,132           23,100           42,896           24,485           23,597           28,655           42,239           31,471           35,250           26,145           38,545           28,281           28,120           29,682           41,619           31,280           40,388           26,297           30,717           28,822	$\begin{array}{c} \text{time} \\ \hline \\ 4.67 \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.00 \\ 7.75 \\ 22.11 \\ 0.00 \\ 7.90 \\ 0.01 \\ 0.00 \\ 0.01 \\ 0.00 \\ 10.05 \\ 0.01 \\ 0.01 \\ 0.01 \\ 0.03 \end{array}$	$\begin{array}{c} C_{max} \\ \hline 33,102 \\ 23,100 \\ 46,806 \\ 24,485 \\ 23,597 \\ 28,655 \\ 42,239 \\ 31,597 \\ 35,794 \\ 26,145 \\ 27,895 \\ 28,120 \\ 29,682 \\ 41,619 \\ 31,280 \\ 40,388 \\ 26,297 \\ 30,717 \\ 28,832 \\ \end{array}$	$\begin{array}{c} \text{time} \\ \hline 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.01 \\ 0.00$	Cmax           34,443           25,032           49,111           24,485           23,597           28,750           45,493           32,669           36,098           26,145           38,756           30,851           28,120           29,682           41,316           22,366           41,316           26,297           33,965           31,304	$\begin{array}{c} \text{time} \\ \hline 0.00 \\ 0.00$	Cmax           33,132           23,100           42,896           24,485           23,597           28,655           26,145           38,545           27,895           28,120           29,682           41,619           31,280           40,388           26,297           30,717           28,832	$\begin{array}{c} \text{time} \\ \hline 0.28 \\ 0.30 \\ 0.34 \\ 0.31 \\ 0.25 \\ 0.32 \\ 0.40 \\ 0.42 \\ 0.32 \\ 0.44 \\ 7.80 \\ 0.32 \\ 0.44 \\ 7.80 \\ 0.38 \\ 0.47 \\ 0.38 \\ 0.47 \\ 0.38 \end{array}$
miniYFJS01 miniYFJS03 miniYFJS03 miniYFJS05 miniYFJS06 miniYFJS07 miniYFJS09 miniYFJS09 miniYFJS10 miniYFJS10 miniYFJS11 miniYFJS13 miniYFJS13 miniYFJS14 miniYFJS16 miniYFJS16 miniYFJS18 miniYFJS18 miniYFJS18 miniYFJS12 miniYFJS20 miniYFJS21	$\begin{array}{c} \hline C_{\rm max} \\ 33,132 \\ 23,100 \\ 42,896 \\ 24,485 \\ 23,597 \\ 28,655 \\ 28,555 \\ 31,471 \\ 35,250 \\ 26,145 \\ 38,545 \\ 27,895 \\ 28,120 \\ 29,682 \\ 41,619 \\ 31,280 \\ 40,388 \\ 26,297 \\ 30,717 \\ 28,832 \\ 34,811 \\ \end{array}$	time 0.00 0.00 0.00 0.00 0.01 0.00 0.02 0.01 0.01 0.01 0.01 0.01 0.02 0.01 0.01 0.02 0.01 0.02 0.01 0.02 0.01 0.02 0.01 0.02 0.01 0.02 0.01 0.02 0.01 0.02 0.01 0.02 0.01 0.02 0.02 0.01 0.02 0.03 0.03 0.03 0.13	$\begin{array}{c} C_{\rm max} \\ \hline \\ 33,132 \\ 23,100 \\ 42,896 \\ 24,485 \\ 23,597 \\ 28,655 \\ 23,597 \\ 28,655 \\ 23,597 \\ 28,652 \\ 31,471 \\ 35,250 \\ 26,145 \\ 38,545 \\ 27,895 \\ 28,120 \\ 29,682 \\ 41,619 \\ 31,280 \\ 40,388 \\ 26,297 \\ 30,717 \\ 28,832 \\ 34,811 \end{array}$	$\begin{array}{c} \text{time} \\ \hline 0.00 \\ 0.01 \\ 0.01 \\ 0.00 \\ 0.00 \\ 0.01 \\ 0.05 \\ 0.15 \\ 0.01 \\ 0.00 \\ 0.02 \\ 0.09 \\ 0.00$	$\begin{array}{c} C_{\rm max} \\ \hline \\ 33,132 \\ 23,100 \\ 42,896 \\ 24,485 \\ 23,597 \\ 28,655 \\ 23,597 \\ 28,655 \\ 23,597 \\ 31,471 \\ 35,250 \\ 26,145 \\ 38,545 \\ 27,895 \\ 28,120 \\ 29,682 \\ 41,619 \\ 31,280 \\ 40,388 \\ 26,297 \\ 30,717 \\ 28,832 \\ 34,811 \end{array}$	$\begin{array}{c} \text{time} \\ \hline 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.01 \\ 0.00 \\ 4.98 \\ 5.41 \\ 3.71 \\ 48.02 \\ 0.00 \\ 0.0$	Cmax           33,132           23,100           42,896           24,485           23,597           28,655           28,655           28,239           31,471           35,250           26,145           28,545           28,281           28,622           41,619           31,286           40,388           26,297           30,717           28,832           34,811	$\begin{array}{c} \text{time} \\ \hline \\ 4.67 \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.00 \\ 7.75 \\ 22.11 \\ 0.01 \\ 0.00 \\ 7.90 \\ 0.01 \\ 0.02 \\ 0.00 \\ 0.01 \\ 0.00 \\ 10.05 \\ 0.01 \\ 0.01 \\ 0.03 \\ 0.06 \end{array}$	$\begin{array}{c} \hline C_{max} \\ \hline 33,132 \\ 23,100 \\ 46,806 \\ 24,485 \\ 23,597 \\ 28,655 \\ 23,597 \\ 35,597 \\ 35,794 \\ 26,145 \\ 38,545 \\ 27,895 \\ 28,120 \\ 29,682 \\ 41,619 \\ 31,280 \\ 40,388 \\ 26,297 \\ 30,717 \\ 28,832 \\ 34,876 \\ \end{array}$	$\begin{array}{c} \text{time} \\ \hline 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.01 \\ 0.01 \\ 0.01 \\ 0.03 \\ 0.00$	Cmax           34,443           25,032           49,111           24,485           23,597           28,750           32,669           36,098           26,145           38,756           30,851           29,682           42,415           32,366           31,304           41,316           26,297           33,965           31,304           34,811	$\begin{array}{c} \text{time} \\ \hline 0.00 \\ 0.05 \\ \end{array}$	Cmax           33,132           23,100           42,896           24,485           23,597           28,655           24,485           23,597           28,655           28,655           28,655           26,145           38,545           29,682           41,619           31,280           40,388           26,297           30,717           28,832           34,811	$\begin{array}{c} \text{time} \\ \hline 0.28 \\ 0.30 \\ 0.31 \\ 0.25 \\ 0.32 \\ 0.42 \\ 0.32 \\ 0.32 \\ 0.44 \\ 7.80 \\ 0.38 \\ 0.37 \\ 0.41 \\ 0.48 \\ 0.44 \\ 0.38 \\ 0.44 \\ 0.38 \\ 0.47 \\ 0.38 \\ 24.18 \end{array}$
miniYFJS01 miniYFJS02 miniYFJS03 miniYFJS05 miniYFJS05 miniYFJS06 miniYFJS09 miniYFJS09 miniYFJS09 miniYFJS11 miniYFJS11 miniYFJS12 miniYFJS12 miniYFJS15 miniYFJS15 miniYFJS18 miniYFJS18 miniYFJS18 miniYFJS19 miniYFJS21 miniYFJS21 miniYFJS22	Cmax           33,132           23,100           42,896           24,485           23,597           28,655           42,239           31,471           35,250           26,145           29,682           29,682           29,682           20,717           28,832           30,717           28,832           34,811           31,702	$\begin{array}{c} \text{time} \\ \hline 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.01 \\ 0.02 \\ 0.02 \\ 0.01 \\ 0.02 \\ 0.01 \\ 0.01 \\ 0.02 \\ 0.00 \\ 0.02 \\ 0.01 \\ 0.00 \\ 0.02 \\ 0.01 \\ 0.00 \\ 0.02 \\ 0.01 \\ 0.00 \\ 0.02 \\ 0.01 \\ 0.01 \\ 0.01 \\ 0.01 \\ 0.01 \\ 0.01 \\ 0.01 \\ 0.00 \\ 0.01 \\ 0.01 \\ 0.01 \\ 0.01 \\ 0.00 \\ 0.01 \\ 0.01 \\ 0.01 \\ 0.01 \\ 0.00 \\ 0.01$	$\begin{array}{c} C_{max} \\ \hline \\ 33,132 \\ 23,100 \\ 42,896 \\ 24,485 \\ 23,597 \\ 28,655 \\ 42,239 \\ 31,471 \\ 35,250 \\ 26,145 \\ 26,145 \\ 26,145 \\ 28,120 \\ 29,682 \\ 41,619 \\ 31,280 \\ 40,388 \\ 26,297 \\ 30,717 \\ 28,832 \\ 34,811 \\ 31,702 \end{array}$	$\begin{array}{c} \text{time} \\ \hline 0.00 \\ 0.01 \\ 0.01 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.01 \\ 0.05 \\ 0.15 \\ 0.01 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.03 \\ 0.01 \\ 0.06 \\ 0.09 \\ 0.03 \end{array}$	$\begin{array}{c} C_{max} \\ \hline \\ 33,132 \\ 23,100 \\ 42,896 \\ 24,485 \\ 23,597 \\ 28,655 \\ 42,239 \\ 31,471 \\ 35,250 \\ 26,145 \\ 27,895 \\ 28,120 \\ 29,682 \\ 41,619 \\ 31,280 \\ 40,388 \\ 26,297 \\ 30,717 \\ 28,832 \\ 34,811 \\ 31,702 \end{array}$	$\begin{array}{c} \text{time} \\ \hline 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 4.98 \\ 5.41 \\ 3.71 \\ 48.02 \\ 0.00 \\ 0.0$	Cmax           33,132           23,100           42,896           24,485           23,557           28,655           42,239           31,471           35,250           26,145           28,655           28,281           29,682           29,682           26,297           30,717           28,821           31,747	$\begin{array}{c} \text{time} \\ \hline \\ 4.67 \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.00 \\ 0.00 \\ 7.75 \\ 22.11 \\ 0.01 \\ 0.00 \\ 7.90 \\ 0.01 \\ 0.02 \\ 0.00 \\ 0.01 \\ 0.02 \\ 0.00 \\ 0.01 \\ 0$	$\begin{array}{c} C_{max} \\ \hline \\ 33,132 \\ 23,100 \\ 46,806 \\ 24,485 \\ 23,597 \\ 28,655 \\ 42,239 \\ 31,597 \\ 35,794 \\ 26,145 \\ 38,545 \\ 27,895 \\ 28,120 \\ 29,682 \\ 41,619 \\ 31,280 \\ 40,388 \\ 26,297 \\ 30,717 \\ 28,832 \\ 34,876 \\ 31,702 \\ \end{array}$	$\begin{array}{c} \text{time} \\ \hline 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.01 \\ 0.01 \\ 0.01 \\ 0.02 \\ 0.03 \\ 0.00 \\ 0.03 \end{array}$	Cmax           34,443           25,032           49,111           24,485           23,597           28,750           32,669           36,098           26,145           29,682           42,415           32,366           41,316           26,297           33,965           31,304           34,811	$\begin{array}{c} \text{time} \\ \hline 0.00 \\ 0.00$	$\frac{C_{\rm max}}{33,132}$ $\frac{33,132}{23,100}$ $42,896$ $42,896$ $42,239$ $31,471$ $35,250$ $26,145$ $27,895$ $28,120$ $29,682$ $29,682$ $29,682$ $29,682$ $29,682$ $29,682$ $29,682$ $29,682$ $29,682$ $29,682$ $31,280$ $40,388$ $26,297$ $30,717$ $28,832$ $34,8112$ $31,702$	$\begin{array}{c} \text{time} \\ \hline 0.28 \\ 0.30 \\ 0.31 \\ 0.25 \\ 0.32 \\ 0.42 \\ 0.32 \\ 0.32 \\ 0.44 \\ 7.80 \\ 0.38 \\ 0.37 \\ 0.41 \\ 0.48 \\ 0.44 \\ 0.38 \\ 0.44 \\ 0.38 \\ 24.18 \\ 0.54 \end{array}$
miniYFJS01 miniYFJS02 miniYFJS03 miniYFJS05 miniYFJS06 miniYFJS06 miniYFJS09 miniYFJS09 miniYFJS10 miniYFJS12 miniYFJS12 miniYFJS13 miniYFJS15 miniYFJS16 miniYFJS16 miniYFJS18 miniYFJS19 miniYFJS19 miniYFJS22 miniYFJS22 miniYFJS23	Cmax           33,132           23,100           42,896           24,485           23,597           28,655           42,239           31,471           35,250           26,145           38,545           27,895           28,120           29,682           41,619           31,280           40,388           26,297           30,717           28,832           34,811           31,700           38,639	$\begin{array}{c} \text{time} \\ \hline 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.02 \\ 0.02 \\ 0.01 \\ 0.15 \\ 0.01 \\ 0.01 \\ 0.00 \\ 0.02 \\ 0.01 \\ 0.00 \\ 0.02 \\ 0.03 \\ 0.13 \\ 0.01 \\ 0.08 \end{array}$	Cmax           33,132           23,100           42,896           24,485           23,597           28,655           42,239           31,471           35,250           26,145           38,545           28,615           28,120           29,682           41,619           31,280           40,388           26,297           30,717           28,822           34,811           31,702           38,639	$\begin{array}{c} \text{time} \\ \hline 0.00 \\ 0.01 \\ 0.01 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.05 \\ 0.15 \\ 0.01 \\ 0.05 \\ 0.01 \\ 0.02 \\ 0.09 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.01 \\ 0.06 \\ 0.02 \\ 0.03 \\ 0.14 \end{array}$	Cmax           33,132           23,100           42,896           24,485           23,597           28,655           42,239           31,471           35,250           26,145           38,545           27,895           28,120           29,682           41,619           31,280           40,388           26,297           30,717           34,811           31,702	$\begin{array}{c} \text{time} \\ \hline 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.01 \\ 0.00 \\ 4.98 \\ 5.41 \\ 3.71 \\ 48.02 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 33.88 \end{array}$	Cmax           33,132           23,100           42,896           24,485           23,597           28,655           42,239           31,471           35,250           26,145           38,545           28,281           28,120           29,682           41,619           31,280           40,388           26,297           30,717           30,713           31,743           38,633	$\begin{array}{c} \text{time} \\ 4.67 \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.00 \\ 0.00 \\ 7.75 \\ 22.11 \\ 0.01 \\ 0.01 \\ 0.00 \\ 0.01 \\ 0.02 \\ 0.00 \\ 10.05 \\ 0.01 \\ 0.01 \\ 0.03 \\ 0.06 \\ 0.17 \\ 39.04 \end{array}$	Cmax           33,132           23,100           46,806           24,485           23,597           28,655           42,239           31,597           35,794           26,145           38,545           28,4120           29,682           41,619           31,280           40,388           26,297           30,717           28,832           34,876           31,762	$\begin{array}{c} \text{time} \\ \hline 0.00 \\ 0.01 \\ 0.01 \\ 0.02 \\ 0.03 \\ 0.00 \\ 0.03 \\ 0.04 \\ \end{array}$	Cmax           34,443           25,032           49,111           24,485           23,597           28,750           45,493           32,669           36,098           26,145           38,756           30,8512           28,120           29,682           41,316           22,366           31,946           30,721	time           0.00	Cmax           33,132           23,100           42,896           24,485           23,597           28,655           42,239           31,471           35,250           26,145           38,545           27,895           28,120           29,682           41,619           31,280           40,388           26,297           30,717           34,811           31,702           38,633	$\begin{array}{c} \text{time} \\ \hline 0.28 \\ 0.30 \\ 0.34 \\ 0.31 \\ 0.25 \\ 0.32 \\ 0.40 \\ 0.42 \\ 0.32 \\ 0.44 \\ 7.80 \\ 0.38 \\ 0.37 \\ 0.41 \\ 0.48 \\ 0.44 \\ 0.38 \\ 0.47 \\ 0.38 \\ 0.47 \\ 0.38 \\ 0.47 \\ 0.38 \\ 0.54 \\ 0.50 \\ \end{array}$
miniYFJS01 miniYFJS03 miniYFJS03 miniYFJS05 miniYFJS06 miniYFJS06 miniYFJS09 miniYFJS09 miniYFJS10 miniYFJS10 miniYFJS13 miniYFJS13 miniYFJS13 miniYFJS16 miniYFJS16 miniYFJS17 miniYFJS19 miniYFJS20 miniYFJS21 miniYFJS23 miniYFJS23 miniYFJS24	Cmax           33,132           23,100           42,896           24,485           23,597           28,655           28,655           26,145           26,145           28,545           27,895           28,120           29,682           41,619           31,280           40,388           26,297           30,717           28,832           34,811           31,702           38,638           28,884	$\begin{array}{c} {\rm time} \\ {\rm 0.00} \\ {\rm 0.02} \\ {\rm 0.01} \\ {\rm 0.01} \\ {\rm 0.01} \\ {\rm 0.01} \\ {\rm 0.02} \\ {\rm 0.01} \\ {\rm 0.02} \\ {\rm 0.01} \\ {\rm 0.02} \\ {\rm 0.03} \\ {\rm 0.03} \\ {\rm 0.03} \\ {\rm 0.03} \\ {\rm 0.05} \\ \end{array}$	Cmax           33,132           23,100           42,896           42,896           24,445           23,597           28,655           24,239           31,471           35,250           26,145           28,555           28,852           29,682           41,619           31,280           40,388           26,297           30,717           28,832           34,811           31,702           38,684	time           0.00           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.01           0.00           0.00           0.01           0.05           0.05           0.01           0.02           0.03           0.04           0.05           0.03           0.04           0.05	$\begin{array}{c} C_{\rm max} \\ \hline C_{\rm max} \\ 33,132 \\ 23,100 \\ 42,896 \\ 24,485 \\ 23,597 \\ 28,655 \\ 23,597 \\ 28,655 \\ 23,597 \\ 31,471 \\ 35,250 \\ 26,145 \\ 38,545 \\ 27,895 \\ 28,120 \\ 29,682 \\ 41,619 \\ 31,280 \\ 29,682 \\ 41,619 \\ 31,286 \\ 29,682 \\ 41,619 \\ 31,280 \\ 28,832 \\ 34,811 \\ 31,702 \\ 38,632 \\ 34,811 \\ 31,702 \\ 38,630 \\ 30,200 \end{array}$	$\begin{array}{c} {\rm time} \\ {\rm 0.00} \\ {\rm 4.98} \\ {\rm 3.71} \\ {\rm 48.02} \\ {\rm 0.00} \\ {\rm 0.01} \\ {\rm 0.04} \\ {\rm 0.07} \\ {\rm 0.03} \\ {\rm 33.88} \\ {\rm 21.84} \end{array}$	Cmax           33,132           23,100           42,896           24,485           23,597           28,655           28,655           26,145           28,545           28,251           26,145           28,251           26,145           28,252           24,619           31,280           29,682           41,619           31,283           24,812           28,832           34,811           31,747           38,638           28,884	$\begin{array}{c} \mbox{time} \\ \mbox{4.67} \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.01 \\ 0.02 \\ 0.01 \\ 0.02 \\ 0.00 \\ 10.05 \\ 0.01 \\ 0.03 \\ 0.06 \\ 0.17 \\ 39.04 \\ 46.64 \end{array}$	$\begin{array}{c} \hline C_{\rm max} \\ \hline 33,132 \\ 23,100 \\ 46,806 \\ 24,485 \\ 23,597 \\ 28,655 \\ 23,597 \\ 35,794 \\ 26,145 \\ 38,545 \\ 27,895 \\ 28,120 \\ 29,682 \\ 41,619 \\ 31,288 \\ 29,682 \\ 41,619 \\ 31,288 \\ 26,297 \\ 30,717 \\ 28,832 \\ 34,876 \\ 31,702 \\ 38,639 \\ 38,884 \\ \end{array}$	time           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.01           0.02           0.03           0.04           0.06	Cmax           34,443           25,032           49,111           24,485           23,597           28,750           32,669           36,098           26,145           38,756           30,851           28,120           29,682           42,415           32,366           41,316           26,297           33,965           31,304           34,811           30,568	time           0.00	Cmax           33,132           23,100           42,896           24,485           23,597           28,655           28,655           26,145           38,545           29,682           41,619           31,288           26,297           30,717           28,832           34,811           31,702           28,884	$\begin{array}{c} \text{time} \\ 0.28 \\ 0.30 \\ 0.34 \\ 0.31 \\ 0.25 \\ 0.32 \\ 0.40 \\ 0.42 \\ 0.32 \\ 0.40 \\ 0.42 \\ 0.32 \\ 0.44 \\ 0.38 \\ 0.37 \\ 0.41 \\ 0.48 \\ 0.44 \\ 0.38 \\ 0.44 \\ 0.38 \\ 0.44 \\ 0.38 \\ 0.41 \\ 0.38 \\ 24.18 \\ 0.54 \\ 0.50 \\ 0.53 \\ \end{array}$
miniYFJS01 miniYFJS02 miniYFJS03 miniYFJS05 miniYFJS05 miniYFJS06 miniYFJS09 miniYFJS09 miniYFJS09 miniYFJS11 miniYFJS12 miniYFJS12 miniYFJS13 miniYFJS15 miniYFJS15 miniYFJS15 miniYFJS18 miniYFJS18 miniYFJS19 miniYFJS21 miniYFJS22 miniYFJS22 miniYFJS23 miniYFJS25	Cmax           33,132           23,100           42,896           24,485           23,597           28,655           28,655           31,471           35,250           26,145           26,145           28,655           27,895           28,6545           29,682           41,619           31,280           40,388           26,297           30,717           28,824           34,811           31,702           38,6639           28,884           34,231	time           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.01         0.00           0.02         0.00           0.01         0.01           0.02         0.02           0.00         0.02           0.00         0.02           0.00         0.02           0.00         0.02           0.01         0.00           0.02         0.03           0.03         0.05           0.05         0.04	Cmax           33,132           23,100           42,896           42,896           24,445           23,597           28,655           24,239           31,471           35,250           26,145           26,145           27,895           28,655           29,682           41,619           31,280           40,388           26,297           30,717           28,832           34,811           31,702           38,639           28,884           34,231	time           0.00         0.01           0.01         0.00           0.01         0.00           0.01         0.05           0.15         0.15           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.03         0.01           0.02         0.03           0.03         0.14           0.04         0.04	$\begin{array}{c} C_{\rm max} \\ \hline C_{\rm max} \\ 33,132 \\ 23,100 \\ 42,896 \\ 24,485 \\ 23,597 \\ 28,655 \\ 23,597 \\ 28,655 \\ 23,597 \\ 30,471 \\ 35,250 \\ 26,145 \\ 38,545 \\ 27,895 \\ 28,120 \\ 29,682 \\ 41,619 \\ 31,280 \\ 40,388 \\ 26,297 \\ 30,717 \\ 28,832 \\ 34,811 \\ 31,702 \\ 38,639 \\ 30,200 \\ 30,200 \\ 30,231 \\ \end{array}$	$\begin{array}{c} {\rm time} \\ {\rm 0.00} \\ {\rm 0.01} \\ {\rm 0.00} \\ {\rm 0.01} \\ {\rm 0.03} \\ {\rm 33.88} \\ {\rm 21.84} \\ {\rm 22.59} \end{array}$	Cmax           33,132           23,100           42,896           24,485           23,597           28,655           28,655           31,471           35,250           26,145           28,655           28,281           28,652           29,682           41,619           31,280           40,388           26,297           30,717           28,824           34,811           31,747           38,6639           28,884           34,231	$\begin{array}{c} \mbox{time} \\ \mbox{4.67} \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.00 \\ 0.00 \\ 7.75 \\ 22.11 \\ 0.01 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.01 \\ 0.01 \\ 0.01 \\ 0.01 \\ 0.01 \\ 0.01 \\ 0.01 \\ 0.01 \\ 0.01 \\ 0.01 \\ 0.01 \\ 0.01 \\ 0.01 \\ 0.06 \\ 0.17 \\ 39.04 \\ 46.64 \\ 41.59 \end{array}$	Cmax           33,132           23,100           46,806           24,485           23,597           28,655           28,655           31,597           35,794           26,145           28,655           28,655           28,7895           28,794           29,682           41,619           31,280           40,388           26,297           30,717           28,882           34,876           31,702           38,6639           28,884           34,231	time           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.01           0.02         0.03           0.04         0.06           0.05         0.01	Cmax           34,443           25,032           49,111           24,485           23,597           28,750           32,669           36,098           26,145           28,756           30,851           29,682           29,682           41,316           26,297           31,304           34,811           30,568           30,526	time           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.01           0.00	Cmax           33,132           23,100           42,896           24,485           23,597           28,655           24,485           23,597           28,655           27,895           28,655           29,682           41,619           31,280           40,388           26,297           30,717           28,882           34,811           31,702           38,639           28,884           34,231	$\begin{array}{c} \mbox{time} \\ 0.28 \\ 0.30 \\ 0.34 \\ 0.31 \\ 0.25 \\ 0.32 \\ 0.40 \\ 0.42 \\ 0.32 \\ 0.44 \\ 7.80 \\ 0.32 \\ 0.44 \\ 7.80 \\ 0.37 \\ 0.41 \\ 0.38 \\ 0.47 \\ 0.38 \\ 0.44 \\ 0.38 \\ 0.44 \\ 0.54 \\ 0.54 \\ 0.54 \\ 0.53 \\ 0.53 \\ 0.46 \end{array}$
miniYFJS01 miniYFJS02 miniYFJS03 miniYFJS05 miniYFJS06 miniYFJS06 miniYFJS09 miniYFJS09 miniYFJS09 miniYFJS10 miniYFJS12 miniYFJS13 miniYFJS13 miniYFJS16 miniYFJS16 miniYFJS16 miniYFJS19 miniYFJS19 miniYFJS21 miniYFJS22 miniYFJS23 miniYFJS23 miniYFJS23 miniYFJS25 miniYFJS26	Cmax           33,132           23,100           42,896           24,485           23,597           28,655           42,239           31,471           35,250           26,145           38,545           27,895           28,120           29,682           41,619           31,280           40,388           26,297           30,717           28,832           34,811           31,702           28,844           34,231           34,251	$\begin{array}{c} {\rm time} \\ {\rm 0.00} \\ {\rm 0.01} \\ {\rm 0.00} \\ {\rm 0.02} \\ {\rm 0.01} \\ {\rm 0.02} \\ {\rm 0.01} \\ {\rm 0.02} \\ {\rm 0.02} \\ {\rm 0.01} \\ {\rm 0.02} \\ {\rm 0.02} \\ {\rm 0.02} \\ {\rm 0.03} \\ {\rm 0.03} \\ {\rm 0.03} \\ {\rm 0.03} \\ {\rm 0.04} \\ {\rm 0.01} \\ \end{array}$	Cmax           33,132           23,100           42,896           24,485           23,597           28,655           42,239           31,471           35,250           26,145           38,545           27,895           28,120           29,682           41,619           31,280           40,388           26,297           30,717           28,832           34,811           31,702           28,843           34,231           47,519	$\begin{array}{c} \mbox{time} \\ \hline \mbox{0.00} \\ 0.01 \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.01 \\ 0.05 \\ 0.01 \\ 0.00 \\ $	$\begin{array}{c} C_{\rm max} \\ 33,132 \\ 23,100 \\ 42,896 \\ 24,485 \\ 23,597 \\ 28,655 \\ 42,239 \\ 31,471 \\ 35,250 \\ 26,145 \\ 38,545 \\ 27,895 \\ 28,120 \\ 29,682 \\ 41,619 \\ 33,280 \\ 40,388 \\ 26,297 \\ 30,717 \\ 28,832 \\ 34,811 \\ 31,702 \\ 38,639 \\ 30,200 \\ 34,231 \\ 34,251 \end{array}$	$\begin{array}{c} \mbox{time} \\ 0.00 \\ 0.01 \\ 0.03 \\ 33.88 \\ 21.84 \\ 26.59 \\ 1.48 \end{array}$	Cmax           33,132           23,100           23,102           23,132           23,597           28,655           42,239           31,471           35,250           26,145           38,545           28,821           28,120           29,682           41,619           31,280           40,388           26,297           30,717           28,832           34,811           31,747           38,639           28,84           34,231           34,251	$\begin{array}{c} \mbox{time} \\ \mbox{4.67} \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.00 \\ 7.75 \\ 22.11 \\ 0.00 \\ 7.90 \\ 0.01 \\ 0.00 \\ 0.01 \\ 0.02 \\ 0.00 \\ 0.01 \\ 0.02 \\ 0.00 \\ 0.01 \\ 0.03 \\ 0.06 \\ 0.01 \\ 0.03 \\ 0.01 \\ 0.03 \\ 0.01 \\ 0.01 \\ 0.03 \\ 0.01 \\ 0.01 \\ 0.01 \\ 0.01 \\ 0.03 \\ 0.01 \\ 0$	Cmax           33,132           23,100           46,806           24,485           23,597           28,655           42,239           31,597           35,794           26,145           38,545           27,895           28,120           29,682           41,619           31,280           40,388           26,297           30,717           28,832           34,876           31,702           28,84           34,231           49,202	time           0.00           0.01           0.02           0.03           0.04           0.04	Cmax           34,443           25,032           49,111           24,485           23,597           28,750           45,493           32,669           36,098           26,145           38,756           30,851           28,120           28,682           41,316           29,682           41,316           30,955           31,304           39,721           30,558           35,256           48,066	time           0.00	Cmax           33,132           23,100           42,896           24,485           23,597           28,655           42,239           31,471           35,250           26,145           38,545           27,895           28,120           29,682           41,619           31,280           40,388           26,297           30,717           28,832           34,811           31,700           28,639           28,643           34,231           34,251           34,251	$\begin{array}{c} {\rm time} \\ 0.28\\ 0.30\\ 0.34\\ 0.31\\ 0.31\\ 0.40\\ 0.42\\ 0.32\\ 0.40\\ 0.32\\ 0.32\\ 0.32\\ 0.32\\ 0.32\\ 0.33\\ 0.38\\ 0.37\\ 0.41\\ 0.38\\ 0.48\\ 0.44\\ 0.38\\ 0.44\\ 0.38\\ 0.44\\ 0.38\\ 0.44\\ 0.50\\ $
miniYFJS01 miniYFJS03 miniYFJS03 miniYFJS05 miniYFJS06 miniYFJS06 miniYFJS09 miniYFJS09 miniYFJS09 miniYFJS10 miniYFJS11 miniYFJS13 miniYFJS13 miniYFJS15 miniYFJS16 miniYFJS16 miniYFJS16 miniYFJS17 miniYFJS19 miniYFJS20 miniYFJS22 miniYFJS23 miniYFJS23 miniYFJS24 miniYFJS26 miniYFJS26 miniYFJS27	$\begin{array}{c} \hline C_{\rm max} \\ \hline 33,132 \\ 23,100 \\ 42,896 \\ 24,485 \\ 23,597 \\ 28,655 \\ 42,239 \\ 31,471 \\ 35,250 \\ 26,145 \\ 38,545 \\ 27,895 \\ 28,120 \\ 29,682 \\ 41,619 \\ 31,280 \\ 29,682 \\ 41,619 \\ 31,280 \\ 28,812 \\ 30,717 \\ 28,832 \\ 34,811 \\ 31,702 \\ 38,639 \\ 28,884 \\ 34,231 \\ 47,519 \\ 34,042 \\ \end{array}$	$\begin{array}{c} \mbox{time} \\ \hline \mbox{time} \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.01 \\ 0.01 \\ 0.01 \\ 0.01 \\ 0.01 \\ 0.02 \\ 0.01 \\ 0.01 \\ 0.02 \\ 0.01 \\ 0.00 \\ 0.02 \\ 0.01 \\ 0.00 \\ 0.02 \\ 0.01 \\ 0.00 \\ 0.02 \\ 0.01 \\ 0.00 \\ 0.03 \\ 0.03 \\ 0.03 \\ 0.05 \\ 0.04 \\ 0.01 \\ 0.08 \\ 0.08 \\ 0.08 \end{array}$	$\begin{array}{c} C_{\rm max} \\ \hline C_{\rm max} \\ 33,132 \\ 23,100 \\ 42,896 \\ 24,485 \\ 23,597 \\ 28,655 \\ 23,597 \\ 28,655 \\ 23,597 \\ 31,471 \\ 35,250 \\ 26,145 \\ 38,545 \\ 27,895 \\ 28,120 \\ 29,682 \\ 41,619 \\ 31,280 \\ 29,682 \\ 41,619 \\ 31,280 \\ 28,832 \\ 34,811 \\ 31,702 \\ 38,639 \\ 28,884 \\ 34,231 \\ 47,519 \\ 34,042 \\ \end{array}$	$\begin{array}{c} \mbox{time} \\ \hline \mbox{time} \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.01 \\ 0.00 \\ $	$\begin{array}{c} C_{\rm max} \\ \hline \\ 33,132 \\ 23,100 \\ 42,896 \\ 24,485 \\ 23,597 \\ 28,655 \\ 23,597 \\ 28,655 \\ 23,597 \\ 31,471 \\ 35,250 \\ 28,120 \\ 29,682 \\ 41,619 \\ 31,280 \\ 29,682 \\ 41,619 \\ 31,280 \\ 29,682 \\ 41,619 \\ 31,280 \\ 28,823 \\ 34,811 \\ 31,702 \\ 38,639 \\ 30,200 \\ 34,231 \\ 47,519 \\ 34,042 $	$\begin{array}{c} \mbox{time} \\ \hline \mbox{time} \\ 0.00 \\ 0.01 \\ 0.03 \\ 0.04 \\ 0.07 \\ 0.03 \\ 0.04 \\ 0.03 \\ 0.03 \\ 0.03 \\ 0.03 \\ 0.03 \\ 0.03 \\ 0.03 \\ 0.03 \\ 0.03 \\ 0.03 \\ 0.03 \\ 0.03 \\ 0.03 \\ 0.00 \\ $	$\begin{array}{c} C_{\rm max} \\ \hline \\ 33,132 \\ 23,100 \\ 42,896 \\ 24,485 \\ 23,597 \\ 28,655 \\ 28,239 \\ 31,471 \\ 35,250 \\ 26,145 \\ 38,545 \\ 28,281 \\ 28,120 \\ 29,682 \\ 41,619 \\ 31,280 \\ 29,682 \\ 41,619 \\ 31,280 \\ 29,682 \\ 41,619 \\ 31,280 \\ 28,821 \\ 34,811 \\ 31,747 \\ 38,639 \\ 38,832 \\ 34,811 \\ 31,747 \\ 38,639 \\ 38,834 \\ 34,231 \\ 47,519 \\ 34,042 \\ 34,042 \\ 34,041 \\ 519 \\ 34,042 \\ 34,041 \\ 34,041 \\ 3$	$\begin{array}{c} \mbox{time} \\ \mbox{4.67} \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.00 \\ 7.75 \\ 22.11 \\ 0.01 \\ 7.90 \\ 0.00 \\ 7.90 \\ 0.00 \\ 0$	$\begin{tabular}{ c c c c c }\hline \hline $C_{max}$\\\hline $33,132$\\\hline $23,100$\\\hline $46,806$\\\hline $24,485$\\\hline $23,597$\\\hline $28,655$\\\hline $28,655$\\\hline $28,655$\\\hline $26,145$\\\hline $38,545$\\\hline $27,895$\\\hline $28,120$\\\hline $29,682$\\\hline $41,619$\\\hline $31,280$\\\hline $28,820$\\\hline $28,824$\\\hline $40,388$\\\hline $26,297$\\\hline $30,717$\\\hline $28,832$\\\hline $34,876$\\\hline $31,702$\\\hline $38,639$\\\hline $28,884$\\\hline $34,231$\\\hline $49,202$\\\hline $34,042$\\\hline \end{tabular}$	time           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.01         0.01           0.03         0.04           0.04         0.04           0.01         0.01	Cmax           34,443           25,032           49,111           24,485           23,597           28,750           32,669           36,098           26,145           38,756           30,851           28,120           29,682           41,316           26,297           33,965           31,304           34,811           39,721           30,568           35,256           48,066           34,225	time           0.00	$\frac{C_{\rm max}}{33,132}$ $\frac{23,100}{42,896}$ $\frac{24,485}{23,597}$ $\frac{28,655}{23,597}$ $\frac{28,655}{23,597}$ $\frac{28,145}{38,545}$ $\frac{26,145}{38,545}$ $\frac{26,145}{27,895}$ $\frac{28,120}{29,682}$ $\frac{41,619}{31,280}$ $\frac{31,280}{29,682}$ $\frac{41,619}{31,280}$ $\frac{31,280}{28,824}$ $\frac{34,231}{47,519}$ $\frac{34,042}{34,042}$	$\begin{array}{c} {\rm time} \\ 0.28 \\ 0.30 \\ 0.34 \\ 0.31 \\ 0.25 \\ 0.32 \\ 0.40 \\ 0.42 \\ 0.32 \\ 0.44 \\ 0.38 \\ 0.37 \\ 0.41 \\ 0.38 \\ 0.48 \\ 0.48 \\ 0.48 \\ 0.48 \\ 0.44 \\ 0.38 \\ 0.44 \\ 0.38 \\ 0.418 \\ 0.50 \\ 0.53 \\ 0.50 \\ 0.55 \\ \end{array}$
miniYFJS01 miniYFJS02 miniYFJS03 miniYFJS05 miniYFJS05 miniYFJS06 miniYFJS07 miniYFJS09 miniYFJS09 miniYFJS09 miniYFJS11 miniYFJS12 miniYFJS12 miniYFJS12 miniYFJS15 miniYFJS15 miniYFJS15 miniYFJS16 miniYFJS18 miniYFJS18 miniYFJS18 miniYFJS20 miniYFJS22 miniYFJS22 miniYFJS25 miniYFJS27 miniYFJS28	$\begin{tabular}{ c c c c c c c }\hline \hline $C_{max}$ & $3,132$ & $23,100$ & $42,896$ & $24,485$ & $23,597$ & $28,655$ & $27,895$ & $26,125$ & $26,125$ & $27,895$ & $28,525$ & $28,525$ & $29,682$ & $41,619$ & $31,286$ & $29,682$ & $41,619$ & $31,286$ & $29,682$ & $41,619$ & $31,286$ & $29,682$ & $41,619$ & $31,286$ & $28,884$ & $4,231$ & $37,172$ & $28,884$ & $34,231$ & $37,519$ & $34,042$ & $32,080$ & $32,080$ & \end{tabular}$	time           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.01         0.00           0.02         0.02           0.01         0.01           0.02         0.02           0.01         0.01           0.02         0.00           0.03         0.01           0.04         0.05           0.04         0.04	$\begin{tabular}{ c c c c c c c } \hline $C_{max}$ & $3,132$ \\ $23,100$ & $42,896$ \\ $24,485$ & $23,597$ \\ $28,655$ & $23,597$ \\ $28,652$ & $24,239$ \\ $31,471$ & $35,250$ \\ $26,145$ & $38,545$ \\ $27,895$ & $26,125$ \\ $28,526$ & $28,120$ \\ $29,682$ & $41,619$ \\ $31,280$ & $40,388$ \\ $26,297$ & $30,717$ \\ $28,882$ & $40,388$ \\ $26,297$ & $30,717$ \\ $28,884$ & $40,388$ \\ $34,811$ & $31,702$ \\ $38,639$ & $28,884$ \\ $34,231$ & $47,519$ \\ $32,080$ \\ \end{tabular}$	time           0.00         0.01           0.01         0.00           0.01         0.00           0.00         0.01           0.00         0.01           0.01         0.05           0.15         0.15           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.02           0.03         0.01           0.05         0.05           0.04         0.01           0.09         0.04	$\begin{array}{c} C_{\rm max} \\ \hline C_{\rm max} \\ 33,132 \\ 23,100 \\ 42,896 \\ 24,485 \\ 23,597 \\ 28,655 \\ 23,597 \\ 28,655 \\ 23,597 \\ 31,280 \\ 24,145 \\ 38,545 \\ 27,895 \\ 28,120 \\ 29,682 \\ 41,619 \\ 31,280 \\ 40,388 \\ 26,297 \\ 30,717 \\ 28,832 \\ 29,682 \\ 41,619 \\ 31,280 \\ 31,280 \\ 31,280 \\ 33,545 \\ 27,895 \\ 28,120 \\ 29,682 \\ 41,619 \\ 31,280 \\ 38,639 \\ 31,280 \\ 34,231 \\ 47,519 \\ 34,042 \\ 32,080 \\ \end{array}$	$\begin{array}{c} {\rm time} \\ {\rm 0.00} \\ {\rm 0$	$\begin{array}{c} C_{\rm max} \\ \hline C_{\rm max} \\ 33,132 \\ 23,100 \\ 42,896 \\ 24,485 \\ 23,597 \\ 28,655 \\ 28,239 \\ 31,471 \\ 35,250 \\ 26,145 \\ 38,545 \\ 28,281 \\ 28,120 \\ 42,239 \\ 41,619 \\ 31,280 \\ 40,388 \\ 26,297 \\ 30,717 \\ 28,832 \\ 41,619 \\ 31,286 \\ 40,388 \\ 26,297 \\ 30,717 \\ 28,834 \\ 41,619 \\ 31,747 \\ 38,639 \\ 28,884 \\ 34,231 \\ 47,519 \\ 34,042 \\ 32,080 \\ \end{array}$	$\begin{array}{c} \mbox{time} \\ \mbox{4.67} \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.75 \\ 22.11 \\ 0.00 \\ 7.75 \\ 22.11 \\ 0.01 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.01 \\ 0.01 \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.00 \\ 0.01 \\ 0.00 \\ $	Cmax           33,132           23,100           46,806           24,485           23,597           28,655           31,597           35,794           26,145           28,655           28,655           28,654           26,145           38,545           29,682           41,619           31,280           40,388           26,297           30,717           28,884           34,876           31,702           38,639           28,884           34,231           49,202           34,042           32,080	time           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.01         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.01         0.02	Cmax           34,443           25,032           49,111           24,485           23,597           28,750           32,669           36,048           38,756           30,851           28,750           29,682           42,415           32,366           31,304           41,316           26,297           31,304           31,304           34,811           31,946           35,256           48,066           34,225           32,852	$\begin{array}{c} \mbox{time} \\ \mbox{time} \\ \mbox{0.00} \\ \mbox{0.00} \\ \mbox{0.00} \\ \mbox{0.00} \\ \mbox{0.01} \\ \mbox{0.00} \mbox{0.00} \\ \mbox{0.00} \mb$	Cmax           33,132           23,100           42,896           24,485           23,597           28,655           23,597           28,655           28,655           28,655           28,655           28,545           28,545           29,682           41,619           31,280           40,388           26,297           30,717           28,854           34,811           31,702           38,639           28,884           34,231           47,519           34,082           32,080	$\begin{array}{c} {\rm time} \\ {\rm 0.28} \\ {\rm 0.34} \\ {\rm 0.31} \\ {\rm 0.35} \\ {\rm 0.32} \\ {\rm 0.32} \\ {\rm 0.32} \\ {\rm 0.40} \\ {\rm 0.42} \\ {\rm 0.32} \\ {\rm 0.44} \\ {\rm 0.32} \\ {\rm 0.44} \\ {\rm 0.38} \\ {\rm 0.41} \\ {\rm 0.50} \\ {\rm 0.55} \\ {\rm 0.60} \end{array}$
miniYFJS01 miniYFJS02 miniYFJS03 miniYFJS05 miniYFJS06 miniYFJS06 miniYFJS09 miniYFJS09 miniYFJS09 miniYFJS10 miniYFJS12 miniYFJS12 miniYFJS12 miniYFJS15 miniYFJS16 miniYFJS16 miniYFJS16 miniYFJS19 miniYFJS19 miniYFJS21 miniYFJS22 miniYFJS22 miniYFJS22 miniYFJS26 miniYFJS28 miniYFJS28 miniYFJS28 miniYFJS28 miniYFJS28 miniYFJS28	$\begin{tabular}{ c c c c c }\hline \hline $C_{max}$\\\hline $33,132$\\\hline $23,132$\\\hline $23,597$\\\hline $24,485$\\\hline $24,485$\\\hline $23,597$\\\hline $28,655$\\\hline $42,239$\\\hline $35,250$\\\hline $26,145$\\\hline $38,545$\\\hline $27,895$\\\hline $28,120$\\\hline $29,682$\\\hline $41,619$\\\hline $28,120$\\\hline $29,682$\\\hline $41,619$\\\hline $28,120$\\\hline $29,682$\\\hline $41,619$\\\hline $28,120$\\\hline $29,682$\\\hline $41,619$\\\hline $28,120$\\\hline $28,120$\\\hline $28,120$\\\hline $38,639$\\\hline $28,884$\\\hline $34,231$\\\hline $31,702$\\\hline $38,639$\\\hline $28,884$\\\hline $34,231$\\\hline $34,7519$\\\hline $34,042$\\\hline $32,080$\\\hline $36,093$\\\hline $36,093$\\\hline $36,093$\\\hline \end{tabular}$	$\begin{array}{c} \mbox{time} \\ \hline \mbox{0.00} \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.02 \\ 0.01 \\ 0.02 \\ 0.01 \\ 0.02 \\ 0.00 \\ 0.02 \\ 0.01 \\ 0.02 \\ 0.00 \\ 0.02 \\ 0.00 \\ 0.02 \\ 0.00 \\ 0.00 \\ 0.02 \\ 0.00 \\ $	$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$	$\begin{array}{c} \mbox{time} \\ \hline \mbox{time} \\ 0.00 \\ 0.01 \\ 0.01 \\ 0.00 \\ $	$\begin{array}{c} C_{\rm max} \\ \hline C_{\rm max} \\ 33,132 \\ 23,100 \\ 42,896 \\ 24,485 \\ 23,557 \\ 28,655 \\ 23,597 \\ 28,652 \\ 31,471 \\ 35,250 \\ 26,145 \\ 26,145 \\ 26,145 \\ 27,895 \\ 28,120 \\ 29,682 \\ 41,619 \\ 31,280 \\ 40,388 \\ 26,297 \\ 30,717 \\ 28,832 \\ 34,811 \\ 31,702 \\ 38,639 \\ 30,200 \\ 34,231 \\ 47,519 \\ 34,042 \\ 32,080 \\ 36,093 \end{array}$	$\begin{array}{c} {\rm time} \\ {\rm 0.00} \\ {\rm 0.01} \\ {\rm 0.00} \\ {\rm 0$	$\frac{C_{\rm max}}{33,132}$ $\frac{33,132}{23,100}$ $\frac{23,100}{24,485}$ $\frac{24,485}{23,597}$ $\frac{28,655}{42,239}$ $\frac{31,471}{35,2500}$ $\frac{35,2500}{26,145}$ $\frac{38,545}{28,281}$ $\frac{28,120}{29,682}$ $\frac{41,619}{31,280}$ $\frac{41,619}{30,717}$ $\frac{28,832}{30,717}$ $\frac{34,831}{31,747}$ $\frac{34,831}{34,231}$ $\frac{34,231}{31,747}$ $\frac{34,832}{34,841}$ $\frac{34,231}{34,7519}$ $\frac{34,042}{34,042}$ $\frac{36,093}{36,093}$	$\begin{array}{c} \mbox{time} \\ \mbox{4.67} \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.00 \\ 0.75 \\ 22.11 \\ 0.00 \\ 7.75 \\ 22.11 \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.01 \\ 0.02 \\ 0.00 \\ 0.01 \\ 0.02 \\ 0.00 \\ 0.01 \\ 0.03 \\ 0.06 \\ 0.01 \\ 0.03 \\ 0.06 \\ 1.61 \\ 1.59 \\ 5.00 \\ 1.61 \\ 0.03 \\ 0.01 \\ $	$\begin{tabular}{ c c c c c c c }\hline \hline $C_{max}$ & $3,132$ & $23,103$ & $23,160$ & $46,806$ & $24,485$ & $23,597$ & $28,655$ & $42,239$ & $31,597$ & $35,794$ & $26,145$ & $38,545$ & $27,895$ & $28,120$ & $29,682$ & $41,619$ & $31,280$ & $40,388$ & $26,297$ & $30,717$ & $28,832$ & $34,876$ & $31,202$ & $34,876$ & $31,702$ & $28,884$ & $34,231$ & $34,2876$ & $34,202$ & $34,042$ & $34,042$ & $32,080$ & $36,561$ & $10,212$ & $36,651$ & $10,212$ & $36,651$ & $10,212$ & $36,651$ & $10,212$ & $31,022$ & $36,051$ & $10,212$ & $36,251$ & $36,2$	time           0.00           0.01           0.02           0.01           0.02           0.02           0.02           0.02           0.02	Cmax           34,443           25,032           49,111           24,485           23,597           28,750           32,669           36,098           26,145           28,756           30,851           29,682           42,415           32,366           41,316           41,316           39,652           31,304           33,965           31,304           35,256           48,066           34,225           32,852           36,561	time           0.00	$\frac{C_{\rm max}}{33,132}$ $\frac{33,132}{23,100}$ $\frac{23,100}{42,896}$ $\frac{24,485}{23,597}$ $\frac{28,655}{42,239}$ $\frac{31,471}{35,250}$ $\frac{35,250}{226,145}$ $\frac{35,250}{226,145}$ $\frac{35,250}{228,120}$ $\frac{29,682}{24,1619}$ $\frac{41,619}{31,280}$ $\frac{41,619}{30,717}$ $\frac{34,831}{30,717}$ $\frac{34,831}{31,702}$ $\frac{34,831}{34,231}$ $\frac{34,231}{34,042}$ $\frac{32,080}{36,093}$	$\begin{array}{c} \mbox{time} \\ \hline \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \$
miniYFJS01 miniYFJS02 miniYFJS03 miniYFJS05 miniYFJS06 miniYFJS06 miniYFJS09 miniYFJS09 miniYFJS09 miniYFJS10 miniYFJS12 miniYFJS13 miniYFJS13 miniYFJS16 miniYFJS16 miniYFJS16 miniYFJS18 miniYFJS19 miniYFJS19 miniYFJS20 miniYFJS22 miniYFJS23 miniYFJS23 miniYFJS25 miniYFJS25 miniYFJS26 miniYFJS27 miniYFJS29 miniYFJS29 miniYFJS29	$\begin{tabular}{ c c c c c }\hline \hline $C_{max}$\\\hline $33,132$\\\hline $23,100$\\\hline $42,896$\\\hline $24,485$\\\hline $23,597$\\\hline $28,655$\\\hline $42,239$\\\hline $31,471$\\\hline $35,55$\\\hline $26,239$\\\hline $31,471$\\\hline $35,545$\\\hline $27,895$\\\hline $28,120$\\\hline $29,682$\\\hline $41,619$\\\hline $38,639$\\\hline $28,120$\\\hline $29,682$\\\hline $41,619$\\\hline $31,280$\\\hline $28,120$\\\hline $29,682$\\\hline $41,619$\\\hline $31,280$\\\hline $28,822$\\\hline $34,811$\\\hline $31,280$\\\hline $36,297$\\\hline $30,717$\\\hline $28,832$\\\hline $34,811$\\\hline $31,702$\\\hline $38,639$\\\hline $28,884$\\\hline $34,231$\\\hline $47,519$\\\hline $47,519$\\\hline $34,042$\\\hline $32,080$\\\hline $36,038$\\\hline $31,888$\\\hline $34,838$\\\hline $34,838$\\\hline$	$\begin{array}{c} {\rm time} \\ {\rm 0.00} \\ {\rm 0.01} \\ {\rm 0.01} \\ {\rm 0.01} \\ {\rm 0.01} \\ {\rm 0.02} \\ {\rm 0.03} \\ {\rm 0.03} \\ {\rm 0.04} \\ {\rm 0.03} \\ {\rm 0.03} \\ {\rm 0.03} \\ {\rm 0.03} \\ {\rm 0.04} \\ {\rm 0.03} \\ {\rm 0.04} \\ {\rm 0.03} \\ {\rm 0.04} \\ {\rm 0.03} \\ {\rm 0.03} \\ {\rm 0.04} \\ {\rm 0.03} \\ {\rm 0.03} \\ {\rm 0.04} \\ {\rm 0.03} \\ {\rm 0.03} \\ {\rm 0.04} \\ {\rm 0.03} \\ {\rm 0.03} \\ {\rm 0.04} \\ {\rm 0.03} \\ {\rm 0.04} \\ {\rm 0.03} \\ {\rm 0.03} \\ {\rm 0.04} \\ {\rm 0.04} \\ {\rm 0.03} \\ {\rm 0.03} \\ {\rm 0.04} \\ {\rm 0$	$\begin{array}{c} C_{\rm max} \\ \hline C_{\rm max} \\ 33,132 \\ 23,100 \\ 42,896 \\ 24,485 \\ 23,597 \\ 28,655 \\ 42,239 \\ 31,471 \\ 35,250 \\ 26,145 \\ 38,545 \\ 27,895 \\ 28,120 \\ 29,682 \\ 41,619 \\ 31,280 \\ 29,682 \\ 41,619 \\ 31,280 \\ 28,811 \\ 31,702 \\ 38,639 \\ 28,884 \\ 34,231 \\ 47,519 \\ 34,042 \\ 32,080 \\ 36,093 \\ 31,888 \end{array}$	$\begin{array}{c} \mbox{time} \\ \hline \mbox{time} \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.01 \\ 0.05 \\ 0.01 \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.04 \\ 0.31 \\ 0.42 \\ 0.42 \\ 0.42 \\ 0.42 \\ 0.01 \\ 0.01 \\ 0.01 \\ 0.02 \\ 0.01 \\ 0.01 \\ 0.01 \\ 0.01 \\ 0.02 \\ 0.01 \\ 0.01 \\ 0.01 \\ 0.01 \\ 0.01 \\ 0.01 \\ 0.01 \\ 0.00 \\ 0.04 \\ 0.01 \\ 0.01 \\ 0.00 \\ 0.01 \\ 0.00 \\ $	$\begin{array}{c} C_{\rm max} \\ \hline \\ 33,132 \\ 23,100 \\ 42,896 \\ 24,485 \\ 23,597 \\ 28,655 \\ 28,655 \\ 28,655 \\ 28,655 \\ 28,120 \\ 29,682 \\ 41,619 \\ 31,280 \\ 29,682 \\ 41,619 \\ 31,280 \\ 29,682 \\ 41,619 \\ 31,280 \\ 28,823 \\ 30,200 \\ 34,231 \\ 47,519 \\ 34,042 \\ 32,080 \\ 36,093 \\ 31,888 \end{array}$	$\begin{array}{c} \mbox{time} \\ \hline \mbox{time} \\ 0.00 \\ $	$\begin{array}{c} C_{\rm max} \\ 33,132 \\ 23,100 \\ 42,896 \\ 24,485 \\ 23,597 \\ 28,655 \\ 42,239 \\ 31,471 \\ 35,250 \\ 26,145 \\ 38,545 \\ 28,281 \\ 28,281 \\ 28,120 \\ 29,682 \\ 41,619 \\ 31,280 \\ 40,388 \\ 26,297 \\ 30,717 \\ 28,832 \\ 34,881 \\ 31,747 \\ 38,639 \\ 28,884 \\ 34,231 \\ 47,519 \\ 34,042 \\ 32,080 \\ 36,093 \\ 31,888 \end{array}$	$\begin{array}{c} \mbox{time} \\ \mbox{4.67} \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.00 \\ 7.75 \\ 22.11 \\ 0.01 \\ 0.00 \\ 7.90 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 10.05 \\ 0.01 \\ 0.00 \\ 10.05 \\ 0.01 \\ 0.03 \\ 0.06 \\ 0.17 \\ 0.39.04 \\ 46.64 \\ 43.21 \\ 0.03 \\ 0.66 \\ 46.43 \end{array}$	Cmax           33,132           23,100           46,806           24,485           23,597           28,655           28,655           28,1597           35,794           26,145           28,8545           27,895           28,120           29,682           41,619           31,280           28,822           34,876           31,702           38,639           28,824           34,042           32,080           36,561           31,886	time           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.01         0.01           0.03         0.04           0.04         0.04           0.02         0.02           0.02         0.02	Cmax           34,443           25,032           49,111           24,485           23,597           28,750           45,493           32,669           36,098           26,145           38,756           30,851           28,120           29,682           44,415           32,366           41,316           26,297           33,965           31,304           34,811           30,568           35,256           34,225           32,866           34,225           32,866           34,225           32,866           34,225           32,866           34,225           32,866           34,118	time           0.00	$\begin{array}{c} C_{\rm max} \\ \hline \\ 33,132 \\ 23,100 \\ 42,896 \\ 24,485 \\ 23,597 \\ 28,655 \\ 28,597 \\ 28,655 \\ 27,895 \\ 26,145 \\ 38,545 \\ 27,895 \\ 28,120 \\ 29,682 \\ 41,619 \\ 31,280 \\ 29,682 \\ 41,619 \\ 31,280 \\ 40,388 \\ 26,297 \\ 30,717 \\ 28,832 \\ 34,811 \\ 31,702 \\ 38,639 \\ 28,884 \\ 34,231 \\ 47,519 \\ 34,042 \\ 32,080 \\ 36,093 \\ 31,888 \end{array}$	$\begin{array}{c} \mbox{time} \\ \hline 0.28 \\ 0.30 \\ 0.34 \\ 0.31 \\ 0.25 \\ 0.40 \\ 0.32 \\ 0.40 \\ 0.42 \\ 0.32 \\ 0.44 \\ 0.38 \\ 0.37 \\ 0.41 \\ 0.38 \\ 0.48 \\ 0.44 \\ 0.38 \\ 0.44 \\ 0.38 \\ 0.44 \\ 0.54 \\ 0.50 \\ 0.55 \\ 0.60 \\ 0.55 \\ 0.60 \\ 0.57 \\ 0.61 \\ 1.5 \\ \end{array}$
miniYFJS01 miniYFJS03 miniYFJS03 miniYFJS05 miniYFJS06 miniYFJS06 miniYFJS09 miniYFJS09 miniYFJS09 miniYFJS10 miniYFJS10 miniYFJS11 miniYFJS13 miniYFJS13 miniYFJS15 miniYFJS16 miniYFJS16 miniYFJS17 miniYFJS19 miniYFJS20 miniYFJS20 miniYFJS23 miniYFJS23 miniYFJS24 miniYFJS25 miniYFJS26 miniYFJS26 miniYFJS27 miniYFJS28 miniYFJS28 miniYFJS28 miniYFJS28 miniYFJS20	$\begin{tabular}{ c c c c c c c }\hline \hline $C_{max}$ & $3,132$ & $23,103$ & $23,104$ & $42,896$ & $24,485$ & $24,485$ & $24,485$ & $24,856$ & $24,856$ & $24,856$ & $26,297$ & $31,280$ & $29,682$ & $41,619$ & $31,280$ & $29,682$ & $41,619$ & $31,280$ & $28,832$ & $34,811$ & $31,702$ & $28,832$ & $34,811$ & $31,702$ & $28,884$ & $34,231$ & $47,519$ & $34,042$ & $22,800$ & $36,093$ & $31,888$ & $32,800$ & $32,80$	time           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.01         0.00           0.02         0.02           0.01         0.01           0.02         0.02           0.00         0.02           0.01         0.01           0.02         0.02           0.03         0.01           0.04         0.05           0.04         0.04           0.15         0.53           0.53         7.80	$\begin{array}{c} C_{\rm max} \\ \hline C_{\rm max} \\ 33,132 \\ 23,100 \\ 42,896 \\ 24,485 \\ 23,597 \\ 28,655 \\ 23,597 \\ 28,655 \\ 23,597 \\ 28,655 \\ 23,895 \\ 26,145 \\ 38,545 \\ 27,895 \\ 26,145 \\ 38,545 \\ 27,895 \\ 28,854 \\ 29,682 \\ 41,619 \\ 31,280 \\ 29,682 \\ 41,619 \\ 31,280 \\ 29,682 \\ 41,619 \\ 31,280 \\ 29,682 \\ 41,619 \\ 38,639 \\ 31,280 \\ 34,042 \\ 32,080 \\ 36,093 \\ 31,888 \\ 32,80 \end{array}$	time           0.00         0.01           0.01         0.00           0.01         0.00           0.05         0.15           0.15         0.01           0.00         0.00           0.01         0.00           0.02         0.09           0.03         0.01           0.05         0.05           0.02         0.09           0.03         0.01           0.05         0.04           0.01         0.05           0.04         0.01           0.03         0.02           0.04         0.03	$\frac{C_{\rm max}}{33,132}$ $\frac{23,100}{42,896}$ $\frac{42,896}{24,485}$ $\frac{24,485}{23,597}$ $\frac{24,485}{23,597}$ $\frac{24,445}{38,545}$ $\frac{23,550}{27,895}$ $\frac{26,145}{38,545}$ $\frac{26,145}{38,545}$ $\frac{29,682}{41,619}$ $\frac{41,619}{31,286}$ $\frac{31,286}{29,682}$ $\frac{41,619}{31,288}$ $\frac{30,200}{34,231}$ $\frac{47,519}{34,042}$ $\frac{34,042}{32,080}$ $\frac{36,093}{31,888}$ $\frac{32,855}{32,855}$	time           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.01         0.02           0.02         1.84           26.59         1.48           69.04         0.03           69.04         0.13           1.67         1.67	$\begin{array}{c} C_{\rm max} \\ \hline C_{\rm max} \\ 33,132 \\ 23,100 \\ 42,896 \\ 24,485 \\ 23,597 \\ 28,655 \\ 28,239 \\ 31,471 \\ 35,250 \\ 26,145 \\ 38,545 \\ 26,241 \\ 28,120 \\ 29,682 \\ 41,619 \\ 31,280 \\ 29,682 \\ 41,619 \\ 31,288 \\ 26,297 \\ 30,717 \\ 28,832 \\ 34,811 \\ 31,747 \\ 38,639 \\ 34,811 \\ 31,747 \\ 38,639 \\ 34,811 \\ 31,747 \\ 38,639 \\ 34,811 \\ 34,042 \\ 32,080 \\ 36,093 \\ 31,888 \\ 32,822 \\ \end{array}$	$\begin{array}{c} \mbox{time} \\ \hline \mbox{time} \\ 4.67 \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.00 \\ 7.75 \\ 22.11 \\ 0.01 \\ 7.90 \\ 0.00 \\ 7.90 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.01 \\ 0.03 \\ 0.06 \\ 0.17 \\ 39.04 \\ 41.59 \\ 5.00 \\ 0.16 \\ 1.61 \\ 43.21 \\ 0.03 \\ 2.17 \end{array}$	Cmax           33,132           23,100           46,806           24,485           23,597           28,655           23,597           28,655           23,597           28,655           28,655           26,145           38,545           29,682           41,619           31,288           29,682           40,388           26,297           30,717           28,882           34,876           31,702           28,884           34,042           32,080           36,561           31,888           33,03:	time           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.01         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.01           0.01         0.01           0.03         0.04           0.04         0.01           0.02         0.02           0.26         4.33	Cmax           34,443           25,032           49,111           24,485           23,597           28,750           32,669           36,098           26,145           38,756           30,851           29,682           42,415           32,366           41,316           26,297           33,965           31,304           34,811           30,558           35,256           48,066           34,225           32,852           36,561           33,118           33,933	time           0.00	$\frac{C_{\rm max}}{33,132}$ $\frac{23,100}{42,896}$ $\frac{24,485}{24,485}$ $\frac{24,485}{23,597}$ $\frac{28,655}{23,597}$ $\frac{31,471}{35,250}$ $\frac{36,245}{27,895}$ $\frac{26,145}{38,545}$ $\frac{29,682}{41,619}$ $\frac{31,280}{30,717}$ $\frac{28,832}{28,884}$ $\frac{34,231}{47,519}$ $\frac{34,042}{32,080}$ $\frac{31,888}{32,800}$	$\begin{array}{c} \mbox{time} \\ 0.28 \\ 0.30 \\ 0.34 \\ 0.31 \\ 0.25 \\ 0.32 \\ 0.40 \\ 0.42 \\ 0.32 \\ 0.44 \\ 0.32 \\ 0.44 \\ 0.38 \\ 0.37 \\ 0.41 \\ 0.38 \\ 0.44 \\ 0.38 \\ 0.44 \\ 0.38 \\ 0.44 \\ 0.53 \\ 0.44 \\ 0.53 \\ 0.46 \\ 0.55 \\ 0.60 \\ 0.55 \\ 0.60 \\ 0.47 \\ 1.15 \\ 7.80 \\ \end{array}$
miniYFJS01 miniYFJS02 miniYFJS03 miniYFJS05 miniYFJS05 miniYFJS06 miniYFJS09 miniYFJS09 miniYFJS09 miniYFJS09 miniYFJS11 miniYFJS12 miniYFJS12 miniYFJS12 miniYFJS15 miniYFJS15 miniYFJS16 miniYFJS19 miniYFJS19 miniYFJS20 miniYFJS21 miniYFJS22 miniYFJS22 miniYFJS23 miniYFJS23 miniYFJS28 miniYFJS28 miniYFJS28 miniYFJS29 miniYFJS29 miniYFJS29 miniYFJS20 <i>C</i> max #best	$\begin{array}{c} \hline C_{\rm max} \\ \hline 33,132 \\ 23,100 \\ 42,896 \\ 24,485 \\ 23,597 \\ 28,655 \\ 23,597 \\ 28,655 \\ 23,597 \\ 28,652 \\ 23,250 \\ 28,123 \\ 20,6145 \\ 38,545 \\ 27,895 \\ 28,120 \\ 29,682 \\ 29,682 \\ 29,682 \\ 29,682 \\ 29,682 \\ 29,682 \\ 41,619 \\ 31,280 \\ 40,388 \\ 26,297 \\ 30,717 \\ 28,884 \\ 40,388 \\ 26,297 \\ 30,717 \\ 28,884 \\ 41,280 \\ 40,388 \\ 28,284 \\ 34,231 \\ 47,519 \\ 34,042 \\ 32,080 \\ 36,093 \\ 31,888 \\ 32,800 \\ 30 \\ 30 \\ 30 \\ 30 \\ 30 \\ 30 \\ 30 \\$	$\begin{array}{c} \mbox{time} \\ \hline \mbox{time} \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.02 \\ 0.00 \\ 0.02 \\ 0.00 \\ 0.01 \\ 0.01 \\ 0.01 \\ 0.00 \\ 0.02 \\ 0.00 \\ 0.02 \\ 0.00 \\ 0.02 \\ 0.00 \\ 0.02 \\ 0.01 \\ 0.00 \\ 0.02 \\ 0.01 \\ 0.00 \\ 0.02 \\ 0.03 \\ 0.01 \\ 0.03 \\ 0.01 \\ 0.05 \\ 0.04 \\ 0.01 \\ 0.05 \\ 0.04 \\ 0.01 \\ 0.05 \\ 0.04 \\ 0.01 \\ 0.05 \\ 0.04 \\ 0.01 \\ 0.03 \\ 0.05 \\ 0.04 \\ 0.01 \\ 0.05 \\ 0.04 \\ 0.01 \\ 0.05 \\ 0.04 \\ 0.01 \\ 0.03 \\ 0.05 \\ 0.04 \\ 0.01 \\ 0.05 \\ 0.04 \\ 0.01 \\ 0.03 \\ 0.04 \\ 0.01 \\ 0.03 \\ 0.04 \\ 0.04 \\ 0.04 \\ 0.04 \\ 0.04 \\ 0.04 \\ 0.04 \\ 0.04 \\ 0.04 \\ 0.04 \\ 0.05 \\ 0.04 \\ 0.04 \\ 0.05 \\ 0.04 \\ 0.05 \\ 0.04 \\ 0.05 \\ 0.04 \\ 0.05 \\ 0.04 \\ 0.05 \\ 0.04 \\ 0.05 \\ 0.04 \\ 0.05 \\ 0.04 \\ 0.05 \\ 0.04 \\ 0.01 \\ 0.05 \\ 0.04 \\ 0.01 \\ 0.05 \\ 0.04 \\ 0.01 \\ 0.05 \\ 0.04 \\ 0.01 \\ 0.05 \\ 0.04 \\ 0.01 \\ 0.05 \\ 0.04 \\ 0.01 \\ 0.05 \\ 0.04 \\ 0.01 \\ 0.05 \\ 0.04 \\ 0.01 \\ 0.05 \\ 0.04 \\ 0.01 \\ 0.05 \\ 0.04 \\ 0.01 \\ 0.05 \\ 0.04 \\ 0.01 \\ 0.05 \\ 0.04 \\ 0.01 \\ 0.05 \\ 0.04 \\ 0.01 \\ 0.05 \\ 0.04 \\ 0.05 \\ $	Cmax           33,132           23,100           42,896           42,896           24,445           23,597           28,655           24,485           23,597           28,655           28,655           28,655           26,145           26,145           26,145           28,854           29,682           41,619           31,280           40,388           26,297           30,717           28,884           34,811           31,702           38,6639           22,0800           36,093           31,888           32,0800           36,093           31,888           32,080           36,093           31,888	$\begin{array}{c} \mbox{time} \\ \hline \mbox{time} \\ 0.00 \\ 0.01 \\ 0.01 \\ 0.00 \\ 0.01 \\ 0.05 \\ 0.15 \\ 0.15 \\ 0.01 \\ 0.00 \\ $	$\begin{array}{c} C_{\rm max} \\ \hline C_{\rm max} \\ 33,132 \\ 23,100 \\ 42,896 \\ 24,485 \\ 23,597 \\ 28,655 \\ 23,597 \\ 28,655 \\ 23,597 \\ 31,471 \\ 35,250 \\ 26,145 \\ 38,545 \\ 27,895 \\ 28,120 \\ 29,682 \\ 41,619 \\ 31,280 \\ 40,388 \\ 26,297 \\ 30,717 \\ 28,832 \\ 34,811 \\ 31,702 \\ 38,639 \\ 30,200 \\ 34,231 \\ 47,519 \\ 34,042 \\ 32,080 \\ 36,093 \\ 31,888 \\ 32,85 \\ 29,85 \\ 22,85 \\ 22,85 \\ 22,96 \\ 32,85 \\ 22,85 \\ 22,96 \\ 32,85 \\ 22,85$	$\begin{array}{c} {\rm time} \\ {\rm 0.00} \\ {\rm 0.01} \\ {\rm 0.03} \\ {\rm 33.88} \\ {\rm 226.59} \\ {\rm 1.48} \\ {\rm 0.03} \\ {\rm 59.15} \\ {\rm 59.15} \\ {\rm 59.15} \\ {\rm 1.67} \end{array}$	Cmax           33,132           23,100           42,896           24,485           23,597           28,655           28,655           28,259           31,471           35,250           26,145           28,251           28,281           28,281           29,682           41,619           31,280           40,388           26,297           30,717           28,882           34,811           31,747           38,6639           22,080           36,093           31,888           32,080           36,093           31,888           32,820	$\begin{array}{c} \mbox{time} \\ \mbox{4.67} \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 7.75 \\ 22.11 \\ 0.00 \\ 7.90 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.01 \\ 0.01 \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.01 \\ 0.01 \\ 0.00 \\ 0.01 \\ 0.01 \\ 0.00 \\ 0.01 \\ 0.01 \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.00 \\ 0.01 \\ 0.00 \\ 0$	Cmax           33,132           23,100           46,806           24,485           23,597           28,655           28,655           28,655           28,655           28,655           28,655           28,655           28,794           26,145           26,145           26,145           28,854           29,682           41,619           31,280           40,388           26,297           30,717           28,884           34,876           31,702           34,876           32,080           36,561           31,888           33,03:	time           0.00           0.01           0.02           0.03           0.04           0.01           0.04           0.05           0.06           0.01           0.04           0.02           0.02           0.02           0.02           0.03	Cmax           34,443           25,032           49,111           24,485           23,597           28,750           32,669           36,048           26,145           38,756           30,851           29,682           42,415           32,366           41,316           26,297           33,965           31,304           34,811           30,568           34,255           32,556           48,066           34,225           32,556           33,118           33,393           33,393	time 0.00	$\begin{array}{c} C_{\rm max} \\ \hline C_{\rm max} \\ 33,132 \\ 23,100 \\ 42,896 \\ 24,485 \\ 23,597 \\ 28,655 \\ 23,597 \\ 28,655 \\ 23,597 \\ 35,250 \\ 28,125 \\ 28,125 \\ 29,682 \\ 41,619 \\ 31,280 \\ 40,388 \\ 29,682 \\ 41,619 \\ 31,280 \\ 40,388 \\ 26,297 \\ 30,717 \\ 28,832 \\ 34,811 \\ 31,702 \\ 38,639 \\ 28,884 \\ 34,231 \\ 47,519 \\ 34,042 \\ 32,080 \\ 36,093 \\ 31,888 \\ 32,280 \\ 30 \\ 30 \\ 30 \\ 30 \\ 30 \\ 30 \\ 30 \\ $	$\begin{array}{c} \mbox{time} \\ 0.28 \\ 0.30 \\ 0.34 \\ 0.31 \\ 0.25 \\ 0.32 \\ 0.40 \\ 0.42 \\ 0.42 \\ 0.42 \\ 0.42 \\ 0.42 \\ 0.44 \\ 0.38 \\ 0.44 \\ 0.38 \\ 0.44 \\ 0.38 \\ 0.44 \\ 0.38 \\ 0.44 \\ 0.38 \\ 0.44 \\ 0.50 \\ 0.53 \\ 0.46 \\ 0.55 \\ 0.55 \\ 0.60 \\ 0.47 \\ 1.15 \\ 7.80 \\ 0.58 \\ 0.60 \\ 0.47 \\ 1.15 \\ 0.60 \\ 0.57 \\ 0.60 \\ 0.$
miniYFJS01 miniYFJS03 miniYFJS03 miniYFJS05 miniYFJS06 miniYFJS06 miniYFJS09 miniYFJS09 miniYFJS09 miniYFJS10 miniYFJS10 miniYFJS11 miniYFJS13 miniYFJS13 miniYFJS15 miniYFJS16 miniYFJS16 miniYFJS17 miniYFJS19 miniYFJS20 miniYFJS20 miniYFJS23 miniYFJS23 miniYFJS24 miniYFJS25 miniYFJS26 miniYFJS26 miniYFJS27 miniYFJS28 miniYFJS28 miniYFJS28 miniYFJS28 miniYFJS20	$\begin{tabular}{ c c c c c }\hline \hline $C_{max}$\\\hline $33,132$\\\hline $23,100$\\\hline $42,896$\\\hline $24,485$\\\hline $24,485$\\\hline $23,597$\\\hline $28,655$\\\hline $24,485$\\\hline $38,545$\\\hline $26,145$\\\hline $38,545$\\\hline $27,895$\\\hline $26,145$\\\hline $38,545$\\\hline $27,895$\\\hline $28,810$\\\hline $29,682$\\\hline $41,619$\\\hline $31,280$\\\hline $29,682$\\\hline $41,619$\\\hline $38,545$\\\hline $29,682$\\\hline $41,619$\\\hline $38,545$\\\hline $29,682$\\\hline $41,619$\\\hline $31,280$\\\hline $32,800$\\\hline $36,093$\\\hline $31,888$\\\hline $32,800$\\\hline $33,800$\\\hline $32,800$\\\hline $32,800$\\\hline $33,800$\\\hline $32,800$\\\hline $33,800$\\\hline $33,800$\\$	time           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.02         0.02           0.01         0.01           0.02         0.02           0.02         0.02           0.02         0.01           0.02         0.02           0.03         0.03           0.04         0.05           0.05         0.04           0.05         0.04	$\begin{array}{c} C_{\rm max} \\ \hline C_{\rm max} \\ 33,132 \\ 23,100 \\ 42,896 \\ 24,485 \\ 23,597 \\ 28,655 \\ 23,597 \\ 28,655 \\ 23,597 \\ 28,655 \\ 23,895 \\ 26,145 \\ 38,545 \\ 27,895 \\ 26,145 \\ 38,545 \\ 27,895 \\ 28,854 \\ 29,682 \\ 41,619 \\ 31,280 \\ 29,682 \\ 41,619 \\ 31,280 \\ 29,682 \\ 41,619 \\ 31,280 \\ 29,682 \\ 41,619 \\ 38,639 \\ 31,280 \\ 34,042 \\ 32,080 \\ 36,093 \\ 31,888 \\ 32,800 \\ 32,800 \\ 31,888 \\ 32,800 \\ 33,800 \\ 32,800 \\ 33,800$	time           0.00         0.01           0.01         0.01           0.00         0.01           0.00         0.00           0.00         0.00           0.01         0.05           0.01         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.01         0.02           0.03         0.01           0.04         0.05           0.03         0.01           0.04         0.05           0.05         0.04	$\frac{C_{\rm max}}{33,132}$ $\frac{23,100}{42,896}$ $\frac{42,896}{24,485}$ $\frac{24,485}{23,597}$ $\frac{24,485}{23,597}$ $\frac{24,445}{38,545}$ $\frac{23,550}{27,895}$ $\frac{26,145}{38,545}$ $\frac{26,145}{38,545}$ $\frac{29,682}{41,619}$ $\frac{41,619}{31,286}$ $\frac{31,286}{29,682}$ $\frac{41,619}{31,288}$ $\frac{30,200}{34,231}$ $\frac{47,519}{34,042}$ $\frac{34,042}{32,080}$ $\frac{36,093}{31,888}$ $\frac{32,855}{32,855}$	$\begin{array}{c} \hline \text{time} \\ \hline 0.00 \\ 0.$	$\begin{array}{c} C_{\rm max} \\ \hline C_{\rm max} \\ 33,132 \\ 23,100 \\ 42,896 \\ 24,485 \\ 23,597 \\ 28,655 \\ 28,239 \\ 31,471 \\ 35,250 \\ 26,145 \\ 38,545 \\ 26,241 \\ 28,120 \\ 29,682 \\ 41,619 \\ 31,280 \\ 29,682 \\ 41,619 \\ 31,288 \\ 26,297 \\ 30,717 \\ 28,832 \\ 34,811 \\ 31,747 \\ 38,639 \\ 34,811 \\ 31,747 \\ 38,639 \\ 34,811 \\ 31,747 \\ 38,639 \\ 34,811 \\ 34,042 \\ 32,080 \\ 36,093 \\ 31,888 \\ 32,822 \\ \end{array}$	$\begin{array}{c} \hline \\ \hline $	Cmax           33,132           23,100           46,806           24,485           23,597           28,655           23,597           28,655           23,597           28,655           28,655           26,145           38,545           29,682           41,619           31,288           29,682           40,388           26,297           30,717           28,882           34,876           31,702           28,884           34,042           32,080           36,561           31,888           33,03:	time           0.00           0.01           0.02           0.03           0.04           0.04           0.04           0.04           0.04           0.05           0.06           0.07           0.08           0.09           0.04           0.05           0.06           0.07           0.08           0.09           0.00           0.00           0.02           0.03           0.04           0.05           0.06           0.07           0.08	Cmax           34,443           25,032           49,111           24,485           23,597           28,750           32,669           36,098           26,145           38,756           30,851           29,682           42,415           32,366           41,316           26,297           33,965           31,304           34,811           30,558           35,256           48,066           34,225           32,852           36,561           33,118           33,933	time           0.00	$\frac{C_{\rm max}}{33,132}$ $\frac{23,100}{42,896}$ $\frac{24,485}{24,485}$ $\frac{24,485}{23,597}$ $\frac{28,655}{23,597}$ $\frac{31,471}{35,250}$ $\frac{36,245}{27,895}$ $\frac{26,145}{38,545}$ $\frac{29,682}{41,619}$ $\frac{31,280}{30,717}$ $\frac{28,832}{28,884}$ $\frac{34,231}{47,519}$ $\frac{34,042}{32,080}$ $\frac{31,888}{32,800}$	$\begin{array}{c} \mbox{time} \\ \hline 0.28 \\ 0.30 \\ 0.34 \\ 0.31 \\ 0.32 \\ 0.40 \\ 0.32 \\ 0.40 \\ 0.32 \\ 0.40 \\ 0.32 \\ 0.40 \\ 0.38 \\ 0.37 \\ 0.41 \\ 0.38 \\ 0.48 \\ 0.48 \\ 0.48 \\ 0.48 \\ 0.48 \\ 0.50 \\ 0.50 \\ 0.55 \\ 0.60 \\ 0.55 \\ 0.60 \\ 0.55 \\ 0.60 \\ 0.57 \\ 0.57 \\ 0.41 \\ 0.58 \\ 0.40 \\ 0.50 \\ $

Table A2: Results of applying the metaheuristics to the small-sized instances with learning rate  $\alpha=0.2.$ 

	ILS-	RN	ILS-	CN	GRASI	P-RN	GRAS	P-CN	TS-I	RN	TS-C	CN	SA	
instance	C <sub>max</sub>	Time	$C_{\text{max}}$	Time	$C_{\text{max}}$	Time	$C_{\text{max}}$	Time	$C_{\text{max}}$	Time	$C_{\text{max}}$	Time	$C_{\text{max}}$	Time
miniDAFJS01	19,443	0.03	19,443	0.06	19,443	24.05	19,443	54.44	19,652	0.00	19,702	0.00	19,443	0.34
miniDAFJS02	18,916	0.00	18,916	0.02	18,916	0.02	18,916	0.05	18,916	0.00	21,136	0.00	18,916	0.25
miniDAFJS03	17,419	0.00	17,419	0.00	17,419	0.00	17,419	0.00	17,419	0.00	17,619	0.00	17,419	0.16
miniDAFJS04	18,800	0.00	18,800	0.00	18,800	0.00	18,800	0.00	18,800	0.00	20,124	0.00	18,800	0.13
miniDAFJS05	17,596	0.05	17,596	0.07	17,596	3.01	17,596	35.51	17,657	0.02	17,657	0.00	17,596	0.30
miniDAFJS06	18,692	0.03	18,692	0.05	18,692	0.00	18,692	0.04	18,692	0.00	18,952	0.00	18,692	0.33
miniDAFJS07 miniDAFJS08	24,256 17,900	0.00 0.00	$24,256 \\ 17,900$	0.01 0.00	$24,256 \\ 17,900$	0.11 0.00	24,256 17,900	$0.43 \\ 0.00$	24,256 17,900	$0.00 \\ 0.00$	24,636 17,900	$0.00 \\ 0.00$	$24,256 \\ 17,900$	0.23 0.03
miniDAFJS09	20,797	0.00	20,797	0.05	20,797	0.00	20,797	0.00	20,797	0.00	21,298	0.00	20,797	0.32
miniDAFJS10	17,395	0.00	17,395	0.00	17,395	0.00	17,395	0.10	17,395	0.00	19,472	0.00	17,395	0.22
miniDAFJS11	25,304	0.02	25,304	0.01	25,304	1.06	25,304	0.00	27,387	0.00	25,554	0.00	25,304	0.37
miniDAFJS12	17,105	0.01	17,105	0.01	17,105	1.01	17,105	1.98	17,105	0.00	17,745	0.00	17,105	0.25
miniDAFJS13	14,077	0.00	14,077	0.00	14,077	0.00	14,077	0.00	14,077	0.00	14,077	0.00	14,077	0.01
miniDAFJS14	20,620	0.00	20,620	0.00	$20,\!620$	0.00	20,620	7.65	20,620	0.00	20,711	0.00	20,620	0.28
miniDAFJS15	18,625	0.00	18,625	0.00	18,625	0.00	18,625	0.00	18,625	0.00	18,625	0.00	18,625	0.18
miniDAFJS16	22,734	0.01	22,734	0.01	22,734	0.00	22,734	4.24	22,939	0.00	22,939	0.00	22,734	0.29
miniDAFJS17	18,253	0.00	$18,253 \\ 16,495$	0.00	18,253	0.00	18,253	0.00	18,253	0.00	18,253	0.00	18,253	0.09
miniDAFJS18 miniDAFJS19	16,495 18,474	0.00 0.00	16,495 18,474	$0.00 \\ 0.00$	$16,495 \\ 18,474$	$0.00 \\ 0.00$	16,495 18,474	0.01 0.00	16,495 18,474	$0.00 \\ 0.00$	17,270 19,030	$0.00 \\ 0.00$	$16,495 \\ 18,474$	0.24 0.14
miniDAFJS20	18,521	0.04	18,521	0.03	18,521	7.15	18,521	0.64	19,587	0.00	18,602	0.00	18,521	0.27
miniDAFJS21 <sup>+</sup>	19,430	0.34	19,430	0.52	19,430	40.61	19,448	49.57	20,368	0.00	20,624	0.00	19,550	0.45
miniDAFJS22	22,322	0.04	22,322	0.22	22,322	56.51	22,322	84.04	22,396	0.01	22,767	0.00	22,322	0.42
$miniDAFJS23^+$	20,932	1.75	20,932	0.63	21,372	0.02	21,372	0.02	21,176	0.01	21,540	0.01	21,031	0.27
miniDAFJS24	20,389	0.03	20,389	0.04	20,389	0.01	20,389	0.02	20,938	0.00	20,389	0.01	20,389	0.39
miniDAFJS25	18,400	0.01	18,400	0.00	18,400	0.00	18,400	35.30	18,400	0.01	18,472	0.00	18,400	0.36
miniDAFJS26	18,396	0.04	18,396	0.02	18,396	17.47	18,396	55.17	18,870	0.01	19,427	0.00	18,396	0.37
miniDAFJS27	18,501	0.12	18,501	0.04	18,501	79.26	18,501	22.10	18,501	0.02	20,586	0.00	18,501	0.38
miniDAFJS28 miniDAFJS29	18,762 18,253	0.11 0.01	$18,762 \\ 18,253$	$0.06 \\ 0.00$	$18,762 \\ 18,253$	0.00	18,762	3.62 0.01	18,762	0.01 0.00	20,020 18,560	$0.00 \\ 0.00$	18,916 18,253	0.35 0.31
miniDAFJS30 <sup>+</sup>	18,233 19,504	0.01	18,233 19,504	0.00	18,233 19,504	1.39 31.31	18,253 20,137	30.57	18,253 19,504	0.00	19,659	0.00	19,618	0.31
	19,21		19,304		19,22		19,24		19,40		19,005		19,018	
#best	30		30		29		27		20		5		26	
gap(%)	0.0	0	0.0	0	0.0	7	0.1		0.9		3.0	2	0.0	8
$\overline{\text{gap}}(\%)$	0.0	0	0.0	0	0.2	4	0.3	2	0.9	3	3.0	2	0.6	1
	пе	DN	ΠC	CN	CDASI		1				TS (	- NI	S.1	
instance	ILS-	RN time	ILS- C <sub>max</sub>	CN time	GRASI C <sub>max</sub>		GRASI C <sub>max</sub>		TS-I C <sub>max</sub>		TS-0 C <sub>max</sub>	CN time	SA C <sub>max</sub>	time
instance miniYFJS01	ILS- C <sub>max</sub> 31,008		ILS- C <sub>max</sub> 31,008		GRASI C <sub>max</sub> 31,008	P-RN	GRASI	P-CN	TS-I C <sub>max</sub> 31,008	RN	TS-0 C <sub>max</sub> 32,506		SA C <sub>max</sub> 31,008	
	C <sub>max</sub>	time	$C_{\max}$	time	$C_{\max}$	P–RN time	GRASI C <sub>max</sub>	P-CN time	C <sub>max</sub>	RN time	$C_{\max}$	time	$C_{\max}$	time
miniYFJS01 miniYFJS02 miniYFJS03	C <sub>max</sub> 31,008 22,010 38,935	time 0.00 0.00 0.00	C <sub>max</sub> 31,008 22,010 38,935	time 0.00 0.02 0.00	C <sub>max</sub> 31,008 22,010 38,935	P-RN time 0.00 0.00 0.00	GRASI C <sub>max</sub> 31,008 22,010 38,935	P-CN time 13.25 0.00 0.00	C <sub>max</sub> 31,008 22,010 41,699	RN time 0.00 0.01 0.00	$C_{\text{max}}$ 32,506 24,146 42,339	time 0.00 0.00 0.00	C <sub>max</sub> 31,008 22,010 38,935	time 0.25 0.28 0.34
miniYFJS01 miniYFJS02 miniYFJS03 miniYFJS04	$\begin{array}{c} \hline C_{\rm max} \\ 31,008 \\ 22,010 \\ 38,935 \\ 23,774 \end{array}$	time 0.00 0.00 0.00 0.00	$\begin{array}{c} C_{\rm max} \\ 31,008 \\ 22,010 \\ 38,935 \\ 23,774 \end{array}$	time 0.00 0.02 0.00 0.00	$\begin{array}{c} C_{\rm max} \\ 31,008 \\ 22,010 \\ 38,935 \\ 23,774 \end{array}$	P-RN time 0.00 0.00 0.00 0.00	GRASI C <sub>max</sub> 31,008 22,010 38,935 23,774	P-CN time 13.25 0.00 0.00 0.00	Cmax           31,008           22,010           41,699           23,774	RN time 0.00 0.01 0.00 0.00	$\begin{array}{c} C_{\rm max} \\ 32,506 \\ 24,146 \\ 42,339 \\ 24,017 \end{array}$	time 0.00 0.00 0.00 0.00	$\begin{array}{c} C_{\rm max} \\ {\bf 31,008} \\ {\bf 22,010} \\ {\bf 38,935} \\ {\bf 23,774} \end{array}$	time 0.25 0.28 0.34 0.28
miniYFJS01 miniYFJS02 miniYFJS03 miniYFJS04 miniYFJS05	$\begin{array}{c} \hline C_{\rm max} \\ 31,008 \\ 22,010 \\ 38,935 \\ 23,774 \\ 22,843 \end{array}$	time 0.00 0.00 0.00 0.00 0.00	$\begin{array}{c} C_{\rm max} \\ 31,008 \\ 22,010 \\ 38,935 \\ 23,774 \\ 22,843 \end{array}$	time 0.00 0.02 0.00 0.00 0.00	$\begin{array}{c} C_{\rm max} \\ 31,008 \\ 22,010 \\ 38,935 \\ 23,774 \\ 22,843 \end{array}$	P-RN time 0.00 0.00 0.00 0.00 0.00	GRASI C <sub>max</sub> 31,008 22,010 38,935 23,774 22,843	P-CN time 13.25 0.00 0.00 0.00 0.00 0.00	Cmax           31,008           22,010           41,699           23,774           22,843	RN time 0.00 0.01 0.00 0.00 0.00	$\begin{array}{c} C_{\rm max} \\ 32,506 \\ 24,146 \\ 42,339 \\ 24,017 \\ 23,236 \end{array}$	time 0.00 0.00 0.00 0.00 0.00	$\begin{array}{c} C_{\rm max} \\ {\bf 31,008} \\ {\bf 22,010} \\ {\bf 38,935} \\ {\bf 23,774} \\ {\bf 22,843} \end{array}$	time 0.25 0.28 0.34 0.28 0.24
miniYFJS01 miniYFJS02 miniYFJS03 miniYFJS04 miniYFJS05 miniYFJS06	$\begin{array}{c} \hline C_{\rm max} \\ \hline 31,008 \\ 22,010 \\ 38,935 \\ 23,774 \\ 22,843 \\ 27,366 \end{array}$	time 0.00 0.00 0.00 0.00 0.00 0.00	$\begin{array}{c} C_{\rm max} \\ \hline 31,008 \\ 22,010 \\ 38,935 \\ 23,774 \\ 22,843 \\ 27,366 \end{array}$	time 0.00 0.02 0.00 0.00 0.00 0.00	$\begin{array}{c} C_{\rm max} \\ \hline 31,008 \\ 22,010 \\ 38,935 \\ 23,774 \\ 22,843 \\ 27,366 \end{array}$	P-RN time 0.00 0.00 0.00 0.00 0.00 0.00	GRASI C <sub>max</sub> 31,008 22,010 38,935 23,774 22,843 27,366	P-CN time 13.25 0.00 0.00 0.00 0.00 0.00 0.00	Cmax           31,008           22,010           41,699           23,774           22,843           27,366	RN time 0.00 0.01 0.00 0.00 0.00 0.00	$\begin{array}{c} C_{\rm max} \\ 32,506 \\ 24,146 \\ 42,339 \\ 24,017 \\ 23,236 \\ \textbf{27,366} \end{array}$	time 0.00 0.00 0.00 0.00 0.00 0.00	$\begin{array}{c} C_{\rm max} \\ 31,008 \\ 22,010 \\ 38,935 \\ 23,774 \\ 22,843 \\ 27,366 \end{array}$	time 0.25 0.28 0.34 0.28 0.24 0.00
miniYFJS01 miniYFJS02 miniYFJS03 miniYFJS05 miniYFJS06 miniYFJS07	$\begin{array}{c} \hline C_{\rm max} \\ \hline 31,008 \\ 22,010 \\ 38,935 \\ 23,774 \\ 22,843 \\ 27,366 \\ 38,932 \\ \end{array}$	time 0.00 0.00 0.00 0.00 0.00 0.00 0.00	$\begin{array}{c} C_{\rm max} \\ 31,008 \\ 22,010 \\ 38,935 \\ 23,774 \\ 22,843 \\ 27,366 \\ 38,932 \end{array}$	time 0.00 0.02 0.00 0.00 0.00 0.00 0.00	$\begin{array}{c} C_{\rm max} \\ 31,008 \\ 22,010 \\ 38,935 \\ 23,774 \\ 22,843 \\ 27,366 \\ 38,932 \end{array}$	P-RN time 0.00 0.00 0.00 0.00 0.00 0.00 0.24	$\begin{array}{c} {\rm GRASI}\\ \hline C_{\rm max}\\ 31,008\\ 22,010\\ 38,935\\ 23,774\\ 22,843\\ 27,366\\ 38,932\\ \end{array}$	P-CN time 13.25 0.00 0.00 0.00 0.00 0.00 13.11	Cmax           31,008           22,010           41,699           23,774           22,843           27,366           38,932	RN time 0.00 0.01 0.00 0.00 0.00 0.00 0.00 0.0	$\begin{array}{c} C_{\rm max} \\ 32,506 \\ 24,146 \\ 42,339 \\ 24,017 \\ 23,236 \\ \textbf{27,366} \\ 41,487 \end{array}$	time 0.00 0.00 0.00 0.00 0.00 0.00 0.00	$\begin{array}{c} C_{\rm max} \\ {\bf 31,008} \\ {\bf 22,010} \\ {\bf 38,935} \\ {\bf 23,774} \\ {\bf 22,843} \\ {\bf 27,366} \\ {\bf 38,932} \end{array}$	time 0.25 0.28 0.34 0.28 0.24 0.00 0.39
miniYFJS01 miniYFJS02 miniYFJS03 miniYFJS05 miniYFJS05 miniYFJS06 miniYFJS07 miniYFJS08	$\begin{array}{c} C_{\rm max} \\ 31,008 \\ 22,010 \\ 38,935 \\ 23,774 \\ 22,843 \\ 27,366 \\ 38,932 \\ 29,464 \end{array}$	time 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	$\begin{array}{c} C_{\rm max} \\ {\bf 31,008} \\ {\bf 22,010} \\ {\bf 38,935} \\ {\bf 23,774} \\ {\bf 22,843} \\ {\bf 27,366} \\ {\bf 38,932} \\ {\bf 29,464} \end{array}$	time 0.00 0.02 0.00 0.00 0.00 0.00 0.06 0.04	$\begin{array}{c} C_{\rm max} \\ 31,008 \\ 22,010 \\ 38,935 \\ 23,774 \\ 22,843 \\ 27,366 \\ 38,932 \\ 29,464 \end{array}$	P-RN time 0.00 0.00 0.00 0.00 0.00 0.00 0.24 18.16	GRASI C <sub>max</sub> 31,008 22,010 38,935 23,774 22,843 27,366 38,932 29,464	P-CN time 13.25 0.00 0.00 0.00 0.00 0.00 13.11 9.52	C <sub>max</sub> 31,008           22,010           41,699           23,774           22,843           27,366           38,932           29,898	RN           0.00           0.01           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00	$\begin{array}{c} C_{\rm max} \\ 32,506 \\ 24,146 \\ 42,339 \\ 24,017 \\ 23,236 \\ \textbf{27,366} \\ \textbf{41,487} \\ 30,276 \end{array}$	time 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	$\begin{array}{c} C_{\rm max} \\ {\bf 31,008} \\ {\bf 22,010} \\ {\bf 38,935} \\ {\bf 23,774} \\ {\bf 22,843} \\ {\bf 27,366} \\ {\bf 38,932} \\ {\bf 29,464} \end{array}$	time 0.25 0.28 0.34 0.28 0.24 0.00 0.39 0.43
miniYFJS01 miniYFJS02 miniYFJS03 miniYFJS04 miniYFJS05 miniYFJS07 miniYFJS08 miniYFJS09	$\begin{array}{c} C_{\rm max} \\ 31,008 \\ 22,010 \\ 38,935 \\ 23,774 \\ 22,843 \\ 27,366 \\ 38,932 \\ 29,464 \\ 33,763 \end{array}$	time 0.00 0.00 0.00 0.00 0.00 0.00 0.02 0.01	$\begin{array}{c} C_{\rm max} \\ {\bf 31,008} \\ {\bf 22,010} \\ {\bf 38,935} \\ {\bf 23,774} \\ {\bf 22,843} \\ {\bf 27,366} \\ {\bf 38,932} \\ {\bf 29,464} \\ {\bf 33,763} \end{array}$	time 0.00 0.02 0.00 0.00 0.00 0.00 0.06 0.04 0.01	$\begin{array}{c} C_{\rm max} \\ 31,008 \\ 22,010 \\ 38,935 \\ 23,774 \\ 22,843 \\ 27,366 \\ 38,932 \\ 29,464 \\ 33,763 \end{array}$	P-RN time 0.00 0.00 0.00 0.00 0.00 0.00 0.24 18.16 0.00	$\begin{array}{c} {\rm GRASI}\\ \hline C_{\rm max}\\ \hline 31,008\\ 22,010\\ 38,935\\ 23,774\\ 22,843\\ 27,366\\ 38,932\\ 29,464\\ 33,763\\ \end{array}$	P-CN time 13.25 0.00 0.00 0.00 0.00 0.00 13.11 9.52 0.00	C <sub>max</sub> <b>31,008 22,010</b> 41,699 <b>23,774 22,843 27,366 38,932</b> 29,898 <b>33,763</b>	Imme           0.00           0.01           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.01           0.00           0.01           0.00           0.04	$\begin{array}{c} C_{\rm max} \\ 32,506 \\ 24,146 \\ 42,339 \\ 24,017 \\ 23,236 \\ \textbf{27,366} \\ \textbf{41,487} \\ 30,276 \\ 34,357 \end{array}$	time 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	$\begin{array}{c} C_{\rm max} \\ 31,008 \\ 22,010 \\ 38,935 \\ 23,774 \\ 22,843 \\ 27,366 \\ 38,932 \\ 29,464 \\ 33,763 \end{array}$	$\begin{array}{c} \text{time} \\ 0.25 \\ 0.28 \\ 0.34 \\ 0.28 \\ 0.24 \\ 0.00 \\ 0.39 \\ 0.43 \\ 0.30 \end{array}$
miniYFJS01 miniYFJS02 miniYFJS03 miniYFJS05 miniYFJS05 miniYFJS06 miniYFJS07 miniYFJS08	$\begin{array}{c} C_{\rm max} \\ 31,008 \\ 22,010 \\ 38,935 \\ 23,774 \\ 22,843 \\ 27,366 \\ 38,932 \\ 29,464 \end{array}$	time 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	$\begin{array}{c} C_{\rm max} \\ {\bf 31,008} \\ {\bf 22,010} \\ {\bf 38,935} \\ {\bf 23,774} \\ {\bf 22,843} \\ {\bf 27,366} \\ {\bf 38,932} \\ {\bf 29,464} \end{array}$	time 0.00 0.02 0.00 0.00 0.00 0.00 0.06 0.04	$\begin{array}{c} C_{\rm max} \\ 31,008 \\ 22,010 \\ 38,935 \\ 23,774 \\ 22,843 \\ 27,366 \\ 38,932 \\ 29,464 \end{array}$	P-RN time 0.00 0.00 0.00 0.00 0.00 0.00 0.24 18.16	GRASI C <sub>max</sub> 31,008 22,010 38,935 23,774 22,843 27,366 38,932 29,464	P-CN time 13.25 0.00 0.00 0.00 0.00 0.00 13.11 9.52	C <sub>max</sub> 31,008           22,010           41,699           23,774           22,843           27,366           38,932           29,898	RN           0.00           0.01           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.01           0.00	$\begin{array}{c} C_{\rm max} \\ 32,506 \\ 24,146 \\ 42,339 \\ 24,017 \\ 23,236 \\ \textbf{27,366} \\ \textbf{41,487} \\ 30,276 \end{array}$	time 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	$\begin{array}{c} C_{\rm max} \\ {\bf 31,008} \\ {\bf 22,010} \\ {\bf 38,935} \\ {\bf 23,774} \\ {\bf 22,843} \\ {\bf 27,366} \\ {\bf 38,932} \\ {\bf 29,464} \end{array}$	time 0.25 0.28 0.34 0.28 0.24 0.00 0.39 0.43
miniYFJS01 miniYFJS02 miniYFJS03 miniYFJS03 miniYFJS05 miniYFJS06 miniYFJS07 miniYFJS09 miniYFJS09	$\begin{array}{c} C_{\rm max} \\ \hline 31,008 \\ 22,010 \\ 38,935 \\ 23,774 \\ 22,843 \\ 27,366 \\ 38,932 \\ 29,464 \\ 33,763 \\ 25,072 \end{array}$	time 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.02 0.01 0.15	$\begin{array}{c} C_{\rm max} \\ 31,008 \\ 22,010 \\ 38,935 \\ 23,774 \\ 22,843 \\ 27,366 \\ 38,932 \\ 29,464 \\ 33,763 \\ 25,072 \end{array}$	time 0.00 0.02 0.00 0.00 0.00 0.00 0.06 0.04 0.01 0.10	$\begin{array}{c} C_{\rm max} \\ 31,008 \\ 22,010 \\ 38,935 \\ 23,774 \\ 22,843 \\ 27,366 \\ 38,932 \\ 29,464 \\ 33,763 \\ 25,072 \end{array}$	P-RN time 0.00 0.00 0.00 0.00 0.00 0.00 0.24 18.16 0.00 30.31	$\begin{array}{c} {\rm GRASI}\\ \hline C_{\rm max}\\ 31,008\\ 22,010\\ 38,935\\ 23,774\\ 22,843\\ 27,366\\ 38,932\\ 29,464\\ 33,763\\ 25,072\\ \end{array}$	P-CN time 13.25 0.00 0.00 0.00 0.00 0.00 13.11 9.52 0.00 49.47	Cmax           31,008           22,010           41,699           23,774           22,843           27,366           38,932           29,898           33,763           25,072	time           0.00           0.01           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.01           0.00           0.01           0.00           0.04           0.00	$\begin{array}{c} C_{\max} \\ 32,506 \\ 24,146 \\ 42,339 \\ 24,017 \\ 23,236 \\ \textbf{27,366} \\ \textbf{41,487} \\ 30,276 \\ 34,357 \\ 25,093 \end{array}$	time 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00	$\begin{array}{c} C_{\max} \\ 31,008 \\ 22,010 \\ 38,935 \\ 23,774 \\ 22,843 \\ 27,366 \\ 38,932 \\ 29,464 \\ 33,763 \\ 25,072 \end{array}$	$\begin{array}{c} \text{time} \\ 0.25 \\ 0.28 \\ 0.34 \\ 0.28 \\ 0.24 \\ 0.00 \\ 0.39 \\ 0.43 \\ 0.30 \\ 6.20 \end{array}$
miniYFJS01 miniYFJS02 miniYFJS03 miniYFJS05 miniYFJS06 miniYFJS06 miniYFJS08 miniYFJS09 miniYFJS09 miniYFJS10 miniYFJS11 miniYFJS12 miniYFJS13	$\begin{array}{c} \hline C_{max} \\ \hline 31,008 \\ 22,010 \\ 38,935 \\ 23,774 \\ 22,843 \\ 27,366 \\ 38,932 \\ 29,464 \\ 33,763 \\ 25,072 \\ 36,307 \\ 26,219 \\ 25,619 \\ \end{array}$	time 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	$\begin{array}{c} C_{\rm max} \\ \hline 31,008 \\ 22,010 \\ 38,935 \\ 23,774 \\ 22,843 \\ 27,366 \\ 38,932 \\ 29,464 \\ 33,763 \\ 25,072 \\ 36,307 \\ 26,219 \\ 25,619 \end{array}$	$\begin{array}{c} \text{time} \\ 0.00 \\ 0.02 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.01 \\ 0.05 \\ 0.06 \\ 0.01 \end{array}$	$\begin{array}{c} C_{max} \\ \hline 31,008 \\ 22,010 \\ 38,935 \\ 23,774 \\ 22,843 \\ 27,366 \\ 38,932 \\ 29,464 \\ 33,763 \\ 25,072 \\ 36,307 \\ 26,571 \\ 25,619 \end{array}$	P-RN time 0.00 0.00 0.00 0.00 0.00 0.00 0.00 18.16 0.00 30.31 2.55 0.01 0.00	$\begin{array}{c} {\rm GRASI}\\ {\rm C}_{\rm max}\\ 31,008\\ 22,010\\ 38,935\\ 23,774\\ 22,843\\ 27,366\\ 38,932\\ 29,464\\ 33,763\\ 25,072\\ 36,307\\ 26,219\\ 25,619\\ \end{array}$	P-CN time 13.25 0.00 0.00 0.00 0.00 0.00 13.11 9.52 0.00 49.47 9.76 0.09 0.02	$\begin{array}{c} C_{max} \\ \hline 31,008 \\ 22,010 \\ 41,699 \\ 23,774 \\ 22,843 \\ 27,366 \\ 38,932 \\ 29,898 \\ 33,763 \\ 25,072 \\ 36,307 \\ 26,219 \\ 25,619 \end{array}$	RN           time           0.00           0.01           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.01           0.22           0.00	$\begin{array}{c} C_{max} \\ 32,506 \\ 24,146 \\ 42,339 \\ 24,017 \\ 23,236 \\ \textbf{27,366} \\ \textbf{41,487} \\ 30,276 \\ 34,357 \\ 25,093 \\ 39,637 \\ 27,829 \\ 25,881 \end{array}$	time 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	$\frac{C_{\rm max}}{31,008}$ $\frac{31,008}{22,010}$ $\frac{38,935}{23,774}$ $\frac{22,843}{22,843}$ $\frac{29,464}{33,763}$ $\frac{33,763}{25,072}$ $\frac{36,307}{26,219}$ $\frac{25,619}{25,619}$	$\begin{array}{c} \text{time} \\ 0.25 \\ 0.28 \\ 0.34 \\ 0.28 \\ 0.24 \\ 0.00 \\ 0.39 \\ 0.43 \\ 0.30 \\ 6.20 \\ 0.44 \\ 0.44 \\ 0.36 \end{array}$
miniYFJS01 miniYFJS03 miniYFJS03 miniYFJS05 miniYFJS06 miniYFJS07 miniYFJS09 miniYFJS09 miniYFJS10 miniYFJS11 miniYFJS11 miniYFJS13 miniYFJS14	$\begin{array}{c} \hline C_{max} \\ \hline 31,008 \\ 22,010 \\ 38,935 \\ 23,774 \\ 22,843 \\ 27,366 \\ 38,932 \\ 29,464 \\ 33,763 \\ 25,072 \\ 36,307 \\ 26,219 \\ 26,219 \\ 26,219 \\ 26,219 \\ 25,619 \\ 27,428 \end{array}$	time 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	$\begin{array}{c} C_{max} \\ \hline 31,008 \\ 22,010 \\ 38,935 \\ 23,774 \\ 22,843 \\ 27,366 \\ 38,932 \\ 29,464 \\ 33,763 \\ 25,072 \\ 36,307 \\ 26,219 \\ 26,219 \\ 26,219 \\ 26,619 \\ 27,428 \end{array}$	time 0.00 0.02 0.00 0.00 0.00 0.00 0.00 0.0	$\begin{array}{c} C_{max} \\ 31,008 \\ 22,010 \\ 38,935 \\ 23,774 \\ 22,843 \\ 27,366 \\ 38,932 \\ 29,464 \\ 33,763 \\ 25,072 \\ 36,307 \\ 26,571 \\ 26,571 \\ 25,619 \\ 27,428 \end{array}$	P-RN time 0.00 0.00 0.00 0.00 0.00 0.24 18.16 0.00 30.31 2.55 0.01 0.00 0.86	GRASI Cmax 31,008 22,010 38,935 23,774 22,843 27,366 38,932 29,464 33,763 25,072 36,307 26,219 25,619 27,428	P-CN time 13.25 0.00 0.00 0.00 0.00 13.11 9.52 0.00 49.47 9.76 0.09 0.02 0.09	Cmax           31,008           22,010           41,699           23,774           22,843           27,366           38,932           29,898           33,763           25,072           36,3072           26,219           25,619           27,428	RN           time           0.00           0.01           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.01           0.00           0.01           0.02           0.00           0.01           0.22           0.00           0.05	Cmax           32,506           24,146           42,339           24,017           23,236           27,366           41,487           30,276           34,357           25,093           39,637           27,829           25,881           27,428	time 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	$\frac{C_{\rm max}}{31,008}$ $\frac{31,008}{22,010}$ $\frac{38,935}{23,774}$ $\frac{22,843}{27,366}$ $\frac{27,366}{33,763}$ $\frac{29,464}{33,763}$ $\frac{35,072}{26,219}$ $\frac{25,619}{27,428}$	$\begin{array}{c} \text{time} \\ 0.25 \\ 0.28 \\ 0.34 \\ 0.28 \\ 0.24 \\ 0.00 \\ 0.39 \\ 0.43 \\ 0.30 \\ 6.20 \\ 0.44 \\ 0.44 \\ 0.36 \\ 0.52 \end{array}$
miniYFJS01 miniYFJS02 miniYFJS03 miniYFJS05 miniYFJS06 miniYFJS07 miniYFJS08 miniYFJS09 miniYFJS10 miniYFJS11 miniYFJS12 miniYFJS13 miniYFJS14 miniYFJS15	$\begin{array}{c} \hline C_{max} \\ \hline 31,008 \\ 22,010 \\ 38,935 \\ 23,774 \\ 22,843 \\ 27,366 \\ 38,932 \\ 29,464 \\ 33,763 \\ 25,072 \\ 36,307 \\ 26,219 \\ 25,619 \\ 25,619 \\ 27,428 \\ 38,256 \\ \end{array}$	time 0.00 0.00 0.00 0.00 0.00 0.00 0.02 0.01 0.15 0.02 0.04 0.00 0.03 0.01	$\begin{array}{c} \hline C_{max} \\ \hline 31,008 \\ 22,010 \\ 38,935 \\ 23,774 \\ 22,843 \\ 27,366 \\ 38,932 \\ 29,464 \\ 33,763 \\ 25,072 \\ 36,307 \\ 26,219 \\ 25,619 \\ 27,428 \\ 38,256 \\ \end{array}$	time 0.00 0.02 0.00 0.00 0.00 0.06 0.04 0.01 0.05 0.06 0.01 0.04 0.03	$\begin{array}{c} C_{max} \\ 31,008 \\ 22,010 \\ 38,935 \\ 23,774 \\ 22,843 \\ 27,366 \\ 38,932 \\ 29,464 \\ 33,763 \\ 25,072 \\ 36,307 \\ 26,571 \\ 25,619 \\ 27,428 \\ 38,256 \end{array}$	P-RN time 0.00 0.00 0.00 0.00 0.00 0.24 18.16 0.00 30.31 2.55 0.01 0.00 0.86 0.00	$\begin{array}{c} {\rm GRASI}\\ \hline C_{\rm max} & \\ 31,008 \\ 22,010 \\ 38,935 \\ 23,774 \\ 22,843 \\ 27,366 \\ 38,932 \\ 29,464 \\ 33,763 \\ 25,072 \\ 25,072 \\ 36,307 \\ 26,219 \\ 25,619 \\ 27,428 \\ 38,256 \end{array}$	P-CN time 13.25 0.00 0.00 0.00 0.00 13.11 9.52 0.00 49.47 9.76 0.09 0.02 0.09 7.91	$\begin{array}{c} C_{max} \\ \hline 31,008 \\ 22,010 \\ 41,699 \\ 23,774 \\ 22,843 \\ 27,366 \\ 38,932 \\ 29,898 \\ 33,763 \\ 25,072 \\ 36,307 \\ 26,219 \\ 25,619 \\ 27,428 \\ 38,256 \end{array}$	Image: N           0.00           0.01           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.01           0.00           0.01           0.02           0.00           0.01           0.22           0.00           0.05           0.01	Cmax           32,506           24,146           42,391           23,236           27,366           41,487           30,276           34,357           25,093           39,637           27,829           25,881           27,428           39,294	time 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00	$\frac{C_{\max}}{31,008}$ 22,010 38,935 23,774 22,843 27,366 38,932 29,464 33,763 33,763 32,50,72 36,307 26,219 25,619 25,619 27,428 38,256	$\begin{array}{c} \text{time} \\ \hline 0.25 \\ 0.28 \\ 0.34 \\ 0.28 \\ 0.24 \\ 0.00 \\ 0.39 \\ 0.43 \\ 0.30 \\ 0.43 \\ 0.30 \\ 0.44 \\ 0.44 \\ 0.36 \\ 0.52 \\ 0.50 \end{array}$
miniYFJS01 miniYFJS02 miniYFJS03 miniYFJS05 miniYFJS06 miniYFJS06 miniYFJS09 miniYFJS09 miniYFJS10 miniYFJS11 miniYFJS12 miniYFJS12 miniYFJS14 miniYFJS15 miniYFJS16	$\begin{array}{c} C_{max} \\ \hline 31,008 \\ 22,010 \\ 38,935 \\ 23,774 \\ 22,843 \\ 27,366 \\ 38,932 \\ 29,464 \\ 33,766 \\ 33,763 \\ 25,072 \\ 36,307 \\ 26,219 \\ 25,619 \\ 27,428 \\ 38,256 \\ 29,442 \end{array}$	time 0.00 0.00 0.00 0.00 0.00 0.00 0.02 0.01 0.15 0.02 0.04 0.00 0.03 0.01 0.01	$\begin{array}{c} C_{max} \\ 31,008 \\ 22,010 \\ 38,935 \\ 23,774 \\ 22,843 \\ 27,366 \\ 38,932 \\ 29,464 \\ 33,766 \\ 33,763 \\ 25,072 \\ 36,307 \\ 26,219 \\ 25,619 \\ 27,428 \\ 38,256 \\ 29,442 \end{array}$	time 0.00 0.02 0.00 0.00 0.00 0.06 0.04 0.01 0.05 0.06 0.01 0.04 0.03 0.01	$\begin{array}{c} C_{max} \\ \hline 31,008 \\ 22,010 \\ 38,935 \\ 23,774 \\ 22,843 \\ 27,366 \\ 38,932 \\ 29,464 \\ 33,766 \\ 33,763 \\ 25,072 \\ 36,307 \\ 26,571 \\ 25,619 \\ 27,428 \\ 38,256 \\ 29,442 \end{array}$	P-RN time 0.00 0.00 0.00 0.00 0.00 0.24 18.16 0.00 30.31 2.55 0.01 0.00 0.86 0.00 0.00	$\begin{array}{c} {\rm GRASI}\\ \hline C_{\rm max} & \\ 31,008 \\ 22,010 \\ 38,935 \\ 23,774 \\ 22,843 \\ 27,366 \\ 38,932 \\ 29,464 \\ 33,763 \\ 25,072 \\ 36,307 \\ 26,219 \\ 25,619 \\ 27,428 \\ 38,256 \\ 29,442 \\ \end{array}$	$\begin{array}{c} \hline \begin{array}{c} P-CN \\ \hline time \\ \hline 13.25 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 13.11 \\ 9.52 \\ 0.00 \\ 49.47 \\ 9.76 \\ 0.09 \\ 0.02 \\ 0.09 \\ 7.91 \\ 0.00 \end{array}$	$\begin{array}{c} C_{max} \\ \hline 31,008 \\ 22,010 \\ 41,699 \\ 23,774 \\ 22,843 \\ 27,366 \\ 38,932 \\ 29,898 \\ 33,763 \\ 33,763 \\ 25,072 \\ 36,307 \\ 26,219 \\ 25,619 \\ 27,428 \\ 38,256 \\ 29,442 \end{array}$	Image: N           0.00           0.01           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.01           0.00           0.01           0.02           0.00           0.01           0.05           0.01	$\begin{array}{c} C_{max} \\ 32,506 \\ 24,146 \\ 42,339 \\ 24,017 \\ 23,236 \\ \textbf{27,366} \\ \textbf{41,487} \\ 30,276 \\ \textbf{34,357} \\ 25,093 \\ 39,637 \\ \textbf{27,829} \\ \textbf{25,881} \\ \textbf{27,428} \\ \textbf{39,294} \\ 30,386 \end{array}$	time 0.00	$\frac{C_{\rm max}}{31,008}$ $\frac{31,008}{22,010}$ $\frac{32,010}{38,935}$ $\frac{23,774}{22,843}$ $\frac{22,843}{27,366}$ $\frac{38,932}{29,464}$ $\frac{33,763}{36,307}$ $\frac{25,072}{36,307}$ $\frac{25,019}{25,619}$ $\frac{27,428}{38,256}$ $\frac{29,442}{29,442}$	$\begin{array}{c} \text{time} \\ \hline 0.25 \\ 0.28 \\ 0.34 \\ 0.28 \\ 0.24 \\ 0.00 \\ 0.39 \\ 0.43 \\ 0.30 \\ 0.43 \\ 0.30 \\ 0.44 \\ 0.44 \\ 0.36 \\ 0.52 \\ 0.50 \\ 0.41 \\ \end{array}$
miniYFJS01 miniYFJS02 miniYFJS03 miniYFJS05 miniYFJS06 miniYFJS06 miniYFJS07 miniYFJS09 miniYFJS10 miniYFJS10 miniYFJS11 miniYFJS13 miniYFJS13 miniYFJS15 miniYFJS16 miniYFJS17	$\begin{array}{c} C_{max} \\ \hline 31,008 \\ 22,010 \\ 38,935 \\ 23,774 \\ 22,843 \\ 27,366 \\ 38,932 \\ 29,464 \\ 33,763 \\ 25,072 \\ 36,307 \\ 26,219 \\ 25,619 \\ 27,428 \\ 38,256 \\ 29,442 \\ 37,465 \\ \end{array}$	time 0.00 0.00 0.00 0.00 0.00 0.00 0.02 0.01 0.15 0.02 0.04 0.00 0.00 0.00 0.01 0.01 0.01 0.02	$\begin{array}{c} C_{max} \\ 31,008 \\ 22,010 \\ 38,935 \\ 23,774 \\ 22,843 \\ 27,366 \\ 38,932 \\ 29,464 \\ 33,763 \\ 25,072 \\ 36,307 \\ 26,219 \\ 25,619 \\ 25,619 \\ 25,619 \\ 27,428 \\ 38,256 \\ 29,442 \\ 37,465 \end{array}$	time 0.00 0.02 0.00 0.00 0.00 0.00 0.00 0.04 0.01 0.05 0.06 0.01 0.05 0.06 0.01 0.04 0.01 0.02 0.00	$\begin{array}{c} C_{max} \\ \hline 31,008 \\ 22,010 \\ 38,935 \\ 23,774 \\ 22,843 \\ 27,366 \\ 38,932 \\ 29,464 \\ 33,763 \\ 25,072 \\ 36,307 \\ 26,571 \\ 25,619 \\ 27,428 \\ 38,256 \\ 29,442 \\ 37,465 \\ \end{array}$	P-RN time 0.00 0.00 0.00 0.00 0.24 18.16 0.00 30.31 2.55 0.01 0.00 0.86 0.00 0.00 0.00 0.00	$\begin{array}{c} {\rm GRASI}\\ \hline C_{\rm max} \\ 31,008 \\ 22,010 \\ 38,935 \\ 23,774 \\ 22,843 \\ 27,366 \\ 38,932 \\ 29,444 \\ 33,763 \\ 25,072 \\ 36,307 \\ 26,219 \\ 25,619 \\ 27,428 \\ 38,256 \\ 29,442 \\ 37,465 \\ \end{array}$	$\begin{array}{c} \hline \begin{array}{c} \hline \text{P-CN} \\ \hline \text{time} \\ \hline 13.25 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 13.11 \\ 9.52 \\ 0.00 \\ 49.47 \\ 9.76 \\ 0.09 \\ 0.02 \\ 0.09 \\ 7.91 \\ 0.00 \\ 0.10 \\ \end{array}$	$\begin{array}{c} C_{max} \\ \hline 31,008 \\ 22,010 \\ 41,699 \\ 23,774 \\ 22,843 \\ 27,366 \\ 38,932 \\ 29,898 \\ 33,763 \\ 25,072 \\ 36,3072 \\ 25,619 \\ 25,619 \\ 25,619 \\ 25,619 \\ 27,428 \\ 38,256 \\ 29,442 \\ 37,465 \\ \end{array}$	Image: N           0.00           0.01           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.01           0.00           0.01           0.02           0.00           0.01           0.22           0.00           0.05           0.01           0.12	$\begin{array}{c} C_{max} \\ 32,506 \\ 24,146 \\ 42,300 \\ 24,017 \\ 23,236 \\ \textbf{27,366} \\ \textbf{27,366} \\ \textbf{34,357} \\ 25,093 \\ 39,637 \\ \textbf{27,829} \\ \textbf{30,386} \\ \textbf{39,294} \\ \textbf{30,386} \\ \textbf{38,739} \end{array}$	time 0.00	$\frac{C_{\rm max}}{31,008}$ $\frac{31,008}{22,010}$ $\frac{38,932}{23,774}$ $\frac{29,464}{33,763}$ $\frac{29,464}{33,763}$ $\frac{25,072}{26,219}$ $\frac{25,619}{27,428}$ $\frac{38,256}{37,465}$	$\begin{array}{c} \text{time} \\ \hline 0.25 \\ 0.28 \\ 0.34 \\ 0.28 \\ 0.24 \\ 0.00 \\ 0.39 \\ 0.43 \\ 0.30 \\ 6.20 \\ 0.44 \\ 0.36 \\ 0.52 \\ 0.50 \\ 0.41 \\ 0.39 \end{array}$
miniYFJS01 miniYFJS02 miniYFJS03 miniYFJS05 miniYFJS06 miniYFJS07 miniYFJS09 miniYFJS09 miniYFJS10 miniYFJS11 miniYFJS13 miniYFJS13 miniYFJS14 miniYFJS16 miniYFJS18	$\begin{array}{c} C_{max} \\ \hline \\ 31,008 \\ 22,010 \\ 38,935 \\ 23,774 \\ 22,843 \\ 27,366 \\ 38,932 \\ 29,464 \\ 33,763 \\ 25,072 \\ 36,307 \\ 26,219 \\ 25,619 \\ 27,428 \\ 38,256 \\ 29,442 \\ 38,256 \\ 29,442 \\ 37,465 \\ 25,067 \\ \end{array}$	time 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.02 0.01 0.15 0.02 0.04 0.00 0.03 0.01 0.01 0.01 0.02 0.02 0.02 0.02 0.03 0.00	$\begin{array}{c} C_{max} \\ 31,008 \\ 22,010 \\ 38,935 \\ 23,774 \\ 22,843 \\ 27,366 \\ 38,932 \\ 29,464 \\ 33,763 \\ 25,072 \\ 36,307 \\ 26,219 \\ 25,619 \\ 27,428 \\ 38,256 \\ 29,442 \\ 38,256 \\ 29,442 \\ 37,465 \\ 25,067 \end{array}$	$\begin{array}{c} \text{time} \\ \hline 0.00 \\ 0.02 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.06 \\ 0.04 \\ 0.01 \\ 0.05 \\ 0.06 \\ 0.01 \\ 0.05 \\ 0.06 \\ 0.01 \\ 0.04 \\ 0.03 \\ 0.01 \\ 0.02 \\ 0.00 \end{array}$	$\begin{array}{c} C_{max} \\ 31,008 \\ 22,010 \\ 38,935 \\ 23,774 \\ 22,843 \\ 27,366 \\ 38,932 \\ 29,464 \\ 33,763 \\ 25,072 \\ 36,307 \\ 26,571 \\ 25,619 \\ 27,428 \\ 38,256 \\ 29,442 \\ 38,256 \\ 29,442 \\ 37,465 \\ 25,067 \end{array}$	P-RN time 0.00 0.00 0.00 0.00 0.00 0.24 18.16 0.00 30.31 2.55 0.01 0.00 0.86 0.000 0.000 0.000 0.000 0.000	$\begin{array}{c} {\rm GRASI}\\ {\rm GRASI}\\ {\rm C}_{\rm max}\\ {\rm 31,008}\\ {\rm 22,010}\\ {\rm 38,935}\\ {\rm 22,010}\\ {\rm 38,935}\\ {\rm 22,843}\\ {\rm 27,366}\\ {\rm 38,932}\\ {\rm 29,464}\\ {\rm 33,763}\\ {\rm 25,072}\\ {\rm 36,307}\\ {\rm 26,219}\\ {\rm 25,6619}\\ {\rm 27,428}\\ {\rm 38,256}\\ {\rm 29,442}\\ {\rm 37,465}\\ {\rm 25,067}\\ {\rm 25,067}\\ {\rm 10,100}\\ {\rm 10,100$	$\begin{array}{c} \hline P-CN \\ \hline time \\ \hline 13.25 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 13.11 \\ 9.52 \\ 0.00 \\ 49.47 \\ 9.76 \\ 0.09 \\ 0.02 \\ 0.09 \\ 7.91 \\ 0.00 \\ 0.10 \\ 0.00 \end{array}$	$\begin{array}{c} C_{max} \\ 31,008 \\ 22,010 \\ 41,699 \\ 23,774 \\ 22,843 \\ 27,366 \\ 38,932 \\ 29,898 \\ 33,763 \\ 25,072 \\ 36,307 \\ 26,219 \\ 25,619 \\ 27,428 \\ 38,256 \\ 29,442 \\ 37,465 \\ 25,067 \end{array}$	RN           time           0.00           0.01           0.00           0.00           0.00           0.00           0.00           0.00           0.01           0.02           0.00           0.01           0.01           0.12           0.00	Cmax           32,506           24,146           42,339           24,017           23,236 <b>27,366 21,357</b> 30,276           34,357           25,093           39,637           25,881 <b>25,881 25,881 30,276 30,376</b> 38,739 <b>25,067</b>	time 0.00	$\frac{C_{\rm max}}{31,008}$ $\frac{31,008}{22,010}$ $\frac{38,937}{22,843}$ $\frac{29,464}{22,843}$ $\frac{29,464}{33,763}$ $\frac{29,464}{33,763}$ $\frac{25,072}{36,307}$ $\frac{36,307}{26,219}$ $\frac{25,619}{27,428}$ $\frac{38,256}{37,465}$ $\frac{29,442}{37,465}$ $\frac{37,465}{25,067}$	$\begin{array}{c} \text{time} \\ \hline 0.25 \\ 0.28 \\ 0.34 \\ 0.28 \\ 0.24 \\ 0.00 \\ 0.39 \\ 0.43 \\ 0.30 \\ 6.20 \\ 0.44 \\ 0.36 \\ 0.52 \\ 0.52 \\ 0.50 \\ 0.41 \\ 0.39 \\ 0.41 \end{array}$
miniYFJS01 miniYFJS02 miniYFJS03 miniYFJS05 miniYFJS06 miniYFJS06 miniYFJS09 miniYFJS09 miniYFJS10 miniYFJS12 miniYFJS12 miniYFJS12 miniYFJS15 miniYFJS16 miniYFJS18 miniYFJS18 miniYFJS19	$\frac{C_{\rm max}}{31,008}$ $\frac{31,008}{22,010}$ $\frac{38,935}{23,774}$ $\frac{22,843}{27,366}$ $\frac{29,464}{33,763}$ $\frac{33,763}{25,0672}$ $\frac{36,307}{26,219}$ $\frac{25,619}{27,428}$ $\frac{37,465}{25,067}$ $\frac{25,067}{29,207}$	time 0.00 0.00 0.00 0.00 0.00 0.00 0.02 0.01 0.15 0.02 0.04 0.00 0.03 0.01 0.02 0.04 0.00	$\begin{array}{c} C_{max} \\ \hline 31,008 \\ 22,010 \\ 38,935 \\ 23,774 \\ 22,843 \\ 27,366 \\ 38,932 \\ 29,464 \\ 33,763 \\ 25,072 \\ 36,307 \\ 26,219 \\ 25,619 \\ 27,428 \\ 38,256 \\ 29,442 \\ 37,465 \\ 29,442 \\ 37,465 \\ 25,067 \\ 29,207 \end{array}$	$\begin{array}{c} \text{time} \\ \hline 0.00 \\ 0.02 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.06 \\ 0.04 \\ 0.01 \\ 0.05 \\ 0.06 \\ 0.01 \\ 0.05 \\ 0.06 \\ 0.01 \\ 0.03 \\ 0.01 \\ 0.02 \\ 0.00 \\ 0.02 \end{array}$	$\frac{C_{\rm max}}{31,008}$ $\frac{31,008}{22,010}$ $\frac{38,935}{23,774}$ $\frac{22,843}{27,366}$ $\frac{29,464}{33,763}$ $\frac{35,763}{25,067}$ $\frac{26,571}{25,6619}$ $\frac{27,428}{37,465}$ $\frac{37,465}{25,067}$ $\frac{25,067}{29,207}$	P-RN time 0.00 0.00 0.00 0.00 0.00 0.00 0.24 18.16 0.00 30.31 2.55 0.01 0.00 0.86 0.00 0.01 0.00 0.00 0.00 0.00	$\begin{array}{c} {\rm GRASI}\\ \hline C_{\rm max} \\ 31,008 \\ 22,010 \\ 38,935 \\ 23,774 \\ 22,843 \\ 27,366 \\ 38,932 \\ 29,464 \\ 33,763 \\ 25,072 \\ 36,307 \\ 26,219 \\ 25,619 \\ 27,428 \\ 38,256 \\ 29,442 \\ 37,465 \\ 25,067 \\ 29,207 \\ \end{array}$	$\begin{array}{c} \hline P-CN \\ \hline time \\ \hline 13.25 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 13.11 \\ 9.52 \\ 0.00 \\ 49.47 \\ 9.76 \\ 0.09 \\ 0.02 \\ 0.09 \\ 7.91 \\ 0.00 \\ 0.10 \\ 0.00 \\ 0.29 \end{array}$	$\frac{C_{\rm max}}{31,008}$ $\frac{31,008}{22,010}$ $\frac{22,010}{41,699}$ $\frac{33,774}{22,843}$ $\frac{27,366}{38,932}$ $\frac{29,898}{33,763}$ $\frac{35,072}{26,219}$ $\frac{25,067}{25,661}$ $\frac{38,256}{29,442}$ $\frac{37,465}{25,067}$ $\frac{25,067}{29,207}$	RN           time           0.00           0.01           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.01           0.02           0.01           0.12           0.00           0.01           0.02           0.00           0.01           0.12           0.00           0.04	$\begin{array}{c} C_{max} \\ 32,506 \\ 24,146 \\ 42,339 \\ 24,017 \\ 23,236 \\ 27,366 \\ 27,366 \\ 34,357 \\ 25,093 \\ 39,637 \\ 27,829 \\ 25,881 \\ 27,428 \\ 39,234 \\ 30,386 \\ 38,739 \\ 25,067 \\ 30,218 \end{array}$	time 0.00	$\frac{C_{\rm max}}{31,008}$ $\frac{31,008}{22,010}$ $\frac{38,935}{33,774}$ $\frac{22,843}{27,366}$ $\frac{29,464}{33,763}$ $\frac{33,763}{25,072}$ $\frac{36,307}{26,219}$ $\frac{25,619}{25,661}$ $\frac{27,428}{37,465}$ $\frac{29,207}{29,207}$	$\begin{array}{c} \text{time} \\ \hline 0.25 \\ 0.28 \\ 0.34 \\ 0.28 \\ 0.24 \\ 0.00 \\ 0.39 \\ 0.43 \\ 0.30 \\ 6.20 \\ 0.44 \\ 0.36 \\ 0.52 \\ 0.50 \\ 0.41 \\ 0.39 \\ 0.41 \\ 0.45 \end{array}$
miniYFJS01 miniYFJS02 miniYFJS03 miniYFJS05 miniYFJS06 miniYFJS07 miniYFJS09 miniYFJS09 miniYFJS10 miniYFJS11 miniYFJS13 miniYFJS13 miniYFJS14 miniYFJS16 miniYFJS18	$\begin{array}{c} C_{max} \\ \hline \\ 31,008 \\ 22,010 \\ 38,935 \\ 23,774 \\ 22,843 \\ 27,366 \\ 38,932 \\ 29,464 \\ 33,763 \\ 25,072 \\ 36,307 \\ 26,219 \\ 25,619 \\ 27,428 \\ 38,256 \\ 29,442 \\ 38,256 \\ 29,442 \\ 37,465 \\ 25,067 \\ \end{array}$	time 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.02 0.01 0.15 0.02 0.04 0.00 0.03 0.01 0.01 0.01 0.02 0.02 0.02 0.02 0.03 0.00	$\begin{array}{c} C_{max} \\ 31,008 \\ 22,010 \\ 38,935 \\ 23,774 \\ 22,843 \\ 27,366 \\ 38,932 \\ 29,464 \\ 33,763 \\ 25,072 \\ 36,307 \\ 26,219 \\ 25,619 \\ 27,428 \\ 38,256 \\ 29,442 \\ 38,256 \\ 29,442 \\ 37,465 \\ 25,067 \end{array}$	$\begin{array}{c} \text{time} \\ \hline 0.00 \\ 0.02 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.06 \\ 0.04 \\ 0.01 \\ 0.05 \\ 0.06 \\ 0.01 \\ 0.05 \\ 0.06 \\ 0.01 \\ 0.04 \\ 0.03 \\ 0.01 \\ 0.02 \\ 0.00 \end{array}$	$\begin{array}{c} C_{max} \\ 31,008 \\ 22,010 \\ 38,935 \\ 23,774 \\ 22,843 \\ 27,366 \\ 38,932 \\ 29,464 \\ 33,763 \\ 25,072 \\ 36,307 \\ 26,571 \\ 25,619 \\ 27,428 \\ 38,256 \\ 29,442 \\ 38,256 \\ 29,442 \\ 37,465 \\ 25,067 \end{array}$	P-RN time 0.00 0.00 0.00 0.00 0.00 0.24 18.16 0.00 30.31 2.55 0.01 0.00 0.86 0.000 0.000 0.000 0.000 0.000	$\begin{array}{c} {\rm GRASI}\\ {\rm GRASI}\\ {\rm C}_{\rm max}\\ {\rm 31,008}\\ {\rm 22,010}\\ {\rm 38,935}\\ {\rm 22,010}\\ {\rm 38,935}\\ {\rm 22,843}\\ {\rm 27,366}\\ {\rm 38,932}\\ {\rm 29,464}\\ {\rm 33,763}\\ {\rm 25,072}\\ {\rm 36,307}\\ {\rm 26,219}\\ {\rm 25,6619}\\ {\rm 27,428}\\ {\rm 38,256}\\ {\rm 29,442}\\ {\rm 37,465}\\ {\rm 25,067}\\ {\rm 25,067}\\ {\rm 10,100}\\ {\rm 10,100$	$\begin{array}{c} \hline P-CN \\ \hline time \\ \hline 13.25 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 13.11 \\ 9.52 \\ 0.00 \\ 49.47 \\ 9.76 \\ 0.09 \\ 0.02 \\ 0.09 \\ 7.91 \\ 0.00 \\ 0.10 \\ 0.00 \end{array}$	$\frac{C_{\rm max}}{31,008}$ $\frac{31,008}{22,010}$ $\frac{22,010}{41,699}$ $\frac{23,774}{22,843}$ $\frac{29,843}{33,763}$ $\frac{29,898}{33,763}$ $\frac{33,763}{25,072}$ $\frac{25,072}{36,307}$ $\frac{25,619}{27,428}$ $\frac{38,256}{29,442}$ $\frac{29,442}{37,465}$ $\frac{29,442}{27,091}$	RN           time           0.00           0.01           0.00           0.00           0.00           0.00           0.00           0.00           0.01           0.02           0.00           0.01           0.01           0.12           0.00	Cmax           32,506           24,146           42,339           24,017           23,236 <b>27,366 21,357</b> 30,276           34,357           25,093           39,637           25,881 <b>25,881 25,881 30,276 30,376</b> 38,739 <b>25,067</b>	time 0.00	$\frac{C_{\rm max}}{31,008}$ $\frac{31,008}{22,010}$ $\frac{38,937}{22,843}$ $\frac{29,464}{22,843}$ $\frac{29,464}{33,763}$ $\frac{29,464}{33,763}$ $\frac{25,072}{36,307}$ $\frac{36,307}{26,219}$ $\frac{25,619}{27,428}$ $\frac{38,256}{37,465}$ $\frac{29,442}{37,465}$ $\frac{37,465}{25,067}$	$\begin{array}{c} \text{time} \\ \hline 0.25 \\ 0.28 \\ 0.34 \\ 0.28 \\ 0.24 \\ 0.00 \\ 0.39 \\ 0.43 \\ 0.30 \\ 6.20 \\ 0.44 \\ 0.44 \\ 0.36 \\ 0.52 \\ 0.52 \\ 0.50 \\ 0.41 \\ 0.39 \\ 0.41 \end{array}$
miniYFJS01 miniYFJS02 miniYFJS03 miniYFJS05 miniYFJS06 miniYFJS06 miniYFJS09 miniYFJS09 miniYFJS10 miniYFJS11 miniYFJS12 miniYFJS13 miniYFJS13 miniYFJS15 miniYFJS16 miniYFJS17 miniYFJS19 miniYFJS19 miniYFJS20	$\begin{tabular}{ c c c c c c c }\hline \hline $C_{max}$ & $$31,008$ & $22,010$ & $$38,935$ & $23,774$ & $22,843$ & $27,366$ & $38,932$ & $27,366$ & $38,932$ & $25,619$ & $25,619$ & $25,619$ & $27,428$ & $38,256$ & $29,442$ & $37,465$ & $29,442$ & $37,465$ & $25,067$ & $29,207$ & $27,091$ & $$$$$} \end{tabular}$	time 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.01 0.15 0.02 0.04 0.00 0.03 0.01 0.01 0.01 0.01 0.01 0.02 0.01 0.01 0.03 0.01 0.01 0.03 0.01 0.03 0.01 0.03 0.01 0.03 0.01 0.03 0.01 0.03 0.03 0.01 0.03 0.03 0.01 0.03 0.03 0.03 0.03 0.03 0.03 0.03 0.03 0.03 0.03 0.03 0.04 0.03 0.03 0.03 0.03 0.03 0.03 0.03 0.03 0.03 0.01 0.03 0.01 0.03 0.01 0.03 0.01 0.03 0.01 0.03 0.01 0.03 0.01 0.03 0.01 0.03 0.01 0.03 0.01 0.03 0.01 0.03 0.01 0.03 0.01 0.03 0.01 0.03 0.03 0.02 0.01 0.03 0.03 0.03 0.02 0.03 0.02 0.03 0.03 0.02 0.03 0.03 0.02 0.03 0.03 0.03 0.02 0.03 0.02 0.03 0.03 0.02 0.03 0.02 0.03 0.02 0.03 0.02 0.03 0.02 0.03 0.02 0.03 0.02 0.03 0.02 0.04 0.02 0.02 0.02 0.03 0.02 0.02 0.02 0.02 0.02 0.03 0.02 0.02 0.03 0.02 0.03 0.02 0.03 0.02 0.03	$\begin{array}{c} C_{max} \\ \hline & 31,008 \\ 22,010 \\ 38,935 \\ 23,774 \\ 22,843 \\ 27,366 \\ 38,932 \\ 29,464 \\ 33,763 \\ 25,072 \\ 36,307 \\ 26,219 \\ 25,619 \\ 27,428 \\ 38,256 \\ 29,442 \\ 37,465 \\ 29,442 \\ 37,465 \\ 25,067 \\ 29,207 \\ 27,091 \end{array}$	$\begin{array}{c} \text{time} \\ \hline 0.00 \\ 0.02 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.06 \\ 0.04 \\ 0.01 \\ 0.05 \\ 0.06 \\ 0.01 \\ 0.05 \\ 0.06 \\ 0.01 \\ 0.04 \\ 0.03 \\ 0.01 \\ 0.02 \\ 0.00 \\ 0.02 \\ 0.03 \end{array}$	$\begin{array}{c} C_{max} \\ \hline & 31,008 \\ 22,010 \\ 38,935 \\ 23,774 \\ 22,843 \\ 27,366 \\ 38,932 \\ 29,464 \\ 33,763 \\ 33,763 \\ 25,072 \\ 36,307 \\ 26,571 \\ 25,619 \\ 27,428 \\ 33,256 \\ 29,442 \\ 37,465 \\ 29,442 \\ 37,465 \\ 25,067 \\ 29,207 \\ 27,091 \\ \end{array}$	P-RN time 0.00 0.00 0.00 0.00 0.00 0.24 18.16 0.00 30.31 2.55 0.01 0.00 0.86 0.00	$\begin{array}{c} {\rm GRASI}\\ \hline C_{\rm max} \\ 31,008 \\ 22,010 \\ 38,935 \\ 23,774 \\ 22,843 \\ 27,366 \\ 38,932 \\ 29,464 \\ 33,763 \\ 25,072 \\ 36,307 \\ 26,219 \\ 25,619 \\ 25,619 \\ 25,619 \\ 25,619 \\ 25,619 \\ 25,619 \\ 27,428 \\ 38,256 \\ 29,442 \\ 37,465 \\ 29,442 \\ 37,465 \\ 29,207 \\ 27,091 \\ \end{array}$	$\begin{array}{c} \hline \begin{array}{c} -\text{CN} \\ \hline \text{time} \\ \hline 13.25 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 13.11 \\ 9.52 \\ 0.00 \\ 49.47 \\ 9.76 \\ 0.09 \\ 0.02 \\ 0.09 \\ 0.02 \\ 0.09 \\ 0.02 \\ 0.02 \\ 0.00 \\ 0.10 \\ 0.00 \\ 0.10 \\ 0.29 \\ 0.22 \end{array}$	$\frac{C_{\rm max}}{31,008}$ $\frac{31,008}{22,010}$ $\frac{22,010}{41,699}$ $\frac{33,774}{22,843}$ $\frac{27,366}{38,932}$ $\frac{29,898}{33,763}$ $\frac{35,072}{26,219}$ $\frac{25,067}{25,661}$ $\frac{38,256}{29,442}$ $\frac{37,465}{25,067}$ $\frac{25,067}{29,207}$	RN           time           0.00           0.01           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.01           0.02           0.00           0.01           0.02           0.01           0.01           0.01           0.01           0.01           0.02           0.04           0.04           0.04	$\begin{array}{c} C_{max} \\ 32,506 \\ 24,144 \\ 42,339 \\ 24,017 \\ 23,236 \\ 27,366 \\ 41,487 \\ 30,276 \\ 34,357 \\ 25,093 \\ 39,637 \\ 27,829 \\ 25,881 \\ 27,428 \\ 30,386 \\ 38,739 \\ 25,967 \\ 30,218 \\ 30,2$	time 0.00	$\frac{C_{\rm max}}{31,008}$ $\frac{31,008}{22,010}$ $\frac{38,935}{23,774}$ $\frac{22,843}{27,366}$ $\frac{27,366}{33,763}$ $\frac{25,072}{36,307}$ $\frac{36,307}{26,219}$ $\frac{25,619}{27,428}$ $\frac{38,256}{38,256}$ $\frac{29,442}{37,465}$ $\frac{29,442}{37,465}$ $\frac{25,067}{29,007}$ $\frac{27,091}{27,091}$	$\begin{array}{c} \text{time} \\ \hline 0.25 \\ 0.28 \\ 0.28 \\ 0.24 \\ 0.00 \\ 0.39 \\ 0.43 \\ 0.30 \\ 0.43 \\ 0.30 \\ 0.44 \\ 0.44 \\ 0.36 \\ 0.52 \\ 0.50 \\ 0.41 \\ 0.39 \\ 0.41 \\ 0.45 \\ 0.42 \\ \end{array}$
miniYFJS01 miniYFJS02 miniYFJS03 miniYFJS05 miniYFJS06 miniYFJS06 miniYFJS09 miniYFJS09 miniYFJS10 miniYFJS12 miniYFJS12 miniYFJS13 miniYFJS15 miniYFJS16 miniYFJS16 miniYFJS18 miniYFJS19 miniYFJS20 miniYFJS22 miniYFJS22 miniYFJS23 <sup>+</sup>	$\begin{tabular}{ c c c c c c c }\hline \hline $C_{max}$ & $$31,008$ & $22,010$ & $$38,935$ & $23,774$ & $22,843$ & $27,366$ & $38,932$ & $27,366$ & $38,932$ & $25,619$ & $25,619$ & $25,619$ & $27,428$ & $38,256$ & $29,442$ & $37,465$ & $25,067$ & $29,207$ & $27,091$ & $32,166$ & $28,985$ & $35,441$ & $$541$ & $$15,411$ & $$166$ & $28,985$ & $35,441$ & $$$15,411$ & $$15,411$ & $$166$ & $28,985$ & $35,441$ & $$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$	$\begin{array}{c} \text{time} \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.02 \\ 0.01 \\ 0.02 \\ 0.01 \\ 0.02 \\ 0.04 \\ 0.00 \\ 0.03 \\ 0.01 \\ 0.00 \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.00 \\ 0.01 \\ 0.00 \\$	$\begin{array}{c} C_{max} \\ \hline & 31,008 \\ 22,010 \\ 38,935 \\ 23,774 \\ 22,843 \\ 27,366 \\ 38,932 \\ 29,464 \\ 33,763 \\ 25,072 \\ 36,307 \\ 26,219 \\ 25,619 \\ 27,428 \\ 38,256 \\ 29,442 \\ 37,465 \\ 29,442 \\ 37,465 \\ 29,442 \\ 37,465 \\ 29,442 \\ 37,465 \\ 29,442 \\ 37,465 \\ 29,442 \\ 37,465 \\ 29,442 \\ 37,465 \\ 29,442 \\ 37,465 \\ 29,442 \\ 37,465 \\ 29,442 \\ 37,465 \\ 29,442 \\ 37,465 \\ 29,442 \\ 37,465 \\ 29,442 \\ 37,465 \\ 38,441 \\ 33,441 \\ 33,441 \\ 35,442 \\ 35,441 \\ $	$\begin{array}{c} \text{time} \\ \hline 0.00 \\ 0.02 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.01 \\ 0.05 \\ 0.06 \\ 0.01 \\ 0.03 \\ 0.01 \\ 0.02 \\ 0.00 \\ 0.02 \\ 0.03 \\ 0.16 \\ 0.06 \\ 0.18 \end{array}$	$\begin{array}{c} C_{max} \\ \hline 31,008 \\ 22,010 \\ 38,935 \\ 23,774 \\ 22,843 \\ 27,366 \\ 38,932 \\ 29,464 \\ 33,763 \\ 25,072 \\ 36,307 \\ 26,571 \\ 25,619 \\ 27,428 \\ 38,256 \\ 29,442 \\ 37,465 \\ 29,442 \\ 37,465 \\ 29,442 \\ 37,465 \\ 29,442 \\ 37,465 \\ 29,442 \\ 37,465 \\ 29,442 \\ 37,465 \\ 29,442 \\ 37,465 \\ 29,442 \\ 37,465 \\ 29,442 \\ 37,465 \\ 29,207 \\ 27,091 \\ 32,238 \\ 28,985 \\ 35,441 \\ \end{array}$	P-RN time 0.00	$\begin{array}{c} {\rm GRASI}\\ \hline C_{\rm max} \\ 31,008 \\ 22,010 \\ 38,935 \\ 23,774 \\ 22,843 \\ 27,366 \\ 38,932 \\ 29,464 \\ 33,763 \\ 25,072 \\ 36,307 \\ 26,219 \\ 25,619 $	2-CN time 13.25 0.00 0.00 0.00 0.00 0.00 0.00 0.00 13.11 9.52 0.00 49.47 9.76 0.09 0.02 0.09 0.02 0.00 0.02 0.02 0.02 0.02 0.02 0.03 0.02 0.03 0.02 0.03 0.02 0.03 0.02 0.03 0.02 0.03 0.02 0.03 0.02 0.03 0.03 0.03 0.03 0.03 0.03 0.03 0.03 0.03 0.03 0.04 0.04 0.05 0.04 0.05 0.0	$\frac{C_{\rm max}}{31,008}$ $\frac{31,008}{22,010}$ $\frac{22,010}{41,699}$ $\frac{23,774}{22,843}$ $\frac{29,848}{33,763}$ $\frac{29,898}{33,763}$ $\frac{33,763}{25,072}$ $\frac{36,307}{26,219}$ $\frac{25,619}{27,428}$ $\frac{38,256}{29,442}$ $\frac{29,442}{37,465}$ $\frac{29,442}{27,091}$ $\frac{32,166}{28,985}$ $\frac{35,441}{35,441}$	RN           time           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.01           0.22           0.00           0.01           0.12           0.00           0.04           0.04           0.01           0.12           0.04           0.04           0.04           0.04           0.04           0.04           0.04	$\begin{array}{c} C_{max} \\ 32,506 \\ 24,146 \\ 42,339 \\ 24,017 \\ 23,236 \\ 27,366 \\ 41,487 \\ 30,276 \\ 34,357 \\ 27,829 \\ 39,637 \\ 27,829 \\ 25,881 \\ 27,428 \\ 39,294 \\ 30,386 \\ 38,739 \\ 25,067 \\ 30,218 \\ 28,590 \\ 33,027 \\ 29,154 \\ 35,961 \end{array}$	$\begin{array}{c} \text{time} \\ \hline 0.00 \\ 0.00$	$\frac{C_{\rm max}}{31,008}$ $\frac{31,008}{22,010}$ $\frac{38,935}{23,774}$ $\frac{22,843}{22,843}$ $\frac{223,474}{33,763}$ $\frac{23,464}{33,763}$ $\frac{33,763}{25,072}$ $\frac{36,307}{26,219}$ $\frac{25,619}{27,428}$ $\frac{38,256}{38,256}$ $\frac{29,442}{37,465}$ $\frac{29,442}{27,091}$ $\frac{32,166}{35,441}$	$\begin{array}{c} \text{time} \\ 0.25 \\ 0.28 \\ 0.28 \\ 0.24 \\ 0.00 \\ 0.39 \\ 0.43 \\ 0.30 \\ 6.20 \\ 0.44 \\ 0.44 \\ 0.44 \\ 0.44 \\ 0.52 \\ 0.50 \\ 0.41 \\ 0.39 \\ 0.41 \\ 0.45 \\ 0.42 \\ 0.59 \\ 0.54 \\ 0.61 \\ \end{array}$
miniYFJS01 miniYFJS03 miniYFJS03 miniYFJS05 miniYFJS06 miniYFJS06 miniYFJS09 miniYFJS09 miniYFJS10 miniYFJS10 miniYFJS13 miniYFJS13 miniYFJS13 miniYFJS15 miniYFJS16 miniYFJS16 miniYFJS17 miniYFJS19 miniYFJS20 miniYFJS21 miniYFJS22 miniYFJS23 <sup>+</sup>	$\begin{tabular}{ c c c c c }\hline \hline $C_{max}$\\\hline $31,008$\\ $22,010$\\ $38,935$\\ $23,774$\\ $22,843$\\ $27,366$\\ $38,932$\\ $29,464$\\ $33,763$\\ $25,072$\\ $36,307$\\ $26,072$\\ $36,307$\\ $26,219$\\ $25,067$\\ $29,442$\\ $37,465$\\ $25,067$\\ $29,207$\\ $27,023$\\ $35,441$\\ $32,166$\\ $28,985$\\ $35,441$\\ $27,023$\\ $35,441$\\ $27,023$\\ $35,441$\\ $35,441$\\ $27,023$\\ $35,441$\\ $	time           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.01           0.02           0.01           0.02           0.01           0.02           0.01           0.02           0.01           0.02           0.01           0.02           0.01           0.02           0.01           0.02           0.01           0.02           0.01           0.02           0.03           0.04           0.09	$\begin{array}{c} C_{max} \\ \hline \\ 31,008 \\ 22,010 \\ 38,935 \\ 23,774 \\ 22,843 \\ 27,366 \\ 38,932 \\ 29,464 \\ 33,763 \\ 25,072 \\ 36,307 \\ 26,219 \\ 25,619 \\ 27,428 \\ 38,256 \\ 29,442 \\ 37,465 \\ 25,067 \\ 29,207 \\ 27,091 \\ 32,166 \\ 28,985 \\ 35,441 \\ 27,023 \end{array}$	time           0.00         0.02           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.01         0.04           0.02         0.03           0.04         0.01           0.02         0.03           0.04         0.02           0.03         0.16           0.04         0.03           0.18         0.03	$\begin{array}{c} C_{max} \\ \hline \\ 31,008 \\ 22,010 \\ 38,935 \\ 23,774 \\ 22,843 \\ 27,366 \\ 33,763 \\ 29,464 \\ 33,763 \\ 25,072 \\ 36,307 \\ 26,571 \\ 25,619 \\ 27,428 \\ 38,256 \\ 29,442 \\ 37,465 \\ 25,067 \\ 29,207 \\ 27,091 \\ 32,238 \\ 28,985 \\ 35,441 \\ 27,395 \\ 35,441 \\ 27,395 \\ 35,441 \\ 27,395 \\ 35,441 \\ 27,395 \\ 35,441 \\ 27,395 \\ 35,441 \\ 27,395 \\ 35,441 \\ 27,395 \\ 35,441 \\ 27,395 \\ 35,441 \\ 27,395 \\ 35,441 \\ 27,395 \\ 35,441 \\ 27,395 \\ 35,441 \\ 27,395 \\ 35,441 \\ 37,395 \\ 35,441 \\ 37,395 \\ 35,441 \\ 37,395 \\ 35,441 \\ 37,395 \\ 35,441 \\ 37,395 \\ 35,441 \\ 37,395 \\ 35,441 \\ 37,395 \\ 35,441 \\ 37,395 \\ 35,441 \\ 37,395 \\ 35,441 \\ 37,395 \\ 35,441 \\ 37,395 \\ 35,441 \\ 37,395 \\ 35,441 \\ 37,395 \\ 35,441 \\ 37,395 \\ 35,441 \\ 37,395 \\ 35,441 \\ 35,374 \\ $	P-RN           time           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.01           0.00           0.01           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.01           0.02           0.02           0.03           0.04           0.05           0.06           0.04           15.36           52.85	$\begin{array}{c} & {\rm GRASI} \\ \hline & C_{\rm max} \\ 31,008 \\ 22,010 \\ 38,935 \\ 22,010 \\ 38,935 \\ 22,843 \\ 27,366 \\ 38,932 \\ 29,464 \\ 33,763 \\ 25,072 \\ 36,307 \\ 26,219 \\ 25,619 \\ 27,428 \\ 38,256 \\ 29,442 \\ 37,465 \\ 25,067 \\ 29,207 \\ 22,5,067 \\ 29,207 \\ 22,106 \\ 28,985 \\ 35,441 \\ 32,166 \\ 28,985 \\ 35,441 \\ 37,405 \\ 27,023 \\ 35,441 \\ 37,605 \\ 35,441 \\ 37,005 \\ 35,441 \\ 37,005 \\ 35,441 \\ 37,005 \\ 35,441 \\ 37,005 \\ 35,441 \\ 37,005 \\ 35,441 \\ 37,005 \\ 35,441 \\ 37,005 \\ 35,441 \\ 37,005 \\ 35,441 \\ 37,005 \\ 35,441 \\ 37,005 \\ 35,441 \\ 37,005 \\ 35,441 \\ 37,005 \\ 35,441 \\ 37,005 \\ 35,441 \\ 37,005 \\ 35,441 \\ 37,005 \\ 35,441 \\ 37,005 \\ 35,441 \\ 37,005 \\ 35,441 \\ 37,005 \\ 35,441 \\ 37,005 \\ 35,441 \\ 35,005 \\ $	2-CN time 13.25 0.00 0.00 0.00 0.00 0.00 13.11 9.52 0.00 49.47 9.76 0.09 0.02 0.09 0.02 0.09 0.00 0.09 0.00 0.09 0.00 0.09 0.00 0.09 0.00 0.00 0.09 0.00 0.09 0.00 0.09 0.00 0.09 0.00 0.09 0.00 0.09 0.00 0.09 0.00 0.09 0.00 0.09 0.00 0.09 0.00 0.00 0.00 0.09 0.00 0.00 0.00 0.09 0.00 0.02 0.00 0.02 0.00 0.02 0.00 0.02 0.0	$\frac{C_{\rm max}}{31,008}$ $\frac{31,008}{22,010}$ $\frac{41,699}{23,774}$ $\frac{22,843}{27,366}$ $\frac{29,898}{33,763}$ $\frac{33,763}{25,072}$ $\frac{25,077}{36,307}$ $\frac{25,619}{27,428}$ $\frac{38,256}{25,067}$ $\frac{29,442}{27,024}$ $\frac{37,465}{25,067}$ $\frac{27,091}{32,166}$ $\frac{28,985}{35,441}$ $\frac{35,441}{27,024}$	RN           time           0.00           0.01           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.01           0.02           0.00           0.01           0.02           0.00           0.01           0.02           0.00           0.01           0.02           0.04           0.04           0.04           0.04           0.04           0.04           0.02           0.12	Cmax           32,506           24,146           42,339           24,017           23,236           27,366           34,357           25,093           39,637           27,829           25,881           27,829           25,881           27,829           25,881           27,829           25,881           27,829           25,881           27,829           25,881           27,829           25,881           27,829           25,881           27,829           25,881           27,829           25,881           27,829           25,881           27,829           25,881           27,829           25,067           30,218           28,5900           30,227           29,154           31,200	time           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00	$\frac{C_{\rm max}}{31,008}$ $\frac{31,008}{22,010}$ $\frac{38,935}{23,774}$ $\frac{22,843}{27,366}$ $\frac{229,464}{33,763}$ $\frac{35,072}{26,219}$ $\frac{25,072}{26,219}$ $\frac{25,619}{27,428}$ $\frac{38,256}{25,067}$ $\frac{29,442}{27,023}$ $\frac{37,465}{25,067}$ $\frac{27,091}{32,166}$ $\frac{28,985}{35,441}$ $\frac{35,166}{27,093}$	$\begin{array}{c} {\rm time} \\ 0.25 \\ 0.28 \\ 0.34 \\ 0.28 \\ 0.24 \\ 0.00 \\ 0.39 \\ 0.33 \\ 0.30 \\ 0.43 \\ 0.30 \\ 0.44 \\ 0.36 \\ 0.52 \\ 0.54 \\ 0.50 \\ 0.41 \\ 0.39 \\ 0.41 \\ 0.39 \\ 0.41 \\ 0.50 \\ 0.51 \\ 0.42 \\ 0.59 \\ 0.54 \\ 0.61 \\ 0.48 \end{array}$
miniYFJS01 miniYFJS02 miniYFJS03 miniYFJS05 miniYFJS05 miniYFJS09 miniYFJS09 miniYFJS09 miniYFJS10 miniYFJS11 miniYFJS12 miniYFJS12 miniYFJS13 miniYFJS15 miniYFJS15 miniYFJS18 miniYFJS19 miniYFJS19 miniYFJS21 miniYFJS22 miniYFJS22 miniYFJS24 miniYFJS25+	$\begin{tabular}{ c c c c c }\hline $C_{max}$\\\hline $31,008$\\ $22,010$\\ $38,935$\\ $23,774$\\ $22,843$\\ $27,366$\\ $38,932$\\ $29,464$\\ $33,763$\\ $25,072$\\ $20,216$\\ $20,424$\\ $36,307$\\ $26,219$\\ $25,067$\\ $29,424$\\ $37,465$\\ $25,067$\\ $29,207$\\ $25,067$\\ $29,207$\\ $25,067$\\ $29,207$\\ $25,067$\\ $29,207$\\ $25,067$\\ $29,207$\\ $25,067$\\ $29,207$\\ $25,067$\\ $29,207$\\ $25,067$\\ $29,207$\\ $25,067$\\ $29,207$\\ $25,067$\\ $29,207$\\ $25,067$\\ $29,207$\\ $27,021$\\ $32,346$\\ $32,346$\\ \end{tabular}$	$\begin{array}{c} {\rm time} \\ {\rm 0.00} \\ {\rm 0.01} \\ {\rm 0.01} \\ {\rm 0.02} \\ {\rm 0.02} \\ {\rm 0.01} \\ {\rm 0.02} \\ {\rm 0.02} \\ {\rm 0.01} \\ {\rm 0.02} \\ {\rm 0.02} \\ {\rm 0.01} \\ {\rm 0.02} \\ {\rm 0.02} \\ {\rm 0.01} \\ {\rm 0.02} \\ {\rm 0.02} \\ {\rm 0.01} \\ {\rm 0.00} \\ {\rm 0.07} \\ {\rm 0.01} \\ {\rm 0.07} \\ {\rm 0.07} \\ {\rm 0.01} \\ {\rm 0$	$\begin{tabular}{ c c c c c }\hline $C_{max}$\\\hline $31,008$\\ $22,010$\\ $38,935$\\ $23,774$\\ $22,843$\\ $27,366$\\ $38,932$\\ $29,464$\\ $37,763$\\ $25,072$\\ $26,219$\\ $25,077$\\ $26,219$\\ $25,067$\\ $29,207$\\ $25,067$\\ $29,207$\\ $25,067$\\ $29,207$\\ $25,067$\\ $29,207$\\ $25,067$\\ $29,207$\\ $25,067$\\ $29,207$\\ $25,067$\\ $29,207$\\ $25,067$\\ $29,207$\\ $25,067$\\ $29,207$\\ $25,067$\\ $29,207$\\ $25,067$\\ $29,207$\\ $25,067$\\ $29,207$\\ $25,067$\\ $29,207$\\ $25,067$\\ $29,207$\\ $25,067$\\ $29,207$\\ $25,067$\\ $29,207$\\ $27,021$\\ $32,346$\\ $32,346$\\ \end{tabular}$	time           0.00         0.02           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.010         0.05           0.06         0.04           0.03         0.01           0.02         0.03           0.03         0.07	$\begin{array}{c} C_{max} \\ \hline C_{max} \\ 31,008 \\ 22,010 \\ 38,935 \\ 23,774 \\ 22,843 \\ 27,366 \\ 38,932 \\ 29,464 \\ 33,763 \\ 25,072 \\ 25,671 \\ 25,671 \\ 25,671 \\ 25,671 \\ 25,671 \\ 27,428 \\ 38,256 \\ 29,442 \\ 37,465 \\ 25,067 \\ 29,207 \\ 27,091 \\ 32,238 \\ 28,985 \\ 35,441 \\ 27,395 \\ 32,346 \end{array}$	P−RN time 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.02 18.16 0.00 0.02 0.01 0.00	$\begin{array}{c} & {\rm GRASI} \\ \hline \\ C_{\rm max} \\ 31,008 \\ 22,010 \\ 38,935 \\ 22,010 \\ 38,935 \\ 22,813 \\ 27,366 \\ 38,932 \\ 29,464 \\ 33,763 \\ 25,072 \\ 36,307 \\ 26,219 \\ 25,667 \\ 29,207 \\ 27,428 \\ 38,256 \\ 29,442 \\ 37,465 \\ 25,067 \\ 29,207 \\ 27,021 \\ 32,465 \\ 35,441 \\ 27,023 \\ 32,465 \\ \end{array}$	$\begin{array}{c} \hline \hline \\ $	$\begin{array}{c} C_{max} \\ \hline \\ 31,008 \\ 22,010 \\ 41,699 \\ 23,774 \\ 22,843 \\ 27,366 \\ 38,932 \\ 29,898 \\ 33,763 \\ 25,072 \\ 29,808 \\ 33,763 \\ 25,071 \\ 26,219 \\ 25,619 \\ 27,428 \\ 38,256 \\ 29,442 \\ 37,465 \\ 25,067 \\ 29,207 \\ 27,091 \\ 32,166 \\ 28,985 \\ 35,441 \\ 27,023 \\ 32,346 \end{array}$	RN           time           0.00           0.01           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.01           0.02           0.00           0.01           0.02           0.00           0.01           0.02	Cmax           32,506           24,146           42,339           24,017           23,236           27,366           34,357           25,093           39,637           27,829           25,881           27,426           38,739           25,093           39,637           27,829           25,881           27,428           38,739           25,067           30,218           28,5961           31,200           32,513	time           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00	$\frac{C_{\rm max}}{31,008}$ $\frac{31,008}{22,010}$ $\frac{38,935}{23,774}$ $\frac{22,843}{27,366}$ $\frac{22,843}{27,366}$ $\frac{25,072}{29,464}$ $\frac{33,763}{25,072}$ $\frac{25,077}{26,219}$ $\frac{25,077}{27,026}$ $\frac{27,428}{38,256}$ $\frac{37,465}{25,067}$ $\frac{29,207}{27,021}$ $\frac{32,166}{32,166}$ $\frac{28,985}{35,441}$ $\frac{32,364}{27,023}$	$\begin{array}{c} \mbox{time} \\ \mbox{time} \\ 0.25 \\ 0.28 \\ 0.24 \\ 0.00 \\ 0.39 \\ 0.39 \\ 0.39 \\ 0.43 \\ 0.30 \\ 0.44 \\ 0.44 \\ 0.44 \\ 0.44 \\ 0.52 \\ 0.50 \\ 0.41 \\ 0.45 \\ 0.42 \\ 0.59 \\ 0.54 \\ 0.54 \\ 0.54 \\ 0.54 \\ 0.48 \\ 3.21 \\ \end{array}$
miniYFJS01 miniYFJS02 miniYFJS03 miniYFJS05 miniYFJS06 miniYFJS06 miniYFJS09 miniYFJS09 miniYFJS09 miniYFJS10 miniYFJS12 miniYFJS12 miniYFJS13 miniYFJS15 miniYFJS16 miniYFJS16 miniYFJS18 miniYFJS19 miniYFJS19 miniYFJS22 miniYFJS22+ miniYFJS23+ miniYFJS24+ miniYFJS254+ miniYFJS26	$\begin{tabular}{ c c c c c c c }\hline \hline $C_{max}$ & $31,008$ & $22,010$ & $38,935$ & $23,774$ & $22,843$ & $27,366$ & $38,932$ & $27,366$ & $38,932$ & $25,072$ & $36,307$ & $26,219$ & $25,619$ & $27,428$ & $38,256$ & $29,442$ & $37,465$ & $25,067$ & $29,247$ & $20,247$ & $20,245$ & $35,441$ & $27,023$ & $32,346$ & $43,452$ & $20,452$ & $20,452$ & $20,457$ & $20,4$	$\begin{array}{c} {\rm time} \\ {\rm 0.00} \\ {\rm 0.01} \\ {\rm 0.01} \\ {\rm 0.01} \\ {\rm 0.02} \\ {\rm 0.01} \\ {\rm 0.01} \\ {\rm 0.02} \\ {\rm 0.01} \\ {\rm 0.02} \\ {\rm 0.01} \\ {\rm 0.02} \\ {\rm 0.01} \\ {\rm 0.01} \\ {\rm 0.02} \\ {\rm 0.01} \\ {\rm 0$	$\begin{array}{c} C_{max} \\ \hline C_{max} \\ 31,008 \\ 22,010 \\ 38,935 \\ 23,774 \\ 22,843 \\ 23,776 \\ 38,932 \\ 29,464 \\ 33,763 \\ 33,763 \\ 25,072 \\ 36,307 \\ 26,219 \\ 25,619 \\ 27,428 \\ 38,256 \\ 29,442 \\ 37,465 \\ 25,067 \\ 29,447 \\ 27,091 \\ 32,166 \\ 29,207 \\ 27,091 \\ 32,166 \\ 35,441 \\ 27,023 \\ 32,346 \\ 34,452 \\ \end{array}$	$\begin{array}{c} {\rm time} \\ {\rm 0.00} \\ {\rm 0.02} \\ {\rm 0.00} \\ {\rm 0.01} \\ {\rm 0.02} \\ {\rm 0.03} \\ {\rm 0.02} \\ {\rm 0.03} \\ {\rm 0.03} \\ {\rm 0.18} \\ {\rm 0.03} \\ {\rm 0.07} \\ {\rm 0.05} \end{array}$	Cmax           31,008           22,010           38,935           23,774           22,843           27,366           38,932           29,464           33,763           25,072           36,307           26,571           25,619           27,428           38,256           29,442           37,465           25,067           29,427           29,207           27,091           32,386           35,441           27,395           32,345	P-RN           time           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.01           0.00           0.01           0.00           0.01           0.00           0.01           0.00           0.01           0.00           0.01           0.00           0.01           0.00           0.01           0.00           0.01           0.02           0.04           15.36           0.38           0.14	$\begin{array}{c} & {\rm GRASI} \\ \hline C_{\rm max} \\ 31,008 \\ 22,010 \\ 38,935 \\ 23,774 \\ 22,843 \\ 27,366 \\ 38,932 \\ 29,464 \\ 33,763 \\ 25,072 \\ 36,307 \\ 26,219 \\ 27,428 \\ 38,256 \\ 29,442 \\ 37,465 \\ 29,442 \\ 37,465 \\ 29,442 \\ 37,465 \\ 29,207 \\ 27,091 \\ 32,166 \\ 28,985 \\ 35,441 \\ 27,023 \\ 32,465 \\ 35,441 \\ 27,023 \\ 32,465 \\ 32,465 \\ 32,465 \\ 32,465 \\ 32,465 \\ 32,465 \\ 32,465 \\ 32,465 \\ 32,465 \\ 33,452 \\ 33,452 \\ 33,452 \\ 34,52 \\ 34,52 \\ 34,52 \\ 34,52 \\ 34,52 \\ 34,52 \\ 34,52 \\ 34,52 \\ 34,52 \\ 34,52 \\ 34,52 \\ 34,52 \\ 34,52 \\ 35,50 \\ 34,52 \\ 34$	$\begin{array}{c} \hline S^{2}-CN\\ \hline time\\ \hline 13.25\\ 0.00\\ 0.00\\ 0.00\\ 0.00\\ 0.00\\ 0.00\\ 0.00\\ 0.00\\ 0.00\\ 0.00\\ 0.00\\ 0.00\\ 0.09\\ 0.02\\ 0.09\\ 0.02\\ 0.09\\ 0.02\\ 0.00\\ 0.00\\ 0.00\\ 0.00\\ 0.00\\ 0.22\\ 0.04\\ 0.22\\ 0.04\\ 0.22\\ 0.04\\ 0.22\\ 0.05\\ 5.25.93\\ 0.55\\ 25.93\\ 0.00\\ 0.00\\ 0.05\\ 0.55\\ 0.$	$\begin{tabular}{ c c c c c c }\hline $C_{max}$\\\hline $31,008$\\ $22,010$\\ $41,699$\\ $23,774$\\ $22,843$\\ $27,366$\\ $38,932$\\ $29,898$\\ $33,763$\\ $33,763$\\ $25,072$\\ $36,307$\\ $26,219$\\ $25,072$\\ $26,619$\\ $27,428$\\ $38,256$\\ $29,442$\\ $29,442$\\ $29,442$\\ $29,442$\\ $29,207$\\ $27,091$\\ $32,166$\\ $29,207$\\ $27,091$\\ $32,166$\\ $29,207$\\ $27,091$\\ $32,166$\\ $35,441$\\ $27,023$\\ $32,346$\\ $32,346$\\ $44,207$\\ \hline \end{tabular}$	RN           time           0.00           0.01           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.01           0.02           0.00           0.01           0.02           0.04           0.04           0.01           0.02           0.04           0.04           0.04           0.04           0.04           0.04           0.04           0.04           0.02           0.02           0.02           0.02           0.02	Cmax           32,506           24,146           42,339           24,017           23,236           41,487           30,276           34,357           25,093           39,637           25,881           25,881           25,881           25,863           30,386           38,739           25,9067           30,218           28,590           33,0218           29,154           35,961           31,200           32,513           34,633	time           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00	$\frac{C_{\rm max}}{31,008}$ 31,008 22,010 38,935 23,774 22,843 27,366 38,932 29,464 33,763 25,072 36,307 26,219 27,428 38,256 25,067 29,442 37,465 29,442 37,465 29,442 37,465 29,442 37,465 29,067 29,207 27,091 32,166 28,985 35,441 27,023 32,346	$\begin{array}{c} {\rm time} \\ {\rm 0.25} \\ {\rm 0.28} \\ {\rm 0.24} \\ {\rm 0.04} \\ {\rm 0.00} \\ {\rm 0.39} \\ {\rm 0.43} \\ {\rm 0.39} \\ {\rm 0.43} \\ {\rm 0.30} \\ {\rm 0.44} \\ {\rm 0.41} \\ {\rm 0.45} \\ {\rm 0.41} \\ {\rm 0.45} \\ {\rm 0.52} \\ {\rm 0.54} \\ {\rm 0$
miniYFJS01 miniYFJS02 miniYFJS03 miniYFJS05 miniYFJS06 miniYFJS06 miniYFJS09 miniYFJS09 miniYFJS09 miniYFJS10 miniYFJS11 miniYFJS11 miniYFJS13 miniYFJS15 miniYFJS16 miniYFJS16 miniYFJS16 miniYFJS17 miniYFJS19 miniYFJS20 miniYFJS22 miniYFJS22 miniYFJS23 <sup>+</sup> miniYFJS24 miniYFJS26 miniYFJS26 miniYFJS26 miniYFJS26	$\begin{tabular}{ c c c c c }\hline \hline $C_{max}$\\\hline $31,008$\\ $22,010$\\ $38,935$\\ $23,774$\\ $22,843$\\ $27,366$\\ $38,932$\\ $29,442$\\ $33,763$\\ $25,072$\\ $26,219$\\ $25,619$\\ $27,428$\\ $38,256$\\ $29,442$\\ $26,422$\\ $29,442$\\ $38,256$\\ $29,442$\\ $25,067$\\ $29,442$\\ $32,465$\\ $25,067$\\ $29,442$\\ $32,465$\\ $25,067$\\ $29,442$\\ $37,465$\\ $25,067$\\ $29,442$\\ $37,465$\\ $25,067$\\ $29,442$\\ $37,465$\\ $25,067$\\ $29,442$\\ $37,465$\\ $25,067$\\ $29,207$\\ $27,091$\\ $32,166$\\ $28,985$\\ $35,441$\\ $27,023$\\ $32,346$\\ $43,455$\\ $31,571$\\ $	$\begin{array}{c} {\rm time} \\ {\rm 0.00} \\ {\rm 0.01} \\ {\rm 0.02} \\ {\rm 0.02} \\ {\rm 0.04} \\ {\rm 0.02} \\ {\rm 0.02} \\ {\rm 0.02} \\ {\rm 0.03} \\ {\rm 0.01} \\ {\rm 0.02} \\ {\rm 0.02} \\ {\rm 0.02} \\ {\rm 0.01} \\ {\rm 0.02} \\ {\rm 0.02} \\ {\rm 0.02} \\ {\rm 0.01} \\ {\rm 0.00} \\ {\rm 0$	$\begin{tabular}{ c c c c c }\hline $C_{max}$\\\hline $31,008$\\ $22,010$\\ $38,935$\\ $23,774$\\ $22,843$\\ $27,366$\\ $38,932$\\ $29,444$\\ $33,763$\\ $25,072$\\ $26,219$\\ $25,619$\\ $27,428$\\ $38,256$\\ $29,442$\\ $29,442$\\ $25,067$\\ $29,442$\\ $37,465$\\ $25,067$\\ $29,442$\\ $37,465$\\ $25,067$\\ $29,442$\\ $37,465$\\ $25,067$\\ $29,442$\\ $37,465$\\ $25,067$\\ $29,442$\\ $37,465$\\ $25,067$\\ $29,442$\\ $37,465$\\ $25,067$\\ $29,442$\\ $37,465$\\ $25,067$\\ $29,442$\\ $37,465$\\ $25,067$\\ $29,442$\\ $37,465$\\ $25,067$\\ $29,442$\\ $37,465$\\ $25,067$\\ $29,442$\\ $37,465$\\ $25,067$\\ $29,422$\\ $37,465$\\ $25,067$\\ $29,422$\\ $37,465$\\ $25,067$\\ $29,423$\\ $37,465$\\ $25,067$\\ $29,207$\\ $27,001$\\ $32,346$\\ $43,452$\\ $31,571$\\ $3$	$\begin{array}{c} {\rm time} \\ {\rm 0.00} \\ {\rm 0.02} \\ {\rm 0.00} \\ {\rm 0.01} \\ {\rm 0.01} \\ {\rm 0.01} \\ {\rm 0.02} \\ {\rm 0.00} \\ {\rm 0.02} \\ {\rm 0.03} \\ {\rm 0.16} \\ {\rm 0.03} \\ {\rm 0.03} \\ {\rm 0.07} \\ {\rm 0.05} \end{array}$	$\frac{C_{max}}{31,008}$ $\frac{31,008}{22,010}$ $\frac{38,935}{23,774}$ $\frac{22,843}{27,366}$ $\frac{29,442}{33,763}$ $\frac{35,072}{26,571}$ $\frac{25,619}{27,428}$ $\frac{38,256}{32,465}$ $\frac{29,442}{37,465}$ $\frac{37,465}{25,067}$ $\frac{29,442}{27,395}$ $\frac{35,441}{27,395}$ $\frac{32,346}{33,452}$	P-RN time 0.00	$\begin{array}{c} & {\rm GRASI} \\ \hline & C_{\rm max} \\ & 31,008 \\ 22,010 \\ 38,935 \\ 22,010 \\ 38,935 \\ 22,843 \\ 27,366 \\ 38,935 \\ 29,464 \\ 33,763 \\ 25,072 \\ 38,937 \\ 26,219 \\ 25,619 \\ 27,428 \\ 38,256 \\ 29,442 \\ 37,465 \\ 25,067 \\ 29,207 \\ 27,091 \\ 32,166 \\ 28,985 \\ 35,441 \\ 27,023 \\ 32,465 \\ 43,452 \\ 31,571 \\ \end{array}$	$\begin{array}{c} \hline \hline \\ $	$\begin{tabular}{ c c c c c }\hline $C_{max}$\\\hline $31,008$\\ $22,010$\\ $41,699$\\ $23,774$\\ $22,843$\\ $27,366$\\ $38,932$\\ $29,898$\\ $33,763$\\ $25,972$\\ $36,307$\\ $26,219$\\ $25,017$\\ $26,219$\\ $25,619$\\ $27,428$\\ $38,256$\\ $29,442$\\ $29,442$\\ $27,021$\\ $37,465$\\ $25,067$\\ $29,442$\\ $27,091$\\ $37,465$\\ $25,067$\\ $29,201$\\ $27,091$\\ $32,166$\\ $28,985$\\ $35,441$\\ $27,023$\\ $32,346$\\ $44,207$\\ $31,571$\\ $31,571$\\ $31,571$\\ $31,571$\\ \end{tabular}$	RN           time           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.01           0.02           0.00           0.01           0.12           0.00           0.01           0.02           0.00           0.04           0.01           0.02           0.00           0.01           0.02           0.04           0.04           0.04           0.04           0.04           0.04           0.04           0.02           0.00           0.01	Cmax           32,506           24,145           42,339           24,017           23,236           27,366           34,357           35,963           39,637           25,093           39,637           25,881           27,428           30,386           38,739           25,067           30,218           28,590           35,961           31,200           32,513           44,633           31,877	time           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00	$\frac{C_{\rm max}}{31,008}$ $\frac{31,008}{22,010}$ $\frac{38,935}{23,774}$ $\frac{22,843}{27,366}$ $\frac{29,464}{33,763}$ $\frac{35,932}{29,464}$ $\frac{35,067}{26,219}$ $\frac{25,619}{27,428}$ $\frac{37,465}{25,067}$ $\frac{29,442}{27,091}$ $\frac{37,465}{25,067}$ $\frac{29,442}{27,091}$ $\frac{37,465}{35,441}$ $\frac{27,091}{32,166}$ $\frac{28,985}{35,441}$ $\frac{35,441}{27,023}$ $\frac{32,346}{34,552}$	$\begin{array}{c} \mbox{time} \\ \hline \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \$
miniYFJS01 miniYFJS02 miniYFJS03 miniYFJS05 miniYFJS05 miniYFJS09 miniYFJS09 miniYFJS09 miniYFJS09 miniYFJS11 miniYFJS12 miniYFJS12 miniYFJS13 miniYFJS15 miniYFJS15 miniYFJS15 miniYFJS16 miniYFJS18 miniYFJS19 miniYFJS21 miniYFJS22 miniYFJS22 miniYFJS22 miniYFJS24 miniYFJS24 miniYFJS24 miniYFJS25+ miniYFJS28	$\begin{tabular}{ c c c c }\hline \hline $C_{max}$\\\hline $31,008$\\ $22,010$\\ $38,935$\\ $23,774$\\ $22,843$\\ $27,366$\\ $38,932$\\ $29,464$\\ $37,465$\\ $25,072$\\ $26,072$\\ $26,072$\\ $26,072$\\ $26,072$\\ $26,072$\\ $26,072$\\ $26,072$\\ $27,428$\\ $38,256$\\ $29,442$\\ $37,465$\\ $25,067$\\ $29,207$\\ $27,023$\\ $32,166$\\ $28,985$\\ $35,441$\\ $27,023$\\ $32,166$\\ $28,985$\\ $35,441$\\ $27,023$\\ $32,346$\\ $43,452$\\ $31,571$\\ $30,428$\\ \end{tabular}$	$\begin{array}{c} {\rm time} \\ {\rm 0.00} \\ {\rm 0.01} \\ {\rm 0.01} \\ {\rm 0.01} \\ {\rm 0.07} \\ {\rm 0.01} \\ {\rm 0.07} \\ {\rm 0.01} \\ {\rm 0.07} \\ {\rm 0.01} \\ {\rm 0.01} \end{array}$	$\begin{array}{c} C_{\rm max} \\ \hline C_{\rm max} \\ 31,008 \\ 22,010 \\ 38,935 \\ 23,774 \\ 22,843 \\ 27,366 \\ 38,932 \\ 29,464 \\ 33,763 \\ 25,072 \\ 36,307 \\ 26,219 \\ 25,619 \\ 27,428 \\ 38,256 \\ 29,442 \\ 37,465 \\ 25,067 \\ 29,207 \\ 27,021 \\ 32,166 \\ 28,985 \\ 35,441 \\ 27,023 \\ 32,166 \\ 28,985 \\ 35,441 \\ 27,023 \\ 32,346 \\ 43,452 \\ 31,571 \\ 30,428 \end{array}$	time           0.00         0.02           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.01         0.02           0.03         0.02           0.03         0.04           0.04         0.03           0.05         0.06           0.04         0.03           0.05         0.03           0.06         0.03           0.07         0.05           0.01         0.02           0.03         0.03           0.04         0.03           0.05         0.01	$\begin{array}{c} C_{max} \\ \hline \\ 31,008 \\ 22,010 \\ 38,935 \\ 23,774 \\ 22,843 \\ 27,366 \\ 38,932 \\ 29,464 \\ 33,763 \\ 25,072 \\ 36,307 \\ 26,571 \\ 25,677 \\ 26,571 \\ 25,677 \\ 27,428 \\ 38,256 \\ 29,442 \\ 37,465 \\ 25,067 \\ 29,207 \\ 27,298 \\ 32,238 \\ 28,985 \\ 35,441 \\ 27,395 \\ 32,346 \\ 43,452 \\ 31,571 \\ 30,428 \\ \end{array}$	P−RN time 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.24 18.16 0.00 0.24 18.16 0.00 0.01 0.00 0.00 0.01 0.00 0.00 0.00 0.00 0.02 18.16 0.00 0.00 0.02 0.00 0.02 0.02 0.00 0.00 0.00 0.00 0.02 0.00 0.01 0.00 0.00 0.01 75.85 0.38 0.01 74.61 74.61	$\begin{array}{c} & {\rm GRASI} \\ \hline \\ C_{\rm max} \\ 31,008 \\ 22,010 \\ 38,935 \\ 22,010 \\ 38,935 \\ 22,813 \\ 27,366 \\ 38,932 \\ 29,464 \\ 33,763 \\ 25,072 \\ 36,307 \\ 26,219 \\ 25,619 \\ 25,619 \\ 27,428 \\ 38,256 \\ 29,442 \\ 37,465 \\ 29,442 \\ 37,465 \\ 29,442 \\ 37,465 \\ 29,442 \\ 37,465 \\ 29,442 \\ 37,465 \\ 29,442 \\ 38,256 \\ 29,442 \\ 38,256 \\ 29,442 \\ 38,256 \\ 29,442 \\ 38,256 \\ 29,442 \\ 38,256 \\ 29,442 \\ 38,452 \\ 31,571 \\ 30,428 \\ \end{array}$	$\begin{array}{c} \hline \hline \\ $	Cmax           31,008           22,010           41,699           23,774           22,843           27,366           38,932           29,898           33,763           25,072           36,307           26,219           27,428           38,256           29,442           37,465           25,067           29,207           27,023           32,166           28,985           32,346           44,207           30,428	RN           time           0.00           0.01           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.01           0.02           0.05           0.01           0.05           0.01           0.02           0.00           0.01           0.02           0.00           0.01           0.02           0.00           0.01           0.02           0.00           0.01	Cmax           32,506           24,146           42,339           24,017           23,236           27,366           34,357           25,093           39,637           27,829           25,093           39,637           27,829           25,093           39,294           30,386           38,739           25,067           30,218           28,5900           32,513           44,633           31,200           32,513           44,633           31,877           30,428	time           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00	$\frac{C_{\rm max}}{31,008}$ $\frac{31,008}{22,010}$ $\frac{38,935}{23,774}$ $\frac{22,843}{27,366}$ $\frac{229,464}{33,763}$ $\frac{35,072}{26,219}$ $\frac{25,072}{26,307}$ $\frac{25,072}{27,428}$ $\frac{38,256}{25,067}$ $\frac{29,442}{27,428}$ $\frac{37,465}{25,067}$ $\frac{29,207}{27,091}$ $\frac{27,091}{32,166}$ $\frac{32,166}{28,985}$ $\frac{32,166}{32,346}$ $\frac{43,452}{31,571}$ $\frac{30,428}{30,428}$	$\begin{array}{c} \mbox{time} \\ \hline \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \$
miniYFJS01 miniYFJS02 miniYFJS03 miniYFJS05 miniYFJS06 miniYFJS06 miniYFJS09 miniYFJS09 miniYFJS09 miniYFJS10 miniYFJS12 miniYFJS12 miniYFJS12 miniYFJS15 miniYFJS16 miniYFJS16 miniYFJS18 miniYFJS19 miniYFJS20 miniYFJS22 miniYFJS23 <sup>+</sup> miniYFJS24 miniYFJS25 miniYFJS26 miniYFJS28 miniYFJS28 miniYFJS28 miniYFJS28 miniYFJS28 miniYFJS28 miniYFJS28 miniYFJS28	$\begin{tabular}{ c c c c c }\hline \hline $C_{max}$\\\hline $31,008$\\ $22,010$\\ $38,935$\\ $23,774$\\ $22,843$\\ $27,366$\\ $38,932$\\ $29,442$\\ $33,763$\\ $25,072$\\ $26,219$\\ $25,619$\\ $27,428$\\ $38,256$\\ $29,442$\\ $26,422$\\ $29,442$\\ $38,256$\\ $29,442$\\ $25,067$\\ $29,442$\\ $32,465$\\ $25,067$\\ $29,442$\\ $32,465$\\ $25,067$\\ $29,442$\\ $37,465$\\ $25,067$\\ $29,442$\\ $37,465$\\ $25,067$\\ $29,442$\\ $37,465$\\ $25,067$\\ $29,442$\\ $37,465$\\ $25,067$\\ $29,207$\\ $27,091$\\ $32,166$\\ $28,985$\\ $35,441$\\ $27,023$\\ $32,346$\\ $43,455$\\ $31,571$\\ $	$\begin{array}{c} {\rm time} \\ {\rm time} \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.01 \\ 0.01 \\ 0.01 \\ 0.02 \\ 0.01 \\ 0.01 \\ 0.02 \\ 0.01 \\ 0.00 \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.01 \\ 0.02 \\ 0.01 \\ 0.02 \\ 0.01 \\ 0.00 \\ 0.01 \\ 0.02 \\ 0.02 \\ 0.01 \\ 0.00 \\ 0.01 \\ 0.02 \\ 0.02 \\ 0.01 \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.02 \\ 0.02 \\ 0.01 \\ 0.00 \\ 0$	$\begin{tabular}{ c c c c }\hline $C_{max}$\\\hline $31,008$\\ $22,010$\\ $38,935$\\ $23,774$\\ $22,843$\\ $27,366$\\ $38,932$\\ $29,464$\\ $37,763$\\ $25,072$\\ $29,424$\\ $36,307$\\ $26,219$\\ $25,072$\\ $26,027$\\ $27,428$\\ $38,256$\\ $29,442$\\ $37,465$\\ $29,442$\\ $37,465$\\ $29,442$\\ $37,465$\\ $29,442$\\ $37,465$\\ $29,207$\\ $27,028$\\ $32,346$\\ $28,985$\\ $35,441$\\ $27,023$\\ $32,346$\\ $43,452$\\ $31,571$\\ $30,428$\\ $32,826$\\ \end{tabular}$	time           0.00         0.02           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.01         0.05           0.02         0.03           0.03         0.04           0.03         0.04           0.04         0.03           0.05         0.06           0.18         0.03           0.03         0.07           0.05         0.01           0.01         0.036	$\begin{tabular}{ c c c c c }\hline $C_{max}$\\\hline $31,008$\\ $22,010$\\ $38,935$\\ $23,774$\\ $22,843$\\ $27,366$\\ $38,932$\\ $29,464$\\ $37,465$\\ $29,464$\\ $37,465$\\ $29,464$\\ $36,307$\\ $26,571$\\ $25,072$\\ $26,571$\\ $25,072$\\ $27,428$\\ $38,256$\\ $29,442$\\ $37,465$\\ $29,442$\\ $37,465$\\ $29,442$\\ $37,465$\\ $29,442$\\ $37,465$\\ $29,425$\\ $36,407$\\ $29,007$\\ $27,091$\\ $32,346$\\ $34,452$\\ $32,346$\\ $43,452$\\ $31,571$\\ $30,428$\\ $32,826$\\ \end{tabular}$	P-RN           time           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.01           0.00           0.03           0.04           18.16           0.00           0.01           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.01           0.02           0.04           15.36           0.38           0.14           0.01	$\begin{array}{c} & {\rm GRASI} \\ & {\rm C}_{\rm max} \\ & {\rm 31,008} \\ {\rm 22,010} \\ {\rm 38,935} \\ {\rm 22,010} \\ {\rm 38,935} \\ {\rm 22,010} \\ {\rm 38,935} \\ {\rm 22,014} \\ {\rm 23,774} \\ {\rm 22,843} \\ {\rm 27,366} \\ {\rm 38,935} \\ {\rm 29,464} \\ {\rm 33,763} \\ {\rm 25,072} \\ {\rm 36,307} \\ {\rm 26,219} \\ {\rm 25,619} \\ {\rm 27,428} \\ {\rm 38,256} \\ {\rm 29,442} \\ {\rm 37,465} \\ {\rm 25,067} \\ {\rm 29,207} \\ {\rm 27,091} \\ {\rm 32,166} \\ {\rm 28,985} \\ {\rm 35,441} \\ {\rm 27,023} \\ {\rm 32,465} \\ {\rm 43,452} \\ {\rm 31,571} \end{array}$	2-CN time 13.25 0.00 0.00 0.00 0.00 0.00 0.00 13.11 9.52 0.00 49.47 9.76 0.09 0.02 0.09 0.02 0.09 0.02 0.09 0.02 0.00 0.00 0.09 0.22 0.00 0.00 0.22 0.00 0.22 0.00 0.22 0.00 0.22 0.00 0.22 0.00 0.22 0.00 0.22 0.00 0.22 0.00 0.22 0.00 0.22 0.00 0.22 0.00 0.22 0.00 0.22 0.00 0.22 0.00 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.05 5.26 0.55 25.93 0.42 0.42 0.45 0.55 0.42 0.45 0.45 0.55 0.45 0.	$\begin{array}{c} C_{max} \\ \hline \\ 31,008 \\ 22,010 \\ 41,699 \\ 23,774 \\ 22,843 \\ 27,366 \\ 38,932 \\ 29,898 \\ 33,763 \\ 25,072 \\ 36,307 \\ 26,219 \\ 25,619 \\ 27,428 \\ 38,256 \\ 29,442 \\ 37,465 \\ 29,207 \\ 27,091 \\ 32,166 \\ 28,985 \\ 35,441 \\ 27,023 \\ 32,346 \\ 44,207 \\ 31,571 \\ 30,428 \\ 32,826 \end{array}$	RN           time           0.00           0.01           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.01           0.02           0.00           0.01           0.02           0.00           0.04           0.04           0.00           0.02           0.00           0.02           0.00           0.01           0.02           0.00           0.01           0.02           0.00           0.01           0.02           0.00           0.01           0.02           0.02           0.04           0.45	Cmax           32,506           24,145           42,339           24,017           23,236           27,366           34,357           35,963           39,637           25,093           39,637           25,881           27,428           30,386           38,739           25,067           30,218           28,590           35,961           31,200           32,513           44,633           31,877	time           0.00         0.00	$\begin{tabular}{ c c c c c }\hline \hline $C_{max}$\\\hline $31,008$\\ $22,010$\\ $38,935$\\ $23,774$\\ $22,843$\\ $27,366$\\ $38,932$\\ $29,464$\\ $33,763$\\ $25,072$\\ $36,307$\\ $26,519$\\ $25,619$\\ $27,428$\\ $38,256$\\ $29,442$\\ $37,465$\\ $29,442$\\ $37,465$\\ $29,442$\\ $37,465$\\ $29,442$\\ $37,465$\\ $29,442$\\ $37,465$\\ $29,947$\\ $29,207$\\ $27,091$\\ $32,166$\\ $29,942$\\ $35,441$\\ $27,023$\\ $32,346$\\ $32,826$\\ $32,826$\\ \end{tabular}$	$\begin{array}{c} {\rm time} \\ {\rm 0.25} \\ {\rm 0.28} \\ {\rm 0.24} \\ {\rm 0.24} \\ {\rm 0.00} \\ {\rm 0.39} \\ {\rm 0.43} \\ {\rm 0.39} \\ {\rm 0.43} \\ {\rm 0.30} \\ {\rm 0.44} \\ {\rm 0.44} \\ {\rm 0.44} \\ {\rm 0.44} \\ {\rm 0.45} \\ {\rm 0.52} \\ {\rm 0.50} \\ {\rm 0.41} \\ {\rm 0.45} \\ {\rm 0.45} \\ {\rm 0.61} \\ {\rm 0.45} \\ {\rm 0.54} \\ {\rm 0.54} \\ {\rm 0.54} \\ {\rm 0.54} \\ {\rm 0.47} \\ {\rm 0.48} \end{array}$
miniYFJS01 miniYFJS02 miniYFJS03 miniYFJS05 miniYFJS05 miniYFJS09 miniYFJS09 miniYFJS09 miniYFJS09 miniYFJS11 miniYFJS12 miniYFJS12 miniYFJS13 miniYFJS15 miniYFJS15 miniYFJS15 miniYFJS16 miniYFJS18 miniYFJS19 miniYFJS21 miniYFJS22 miniYFJS22 miniYFJS22 miniYFJS24 miniYFJS24 miniYFJS24 miniYFJS25+ miniYFJS28	Cmax           31,008           22,010           38,935           23,774           22,843           27,366           38,932           29,464           33,763           25,072           36,307           26,219           27,428           38,256           29,442           37,465           25,067           29,442           37,465           25,067           29,207           27,091           32,346           28,985           35,441           27,023           32,346           32,346           32,346           32,346           32,346           32,346           32,346           32,344	$\begin{array}{c} \text{time} \\ \hline \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.01 \\ 0.02 \\ 0.02 \\ 0.02 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.01 \\ 0.02 \\ 0.02 \\ 0.02 \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.01 \\ 0.02 \\ 0.02 \\ 0.02 \\ 0.02 \\ 0.02 \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.01 \\ 0.02 \\ 0.02 \\ 0.02 \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.02 \\ 0.00 \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.$	$\begin{array}{c} C_{\rm max} \\ \hline C_{\rm max} \\ 31,008 \\ 22,010 \\ 38,935 \\ 23,774 \\ 22,843 \\ 27,366 \\ 38,932 \\ 29,464 \\ 33,763 \\ 25,072 \\ 36,307 \\ 26,219 \\ 25,619 \\ 27,428 \\ 38,256 \\ 29,442 \\ 37,465 \\ 25,067 \\ 29,207 \\ 27,021 \\ 32,166 \\ 28,985 \\ 35,441 \\ 27,023 \\ 32,166 \\ 28,985 \\ 35,441 \\ 27,023 \\ 32,346 \\ 43,452 \\ 31,571 \\ 30,428 \end{array}$	time           0.00         0.02           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.01         0.05           0.001         0.01           0.02         0.00           0.03         0.16           0.04         0.03           0.05         0.01           0.05         0.01           0.05         0.01	$\begin{array}{c} C_{max} \\ \hline \\ 31,008 \\ 22,010 \\ 38,935 \\ 23,774 \\ 22,843 \\ 27,366 \\ 38,932 \\ 29,464 \\ 33,763 \\ 25,072 \\ 36,307 \\ 26,571 \\ 25,072 \\ 36,307 \\ 26,571 \\ 25,067 \\ 29,442 \\ 38,256 \\ 25,067 \\ 29,207 \\ 27,428 \\ 38,256 \\ 25,067 \\ 29,207 \\ 27,238 \\ 32,346 \\ 43,452 \\ 31,571 \\ 30,428 \\ \end{array}$	P=RN time 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.01 0.00 0.00 0.01 0.00 0.00 0.00 0.01 0.00 0.01	$\begin{array}{c} & {\rm GRASI} \\ \hline C_{\rm max} \\ 31,008 \\ 22,010 \\ 38,935 \\ 23,774 \\ 22,843 \\ 27,366 \\ 38,932 \\ 29,464 \\ 33,763 \\ 25,072 \\ 36,307 \\ 26,219 \\ 25,6619 \\ 27,428 \\ 38,256 \\ 29,442 \\ 37,465 \\ 29,442 \\ 37,465 \\ 29,207 \\ 27,091 \\ 32,166 \\ 29,207 \\ 27,091 \\ 32,165 \\ 35,441 \\ 27,023 \\ 32,465 \\ 43,452 \\ 31,571 \\ 30,428 \\ 32,826 \\ \end{array}$	2-CN time 13.25 0.00 0.00 0.00 0.00 0.00 0.00 13.11 9.52 0.00 49.47 9.76 0.09 0.02 0.09 0.02 0.09 0.02 0.00 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.04 0.22 0.04 0.22 0.04 0.25 0.02 0.04 0.22 0.04 0.25 0.02 0.04 0.22 0.04 0.02 0.02 0.04 0.25 0.04 0.02 0.04 0.02 0.04 0.02 0.04 0.02 0.04 0.02 0.04 0.05 0.05 0.04 0.05 0.05 0.05 0.04 0.05 0.0	Cmax           31,008           22,010           41,699           23,774           22,843           27,366           38,932           29,898           33,763           25,072           36,307           26,219           27,428           38,256           29,442           37,465           25,067           29,207           27,023           32,166           28,985           32,346           44,207           30,428	RN           time           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.01           0.22           0.00           0.01           0.12           0.00           0.01           0.02           0.00           0.01           0.02           0.00           0.01           0.02           0.00           0.01           0.02           0.04	Cmax           32,506           24,146           42,339           24,017           23,236           41,487           30,276           34,357           25,093           39,637           27,829           25,881           27,428           30,286           38,739           25,9067           30,218           28,590           33,027           29,154           35,961           31,877           30,428           33,455	time           0.00         0.00	$\frac{C_{\rm max}}{31,008}$ $\frac{31,008}{22,010}$ $\frac{38,935}{23,774}$ $\frac{22,843}{27,366}$ $\frac{229,464}{33,763}$ $\frac{35,072}{26,219}$ $\frac{25,072}{26,307}$ $\frac{25,072}{27,428}$ $\frac{38,256}{25,067}$ $\frac{29,442}{27,428}$ $\frac{37,465}{25,067}$ $\frac{29,207}{27,091}$ $\frac{27,091}{32,166}$ $\frac{32,166}{28,985}$ $\frac{32,166}{32,346}$ $\frac{43,452}{31,571}$ $\frac{30,428}{30,428}$	$\begin{array}{c} \mbox{time} \\ \hline \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \$
miniYFJS01 miniYFJS02 miniYFJS03 miniYFJS05 miniYFJS05 miniYFJS08 miniYFJS09 miniYFJS09 miniYFJS09 miniYFJS09 miniYFJS11 miniYFJS12 miniYFJS12 miniYFJS12 miniYFJS15 miniYFJS15 miniYFJS16 miniYFJS19 miniYFJS21 miniYFJS22 miniYFJS22 miniYFJS22 miniYFJS24 miniYFJS24 miniYFJS25+ miniYFJS25 miniYFJS28 miniYFJS28 miniYFJS28 miniYFJS28 miniYFJS29 miniYFJS29 miniYFJS29 miniYFJS29 miniYFJS20	$\begin{array}{c} \hline C_{max} \\ \hline 31,008 \\ 22,010 \\ 38,935 \\ 23,774 \\ 22,843 \\ 27,366 \\ 38,932 \\ 29,464 \\ 33,763 \\ 25,072 \\ 25,071 \\ 26,219 \\ 25,619 \\ 27,428 \\ 38,256 \\ 29,442 \\ 37,465 \\ 29,442 \\ 37,465 \\ 25,067 \\ 29,207 \\ 27,021 \\ 32,166 \\ 28,985 \\ 35,441 \\ 27,023 \\ 32,346 \\ 43,452 \\ 31,571 \\ 30,428 \\ 32,826 \\ 29,848 \\ 30,428 \\ 32,826 \\ 29,848 \\ 30,428 \\ $	$\begin{array}{c} {\rm time} \\ {\rm 0.00} \\ {\rm 0.01} \\ {\rm 0.02} \\ {\rm 0.03} \\ {\rm 0.02} \\ {\rm 0.04} \\ {\rm 0.00} \\ {\rm 0.01} \\ {\rm 0.07} \\ {\rm 0.01} \\ {\rm 0.00} \\ {\rm 0.01} \\ {\rm 0.02} \\ {\rm 0.02} \\ {\rm 0.01} \\ {\rm 0.00} \\ {\rm 0.01} \\ {\rm 0.02} \\ {\rm 0.01} \\ {\rm 0.01} \\ {\rm 0.02} \\ {\rm 0.01} \\ {\rm 0.01} \\ {\rm 0.02} \\ {\rm 0.01} \\ {\rm 0.01} \\ {\rm 0.01} \\ {\rm 0.02} \\ {\rm 0.01} \\ {\rm 0.01} \\ {\rm 0.01} \\ {\rm 0.02} \\ {\rm 0.01} \\ {\rm 0.01} \\ {\rm 0.01} \\ {\rm 0.01} \\ {\rm 0.02} \\ {\rm 0.01} \\ {\rm 0.01} \\ {\rm 0.01} \\ {\rm 0.02} \\ {\rm 0.01} \\ {\rm 0.01} \\ {\rm 0.01} \\ {\rm 0.02} \\ {\rm 0.01} \\ {\rm 0.01} \\ {\rm 0.01} \\ {\rm 0.02} \\ {\rm 0.01} \\ {\rm 0$	$\begin{array}{c} C_{\rm max} \\ \hline C_{\rm max} \\ 31,008 \\ 22,010 \\ 38,935 \\ 23,774 \\ 22,843 \\ 27,366 \\ 38,932 \\ 29,464 \\ 33,763 \\ 25,072 \\ 25,071 \\ 25,619 \\ 25,619 \\ 25,619 \\ 25,619 \\ 27,428 \\ 38,256 \\ 29,442 \\ 37,465 \\ 29,442 \\ 37,465 \\ 29,07 \\ 27,021 \\ 32,166 \\ 28,985 \\ 35,441 \\ 27,023 \\ 32,346 \\ 43,452 \\ 31,571 \\ 30,428 \\ 32,826 \\ 29,848 \\ 30,428 \\ 33,644 $	$\begin{array}{c} {\rm time} \\ \hline {\rm 0.00} \\ 0.02 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.00 \\ 0.02 \\ 0.00 \\ 0.02 \\ 0.00 \\ 0.02 \\ 0.00 \\ 0.02 \\ 0.00 \\ 0.02 \\ 0.00 \\ 0.01 \\ 0.00 \\ 0.01 \\ 0.05 \\ 0.01 \\ 0.05 \\ 0.01 \\ 0.05 \\ 0.01 \\ 0.01 \\ 0.05 \\ 0.01 \\ 0.00 \\ 0.01 \\ 0.01 \\ 0.01 \\ 0.01 \\ 0.01 \\ 0.01 \\ 0.01 \\ 0.01 \\ 0.01 \\ 0.01 \\ 0.01 \\ 0.00 \\ 0.01 \\$	$\begin{array}{c} C_{max} \\ \hline C_{max} \\ \hline 31,008 \\ 22,010 \\ 38,935 \\ 23,774 \\ 22,843 \\ 27,366 \\ 38,932 \\ 29,464 \\ 33,763 \\ 25,072 \\ 29,464 \\ 33,763 \\ 25,071 \\ 25,619 \\ 27,428 \\ 38,256 \\ 29,442 \\ 37,465 \\ 29,442 \\ 37,465 \\ 29,442 \\ 37,465 \\ 29,07 \\ 27,091 \\ 32,238 \\ 28,985 \\ 35,441 \\ 27,395 \\ 32,346 \\ 43,452 \\ 31,571 \\ 30,428 \\ 32,826 \\ 29,848 \\ 30,428 \\ 32,826 \\ 29,848 \\ 30,428 \\ $	P=RN           time           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.01           0.00           0.01           0.00           0.01           0.00           0.01           0.00           0.01           0.00           0.00           0.01           0.00           0.00           0.01           0.00           0.00           0.00           0.01           0.02           0.03           1.67	$\begin{array}{c} {\rm GRASI}\\ \hline C_{\rm max}\\ 31,008\\ 22,010\\ 38,935\\ 23,774\\ 22,843\\ 27,366\\ 38,932\\ 22,843\\ 27,366\\ 38,932\\ 29,464\\ 33,763\\ 25,072\\ 36,307\\ 26,219\\ 25,667\\ 29,207\\ 27,428\\ 38,256\\ 29,442\\ 37,465\\ 29,442\\ 37,465\\ 29,442\\ 32,465\\ 29,442\\ 37,465\\ 29,207\\ 27,091\\ 32,166\\ 29,442\\ 33,452\\ 33,571\\ 32,465\\ 43,452\\ 33,571\\ 30,428\\ 32,826\\ 29,848\\ 30,644\\ 25\end{array}$	$\begin{array}{c} \hline \\ \hline $	$\begin{array}{c} C_{max} \\ \hline C_{max} \\ \hline 31,008 \\ 22,010 \\ 41,699 \\ 23,774 \\ 22,843 \\ 27,366 \\ 38,932 \\ 29,898 \\ 33,763 \\ 25,072 \\ 29,898 \\ 33,763 \\ 25,072 \\ 29,898 \\ 38,256 \\ 29,442 \\ 37,465 \\ 25,067 \\ 29,207 \\ 27,021 \\ 32,166 \\ 28,985 \\ 35,441 \\ 27,023 \\ 32,166 \\ 28,985 \\ 35,441 \\ 27,023 \\ 32,346 \\ 44,207 \\ 31,571 \\ 30,428 \\ 32,826 \\ 29,848 \\ 30,470 \\ 27 \\ 727 \\ 29,848 \\ 30,428$	RN           time           0.00           0.01           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.01           0.02           0.00           0.01           0.02           0.00           0.01           0.02           0.00           0.01           0.02           0.00           0.01           0.02           0.00           0.01           0.02           0.00           0.01           0.02           0.00           0.01           0.02           0.04           0.04	Cmax           32,506           24,146           42,339           24,017           23,236           27,366           27,366           34,357           25,093           39,637           27,829           25,093           39,637           27,829           25,867           30,218           28,5961           31,200           32,513           44,633           31,205           30,428           33,455           31,093           31,093           31,093	time           0.00         0.00	$\frac{C_{\rm max}}{31,008}$ $\frac{31,008}{22,010}$ $\frac{38,935}{23,774}$ $\frac{22,843}{27,366}$ $\frac{22,9464}{33,763}$ $\frac{35,072}{26,219}$ $\frac{25,077}{26,219}$ $\frac{25,067}{27,428}$ $\frac{37,465}{35,441}$ $\frac{25,067}{27,0291}$ $\frac{32,166}{32,985}$ $\frac{32,346}{32,346}$ $\frac{43,452}{31,571}$ $\frac{30,428}{30,428}$ $\frac{30,643}{30}$	$\begin{array}{c} {\rm time} \\ {\rm 0.25} \\ {\rm 0.28} \\ {\rm 0.24} \\ {\rm 0.28} \\ {\rm 0.24} \\ {\rm 0.39} \\ {\rm 0.39} \\ {\rm 0.43} \\ {\rm 0.30} \\ {\rm 0.44} \\ {\rm 0.45} \\ {\rm 0.50} \\ {\rm 0.41} \\ {\rm 0.45} \\ {\rm 0.45} \\ {\rm 0.59} \\ {\rm 0.54} \\ {\rm 0.51} \\ {\rm 0.54} \\ {\rm 0.51} \\ {\rm 0.48} \\ {\rm 0.76} \\ {\rm 0.47} \\ {\rm 0.48} \\ {\rm 0.76} \\ {\rm 0.47} \\ {\rm 0.48} \\ {\rm 0.76} \\ {\rm 0.47} \\ {\rm 0.48} \\ {\rm 0.76} \\ {\rm 0.47} \\ {\rm 0.48} \\ {\rm 0.76} \\ {\rm 0.41} \\ {\rm 0.48} \\ {\rm 0.76} \\ {\rm 0.41} \\ {\rm 0.48} \\ {\rm 0.76} \\ {\rm 0.41} \\ {\rm 0.48} \\ {\rm 0.76} \\ {\rm 0.41} \\ {\rm 0$
miniYFJS01 miniYFJS02 miniYFJS03 miniYFJS05 miniYFJS06 miniYFJS06 miniYFJS09 miniYFJS09 miniYFJS09 miniYFJS10 miniYFJS10 miniYFJS11 miniYFJS13 miniYFJS13 miniYFJS15 miniYFJS16 miniYFJS16 miniYFJS17 miniYFJS19 miniYFJS20 miniYFJS20 miniYFJS22 miniYFJS22 miniYFJS24 miniYFJS24 miniYFJS26 miniYFJS26 miniYFJS28 miniYFJS28 miniYFJS28 miniYFJS28 miniYFJS28 miniYFJS28 miniYFJS20 miniYFJS28 miniYFJS28 miniYFJS28 miniYFJS28	$\begin{tabular}{ c c c c c }\hline \hline $C_{max}$\\\hline $31,008$\\ $22,010$\\ $38,935$\\ $23,774$\\ $22,843$\\ $27,366$\\ $38,932$\\ $29,464$\\ $37,465$\\ $25,072$\\ $36,307$\\ $26,072$\\ $36,307$\\ $26,219$\\ $25,067$\\ $29,442$\\ $37,465$\\ $25,067$\\ $29,207$\\ $27,023$\\ $32,166$\\ $28,985$\\ $35,441$\\ $27,023$\\ $32,166$\\ $28,985$\\ $35,441$\\ $32,166$\\ $28,985$\\ $35,441$\\ $30,428$\\ $32,826$\\ $29,848$\\ $30,644$\\ \end{tabular}$	time           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.01           0.02           0.01           0.02           0.02           0.02           0.02           0.02           0.02           0.02           0.02           0.02           0.03           0.04           0.05           0.06           0.07           0.08           0.09           0.01           0.02           0.03           0.04           0.05	$\begin{array}{r} \hline C_{\rm max} \\ \hline 31,008 \\ 22,010 \\ 38,935 \\ 23,774 \\ 22,843 \\ 27,366 \\ 33,932 \\ 29,464 \\ 33,763 \\ 25,072 \\ 36,307 \\ 26,219 \\ 25,619 \\ 27,428 \\ 38,256 \\ 29,442 \\ 37,465 \\ 25,067 \\ 29,207 \\ 27,021 \\ 32,166 \\ 28,985 \\ 35,441 \\ 27,023 \\ 32,346 \\ 43,452 \\ 31,571 \\ 30,428 \\ 32,826 \\ 29,848 \\ 30,648 \\ 30,648 \\ \end{array}$	time           0.00         0.02           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.00         0.00           0.01         0.01           0.02         0.03           0.02         0.03           0.04         0.03           0.05         0.05           0.01         0.05           0.05         0.01           0.01         0.05           0.02         0.03           0.05         0.01	$\begin{tabular}{ c c c c }\hline $C_{max}$\\\hline $31,008$\\ $22,010$\\ $38,932$\\ $23,774$\\ $22,843$\\ $27,366$\\ $38,932$\\ $29,464$\\ $33,763$\\ $25,072$\\ $36,307$\\ $26,072$\\ $36,307$\\ $26,671$\\ $25,619$\\ $27,428$\\ $38,256$\\ $29,442$\\ $37,465$\\ $25,067$\\ $29,207$\\ $27,291$\\ $32,238$\\ $28,985$\\ $35,441$\\ $27,395$\\ $32,346$\\ $43,452$\\ $31,571$\\ $30,428$\\ $32,826$\\ $29,848$\\ $30,67$\\ \hline \end{tabular}$	P=RN           time           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.01           0.00           0.01           0.00           0.01           0.00           0.00           0.01           0.00           0.00           0.01           0.00           0.01           0.00           0.01           0.02           0.03           0.04           1.67	$\begin{array}{c} & {\rm GRASI} \\ \hline C_{\rm max} \\ 31,008 \\ 22,010 \\ 38,935 \\ 22,010 \\ 38,935 \\ 22,843 \\ 27,366 \\ 38,932 \\ 29,464 \\ 33,763 \\ 25,072 \\ 36,307 \\ 26,219 \\ 25,619 \\ 25,619 \\ 25,619 \\ 27,428 \\ 38,256 \\ 29,442 \\ 37,465 \\ 43,452 \\ 32,166 \\ 28,985 \\ 32,465 \\ 43,452 \\ 32,465 \\ 43,452 \\ 31,571 \\ 30,428 \\ 32,826 \\ 29,848 \\ 30,64 \\ 30,6$	2-CN time 13.25 0.00 0.00 0.00 0.00 0.00 13.11 9.52 0.00 49.47 9.76 0.09 0.02 0.09 0.02 0.09 0.02 0.09 0.22 0.00 0.22 0.00 0.22 0.00 0.22 0.23 0.24 0.25 0.25 0.25 0.25 0.25 0.25 0.25 0.25 0.25 0.22 0.22 0.25 0.49 0.49 0.49 0.25 0.25 0.25 0.49 0.49 0.49 0.25 0.25 0.49 0.4	$\begin{tabular}{ c c c c }\hline $C_{max}$\\\hline $31,008$\\ $22,010$\\ $41,699$\\ $23,774$\\ $22,843$\\ $27,366$\\ $38,932$\\ $29,898$\\ $33,763$\\ $25,072$\\ $36,307$\\ $26,219$\\ $25,017$\\ $26,219$\\ $25,042$\\ $27,428$\\ $38,256$\\ $25,067$\\ $29,242$\\ $37,465$\\ $25,067$\\ $29,207$\\ $27,091$\\ $32,166$\\ $28,985$\\ $35,441$\\ $27,093$\\ $32,166$\\ $28,985$\\ $35,441$\\ $27,093$\\ $32,166$\\ $28,985$\\ $35,441$\\ $30,428$\\ $32,826$\\ $29,826$\\ $29,826$\\ $30,776$\\ \end{tabular}$	XN           time           0.00           0.01           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.00           0.01           0.02           0.00           0.01           0.02           0.00           0.04           0.04           0.04           0.04           0.04           0.02           0.00           0.01           0.02           0.00           0.01           0.02           0.01           0.02           0.04           3.90           4	Cmax           32,506           24,146           42,339           24,017           23,236           27,366           34,357           25,093           39,637           27,829           25,881           27,428           39,234           30,386           38,739           25,067           30,218           28,5901           31,200           32,513           44,633           31,877           30,428           33,455           31,093           31,700	time           0.00         0.00	$\frac{C_{\max}}{31,008}$ $\frac{31,008}{22,010}$ $\frac{38,935}{23,774}$ $\frac{22,843}{27,366}$ $\frac{22,9464}{33,763}$ $\frac{35,072}{26,219}$ $\frac{25,072}{26,219}$ $\frac{25,619}{27,428}$ $\frac{38,256}{25,067}$ $\frac{29,442}{27,023}$ $\frac{37,465}{25,067}$ $\frac{29,207}{27,091}$ $\frac{27,091}{32,166}$ $\frac{28,985}{35,441}$ $\frac{37,465}{43,452}$ $\frac{31,571}{30,428}$ $\frac{32,826}{29,848}$ $\frac{30,644}{30,644}$	$\begin{array}{c} \mbox{time} \\ 0.25 \\ 0.28 \\ 0.34 \\ 0.28 \\ 0.24 \\ 0.28 \\ 0.24 \\ 0.24 \\ 0.24 \\ 0.39 \\ 0.40 \\ 0.36 \\ 0.52 \\ 0.50 \\ 0.44 \\ 0.44 \\ 0.44 \\ 0.36 \\ 0.52 \\ 0.50 \\ 0.44 \\ 0.36 \\ 0.51 \\ 0.54 \\ 0.51 \\ 0.54 \\ 0.51 \\ 0.$

Table A3: Results of applying the metaheuristics to the small-sized instances with learning rate  $\alpha = 0.3$ .

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$ \begin{array}{                                    $	instance	$C_{\text{max}}$	Time	$C_{\text{max}}$	Time	$C_{\text{max}}$	Time	$C_{\text{max}}$	Time	$C_{\text{max}}$	Time	$C_{\text{max}}$	Time	Cmax	Time	$C_{\text{max}}$	Time
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	mfis01		0.01		0.00		0.50		0.02		0.00		0.00		0.25		0.01
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$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$																	
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	gap(70)	0.9	10	0.1	I	2.0	54	1.0		0.0	00	2.0	0	2.2	20	2.2	.2
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$		пς	BN	ПС	<u>'N</u>	CRAS	P-BN	CRAS	P-CN	דפו	BN	TS	'N	C.	1	CUNS	WAF
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$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	MIZ01																
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$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$				,				· ·									
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	1 1	· ·						· · ·		· · ·						· · ·	
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$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$																	
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$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	1 1							· · ·		· ·						· · ·	
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$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	#Dest				7												
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$																	
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	gap(70)	1.0	02	0.7	8	0.4	20	4.0	99	3.1	10	5.8	1	1.1	.9	0.4	4
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$		пе	DN	TIE	ON	CDAG	D DN	CDAG	D CN	TCI	DN	TC	<b>N</b>	C	<b>`</b>	CUNE	WAE
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$\left  \begin{array}{c} 0 \\ {\rm gap}(\%) \end{array} \right  = 0.00 = 0.00 = 0.00 = 0.00 = 0.64 = 2.56 = 0.00 = 0.00 = 0.00$																	
gap(%)         0.00         0.00         0.00         0.64         2.56         0.00         0.00	gap(%)	0.0	10	0.0	U	0.0	10	0.0	0	0.6	04	2.5	0	0.0	10	0.0	0

Table A4: Results of applying the metaheuristics and the method introduced in [44] to classical instances of the FJS with learning effect and without sequencing flexibility, with learning effect rate  $\alpha = 0.1$ .

	ILS-	RN	ILS-	CN	GRAS	P-RN	GRAS	P-CN	TS-I	RN	TS-C	N	S	4	GVNS	WAF
instance	Cmax	Time	Cmax	Time	Cmax	Time	Cmax	Time	Cmax	Time	Cmax	Time	Cmax	Time	Cmax	Time
mfjs01	43,208	0.01	43,208	0.01	43,208	2.14	43,208	1.04	43,208	0.01	44,880	0.00	43,208	0.33	43,208	0.01
mfjs02	41,273	0.01	41,273	0.01	41,273	5.09	41,273	0.00	41,200	0.01	45,208	0.00	41,273	0.30	41,273	47.06
mfjs03	43,412	0.11	43,412	0.12	43,412	0.31	43,412	0.16	43,412	0.05	43,412	0.00	43,412	0.39	43,412	4.23
mfjs04	47,717	2.80	47,717	0.90	49,024	78.72	49,024	0.19	47,717	0.74	47,717	0.09	49,921	0.50	47,717	1.16
mfjs05	45,670	0.13	45,670	0.06	45,670	0.09	45,670	0.04	45,670	0.18	45,670	0.00	45,670	0.44	45,670	1.88
mfjs06	56,743	3.25	56,743	6.66	56,743	135.74	57.005	281.92	57,093	4.14	57,889	0.00	57,055	178.01	56,743	3.24
mfjs07	73,865	11.61	73,865	6.71	75,640	262.56	74,821	50.66	73,865	0.60	77,533	0.01	74,646	70.58	73,865	0.73
mfjs08	74,561	165.80	74,359	246.39	76,148	275.69	76,815	3.04	75,880	7.06	78,362	0.17	75,032	1.54	75,032	269.43
mfjs09	88,457	180.68	87,676	9.06	92,100	219.33	90,970	63.40	89,991	137.38	90,853	0.54	87,676	57.99	91,006	7.48
mfjs10	97,980	129.30	97,929	206.55	100,069	164.40	102,337	214.69	97,780	90.39	98,459	0.31	98,058	158.98	99,630	38.54
$\bar{C}_{max}$	61,28	8.60	61,18	5.20	62,32	28.70	62,45	3.50	61,58	8.90	62,998	8.30	61,59	5.10	61,75	5.60
#best	7		9	)	5	i i	4		7		3		5		7	
gap(%)	0.1	.4	0.0	)2	1.4	49	1.6	52	0.5	53	3.0	1	0.7	74	0.6	66
$\overline{\mathrm{gap}}(\%)$	0.2	21	0.1	10	2.1	14	1.7	2	0.5	53	3.0	1	2.1	15	2.3	38
	ILS-	RN	ILS-	CN	GRAS	P-RN	GRAS	P-CN	TS-I	RN	TS-0	CN	S	Ą	GVNS	WAF
instance	Cmax	Time	Cmax	Time	Cmax	Time	Cmax	Time	C <sub>max</sub>	Time	Cmax	Time	Cmax	Time	Cmax	Time
MK01	3,041	65.31	3,041	85.94	3.047	64.27	3.048	141.02	3.052	8.72	3,179	0.01	3,041	26.52	3,201	0.72
MK01 MK02	2,118	28.65	2,118	37.89	2,120	92.83	2,129	97.06	2,118	6.64	2,134	0.13	2,118	8.97	2,129	9.10
MK03	14,781	2.17	14,781	0.33	14,781	1.71	14,781	0.16	14,781	2.68	14,908	0.09	14,781	3.08	14,781	2.68
MK04	4,483	53.69	4,483	94.48	4,484	184.38	4,484	192.52	4,738	9.04	4,983	0.03	4,483	5.74	4,853	1.24
MK05	10,885	160.49	10,892	266.12	10,945	189.24	10.894	220.20	10,875	61.39	10,902	3.61	10,818	272.66	10,940	210.49
MK06	4,377	149.74	4,243	83.62	4,499	266.52	4,592	58.84	4,958	30.18	4,255	20.77	4,134	289.16	4,591	32.71
MK07	9,469	222.13	9,393	23.84	9,642	153.59	9,728	87.87	9,427	21.45	9,857	0.14	9,393	22.45	9,531	20.83
MK08	29,784	217.05	29,758	98.74	30,184	181.23	29,841	159.05	30,962	4.87	31,816	0.20	29,868	242.44	29,895	290.79
MK09	20,641	295.19	20,359	206.55	21,454	148.53	21,176	13.41	23,186	55.94	23,806	0.52	20,435	127.97	20,939	284.25
MK10	13,648	275.95	13,694	185.13	15,879	145.53	15,179	81.71	14,079	231.51	13,770	16.78	14,246	217.07	14,974	145.47
MK11	35,747	185.40	35,680	212.31	36,110	49.28	36,238	181.46	36,093	1.58	35,813	16.15	35,756	25.72	35,893	284.24
MK12	31,539	218.99	31,512	181.46	31,654	169.42	31,592	258.89	32,605	2.07	33,358	0.23	31,625	11.56	31,586	144.52
MK13	26,428	290.21	26,238	292.55	28,472	129.83	27,598	58.96	25,764	197.92	26,690	8.26	26,471	45.26	27,285	122.26
MK14	39,864	299.22	39,829	148.40	40,464	277.76	40,047	263.88	41,968	7.49	43,123	0.23	40,030	70.85	39,891	222.06
MK15	23,815	300.52	23,442	141.00	24,740	285.86	24,859	46.53	23,472	146.44	25,612	0.71	23,862	148.48	24,466	245.22
$\bar{C}_{max}$	18,04		17,96		18,56		18,41		18,53		18,947	7.07	18,07		18,33	
#best	5		1		1		1		3		0		7		1	
gap(%)	0.8		0.3		3.6		3.1		3.8		5.2		0.7		3.4	
$\overline{\text{gap}}(\%)$	1.5	8	0.6	53	4.5	53	3.8	88	3.8	37	5.2	0	1.1	18	5.0	)3
:	ILS-	RN	ILS-	CN	GRAS	P-RN	GRAS	P-CN	TS-I	RN	TS-0	CN	S	4	GVNS	WAF
instance	$C_{\max}$	Time	$C_{\text{max}}$	Time	$C_{\max}$	Time	$C_{\text{max}}$	Time								
sfjs01	6,328	0.00	6,328	0.00	6,328	0.00	6,328	0.00	6,328	0.00	6,328	0.00	6,328	0.00	6,328	0.00
sfjs02	9,872	0.00	9,872	0.00	9,872	0.00	9,872	0.00	9,872	0.00	9,872	0.00	9,872	0.00	9,872	0.00
sfjs03	19,281	0.00	19,281	0.00	19,281	0.00	19,281	0.00	19,281	0.00	20,027	0.00	19,281	0.00	19,281	0.00
sfjs04	31,553	0.00	31,553	0.00	31,553	0.00	31,553	0.00	32,472	0.00	32,472	0.00	31,553	0.00	31,553	0.00
sfjs05	10,198	0.00	10,198	0.00	10,198	0.00	10,198	0.00	10,198	0.00	11,209	0.00	10,198	0.00	10,198	0.00
sfjs06	28,024	0.00	28,024	0.00	28,024	0.00	28,024	0.00	28,024	0.00	28,024	0.00	28,024	0.00	28,024	0.00
sfjs07	36,075	0.00	36,075	0.00	36,075	0.00	36,075	0.00	36,075	0.00	36,075	0.00	36,075	0.00	36,075	0.00
sfjs08	22,515	0.00	22,515	0.00	22,515	0.00	22,515	0.00	22,515	0.00	22,515	0.00	22,515	0.03	22,515	0.01
sfjs09	17,552	0.00	17,552	0.00	17,552	0.00	17,552	0.00	17,552	0.00	17,552	0.00	17,552	0.01	17,552	0.00
sfjs10	47,323	0.00	47,323	0.00	47,323	0.00	47,323	0.00	47,323	0.00	47,323	0.00	47,323	0.09	47,323	0.00
$\bar{C}_{max}$	22,87		22,87		22,87		22,87		22,96		23,139	9.70	22,87		22,87	
#best	10		10		1		10		9		7	_	10		10	
gap(%)	0.0		0.0		0.0		0.0		0.2		1.6		0.0		0.0	
$\overline{\text{gap}}(\%)$	0.0	0	0.0	0	0.0	00	0.0	0	0.2	29	1.6	7	0.0	0	0.0	0

Table A5: Results of applying the metaheuristics and the method introduced in [44] to classical instances of the FJS with learning effect and without sequencing flexibility, with learning effect rate  $\alpha = 0.2$ .

	ILS-	RN	ILS-	CN	GRAS	P-BN	GRAS	P-CN	TS-	RN	TS-0		SA	4	GVNS	WAF
instance	Cmax	Time	Cmax	Time	Cmax	Time	Cmax	Time	Cmax	Time	Cmax	Time	Cmax	Time	Cmax	Time
mfjs01	40,508	0.02	40.508	0.03	40,508	3.74	40,508	1.20	42.562	0.00	41,785	0.00	40,508	0.37	40.508	0.18
mfjs02	40,508 38,996	0.02	40,508 38,996	0.05	40,508 38,996	2.80	38,996	1.20	42,502 38,996	0.00	39,834	0.00	40,508 38,996	0.37	40,508 38,996	4.26
mfjs03	41,318	0.05	41,318	0.03 0.04	41,318	72.50	41,318	14.85	41,318	0.00	44,254	0.00	38,990 41,318	0.29	41,318	4.20 7.82
mfjs04	44,869	2.16	44,869	0.60	44,869	72.50	46,048	61.15	46.048	0.00	46,558	0.00	46,048	25.11	41,318	101.21
mfjs05	44,809	0.21	44,809	0.00	44,809	90.04	40,048	20.87	40,048 44,376	0.03	40,558	0.01	40,048 44,376	23.11 28.30	44,809 44,376	0.29
	53,618	2.31	· ·		,		53,760		<b>44,370</b> 53,760	0.39	57,329				· ·	184.69
mfjs06 mfjs07	69,086	2.31 9.26	$53,618 \\ 69,086$	$10.19 \\ 4.61$	53,760 70,577	84.79 192.72	70,523	$37.32 \\ 80.50$	<b>69,086</b>	12.88	57,329 74,941	$0.00 \\ 0.01$	$53,\!618$ $69,\!086$	184.69 0.84	<b>53,618</b> 70,583	0.02
mfjs08	68,053	9.20 152.28	68,053	4.01 188.36	71,413	4.05	70,323	154.93	69.845	12.88 12.97	70,333	0.01	68,362	11.09	<b>68,053</b>	74.29
mfjs09	79.947	3.22	80,277	249.67	83,975	92.83	82,272	203.95	80,983	27.37	81,939	0.20	80,897	1.69	81,411	40.30
mfjs10	89,188	3.22 217.74	88,515	195.67	91,930	$\frac{92.03}{114.34}$	91,477	158.34	89,644	41.99	90,178	1.03	90,419	7.67	90,144	117.97
	56,99		56,96		58,17		57,99		57,66		59,18		57,36		57,38	
#best	9		9		50,17		3		4		05,10	5.50	6		7	
gap(%)	0.0		0.0		1.0		1.5		1.3		4.0	1	0.6		0.5	
$\frac{\text{gap}(70)}{\text{gap}(\%)}$	0.2		0.1		2.0		1.9		1.3		4.0		1.8		2.6	
gap(70)	0.2	.1	0.1	.0	2.0	55	1.0	/1	1.0	)2	4.0	1	1.0	,,,	2.0	-1
instance	ILS-	RN	ILS-	CN	GRAS	P-RN	GRAS	P-CN	TS-	RN	TS-0	CN	SA	4	GVNS	WAF
Instance	$C_{\rm max}$	Time	$C_{\text{max}}$	Time	$C_{\max}$	Time	$C_{\text{max}}$	Time	$C_{\text{max}}$	Time	$C_{\text{max}}$	Time	$C_{\max}$	Time	$C_{\text{max}}$	Time
MK01	2,618	111.30	2,618	79.93	2,669	26.88	2,668	40.52	2,669	38.63	2,793	0.00	2,618	10.59	2,714	1.38
MK02	1,920	7.79	1,920	3.27	1,920	80.62	1,921	89.79	1,920	1.45	1,932	0.03	1,920	1.90	1,921	1.74
MK03	12,439	3.89	12,439	9.44	12,439	3.27	12,439	2.08	12,439	11.02	12,669	0.03	12,439	3.99	12,481	2.88
MK04	3,877	296.61	3,885	298.13	3,904	117.29	3,917	237.10	3,917	6.97	4,282	0.08	3,872	253.43	4,246	4.82
MK05	8,693	256.96	8,692	246.56	8,736	276.98	8,716	163.93	8,708	56.12	8,688	3.02	$^{8,678}$	63.11	$^{8,675}$	266.29
MK06	3,609	168.58	3,611	232.13	3,830	266.93	3,784	120.00	3,866	188.73	3,556	40.62	3,556	148.27	4,183	267.07
MK07	7,913	46.15	7,914	224.48	8,055	103.05	8,015	216.96	7,938	19.54	8,036	0.17	7,879	54.92	7,938	7.96
MK08	23,265	117.12	23,240	198.23	23,413	30.22	23,442	246.91	23,813	12.18	24,437	0.21	23,333	44.37	23,385	172.23
MK09	16,983	219.10	16,761	121.54	17,571	206.91	17,332	260.19	18,955	47.76	19,508	0.22	16,833	61.28	17,214	48.30
MK10	11,576	263.74	11,172	130.85	12,995	278.38	12,732	234.83	11,828	297.77	12,504	2.51	11,625	155.35	12,039	220.25
MK11 MK19	27,604 25,138	$208.94 \\ 187.88$	$27,542 \\ 25,097$	125.25	27,786 25,301	235.45	27,990 25,197	57.88 79.47	27,692 25,882	$\frac{81.59}{2.39}$	27,644 26,101	$10.97 \\ 0.28$	27,694 25,207	74.08	27,757	275.70 268.75
MK12 MK13	25,138	143.11	25,097 21,150	127.56 227.99	25,301 22,728	$30.19 \\ 141.57$	23,197	72.47 15.97	25,882 21,020	2.39 133.81	20,101	3.22	25,207 21,466	$44.11 \\ 47.61$	25,188 22,182	208.75 214.19
MK15 MK14	30,597	143.11 134.76	<b>30,550</b>	94.94	31,067	283.03	30,815	13.97 124.47	31,674	133.81 131.73	31,223	3.22 1.77	30,778	47.01 88.62	30.672	214.19 280.78
MK15	19.882	260.19	19,775	196.63	20,792	10.26	20,570	79.55	20,477	266.85	24,081	0.19	19,900	269.25	21,345	260.10 56.19
- C <sub>max</sub>	13,002		14,42		14,88		14,81		14,85		15,28		13,300		14,79	
#best	3		11,12		14,00		11,01		3		10,20	1.00	6		14,13	
gap(%)	0.7		0.2		3.4		2.9		3.0		5.8	2	0.6		3.8	
$\overline{\text{gap}}(\%)$	1.5		0.4		4.5		3.5		3.0		5.8		0.8		5.5	
	1						1						1			
instance	ILS-	RN	ILS-	CN	GRAS	P-RN	GRAS	P-CN	TS-	RN	TS-0	CN	SA	4	GVNS	WAF
mstance	$C_{\text{max}}$	Time	$C_{\max}$	Time	$C_{\text{max}}$	Time	C <sub>max</sub>	Time	$C_{\text{max}}$	Time	$C_{\text{max}}$	Time	$C_{\text{max}}$	Time	$C_{\text{max}}$	Time
sfjs01	6,206	0.00	6,206	0.00	6,206	0.00	6,206	0.00	6,206	0.00	6,206	0.00	6,206	0.00	6,206	0.00
sfjs02	9,498	0.00	9,498	0.00	9,498	0.00	9,498	0.00	9,498	0.00	9,498	0.00	9,498	0.00	9,498	0.00
sfjs03	18,062	0.00	18,062	0.00	18,062	0.00	18,062	0.00	18,062	0.00	18,062	0.00	18,062	0.00	18,062	0.00
sfjs04	29,852	0.00	29,852	0.00	29,852	0.00	29,852	0.00	30,648	0.00	30,648	0.00	29,852	0.00	29,852	0.00
sfjs05	9,465	0.00	9,465	0.00	9,465	0.00	9,465	0.00	9,465	0.00	10,288	0.00	9,465	0.00	9,465	0.00
sfjs06	26,281	0.00	26,281	0.00	26,281	0.00	26,281	0.00	26,281	0.00	26,281	0.00	26,281	0.00	26,281	0.00
sfjs07	34,443	0.00	34,443	0.00	34,443	0.00	34,443	0.00	34,443	0.00	34,443	0.00	34,443	0.00	34,443	0.00
sfjs08	21,309	0.00	21,309	0.00	21,309	0.00	21,309	0.00	21,715	0.00	21,309	0.00	21,309	0.02	21,309	0.00
sfjs09	15,973	0.00	15,973	0.00	15,973	0.00	15,973	0.00	15,973	0.00	15,973	0.00	15,973	0.01	15,973	0.00
sfjs10	45,450	0.00	45,450	0.00	45,450	0.00	45,450	0.00	45,450	0.00	45,450	0.00	45,450	0.01	45,450	0.00
C <sub>max</sub>	21,65 10		21,65 10		21,65		21,65 10		21,77		21,81	5.80	21,65 10		21,65 1(	
#best	0.0		0.0		0.0		0.0		0.4		1.1	4	0.0		0.0	
$\frac{\operatorname{gap}(\%)}{\operatorname{gap}(\%)}$	0.0		0.0		0.0		0.0		0.4		1.1		0.0		0.0	
gap(70)	0.0		0.0		0.0	.0	0.0		0.4	10	1.1	т	0.0		0.0	

Table A6: Results of applying the metaheuristics and the method introduced in [44] to classical instances of the FJS with learning effect and without sequencing flexibility, with learning effect rate  $\alpha = 0.3$ .