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Mixed integer programming formulations for the robust resource constrained project scheduling problem

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Abstract

This report investigates the impact of different formulations on the solution quality of the robust resource constrained project scheduling problem (RCPSP). A robust model is defined for the RCPSP under uncertainty. Different instances of the corresponding uncertainty set are solved optimally using a commercial solver and a priority based heuristic is employed to provide initial feasible solutions. Two different mixed-integer programming (MIP) formulations are then presented under the assumption of deterministic activity processing times. One separates the time horizon into discrete intervals and the other assumes a continuous horizon. Using a bilevel approach, the robust RCPSP is reformulated to each of these perfect-knowledge MIP formulations and then solved using a commercial solver. Computational experiments are conducted to compare the quality of the solutions obtained through the aforementioned approaches.

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Chapter 1

Introduction

The resource constrained project scheduling problem (RCPSP) considered in this report has been studied extensively in the literature due to the importance of scheduling decisions in project management. Several planning and scheduling problems can be formulated as the RCPSP making it a highly valuable research topic both for academic and industrial applications. The baseline form of the problem consists of scheduling a set of activities with deterministic, known in advance, processing times. Moreover, precedence constraints demand that each activity can only be processed after all of its predecessors have been completed. Activities consume resources from a pool of renewable and non-renewable resource types. Each resource type has a maximum availability which can not be exceeded at any given time. The aim is to minimize the total duration of the schedule, known as the makespan [7].

1.1 Motivation

The assumption that the processing times of activities are deterministic might not be realistic for complex projects. For example, in a construction project, poor weather conditions might delay excavation and foundation covering. In IT projects, delays are almost certain to arise as requirements are constantly reevaluated following the interaction between software developers and business users. To deal with that uncertainty, many different approaches have been proposed. The stochastic approach, and stochastic programming in general, assumes that uncertain problem parameters follow a known distribution. Under the stochastic approach only decisions that are absolutely necessary to kickstart the project are made in advance based on a confidence interval, and therefore with an unavoidable error. Remaining decisions are made as new information becomes available. Reactive scheduling aims at repairing existing partial schedules on-the-fly. We consider however dynamic resource reallocation to be an expensive and possibly infeasible process. Reactively transferring idle resources from a delayed project to another might cause excessive costs and further delays if done sub-optimally and requires an elaborate opportunity/cost analysis. We believe that a more intuitive approach is to create robust baseline schedules that can absorb as much delay as possible. This proactive approach considers the duration of the activities to lie somewhere in a given uncertainty set. Robust optimization then aims to find solutions that are robust for all scenarios that can arise from that uncertainty set [9]. Assuming that activities have a normal and a worst case duration, the aim is to construct a schedule that can mitigate the impact of delays. Robust models can be solved optimally for a specific instance of the uncertainty set which might however not be feasible compared to the true instance containing the actual project durations. A heuristic might be used in that case to right-shift the robust schedule and make it feasible once the actual processing times of the activities become known. Another approach is to use bilevel programming to separate the robust instance to several decision levels. The outer level might aim to minimize the project makespan and the inner level to identify a worst case scenario within the uncertainty set for that makespan. Each of these levels can be reformulated to a mixed integer linear programming instance and then solved optimally using a commercial solver.

1.2 Contribution

In this report we assume a conservative approach for the uncertain RCPSP as we aim to minimize the worst case makespan that can arise among all possible scenarios. For that purpose, we extend two well known formulations for the deterministic RCPSP and create two bilevel formulations for the uncertain counterpart. The aim is to create baseline schedules with a makespan that remains unaffected from possible activity execution delays, referred to as proactive or robust scheduling [21]. As we optimize for the worst case scenario under this conservative approach, the makespan of our baseline solution is immune to any duration deviations within the uncertainty set.

1.3 Report Structure

The remainder of this report is structured as follows. Initially an overview of the RCPSP is provided based on the conceptual formulation of Christofides et al. (1987) [1] along with a depiction of an RCPSP instance as a directed acyclic graph. In chapter 3, a literature review on different RCPSP formulations and solution approaches is provided along with an introduction to uncertainty and robustness. Chapter 4 describes the mixed-integer programming formulations that were chosen to model the RCPSP under the assumption of deterministic activity durations as well as the structure and operations performed in the preprocessing phase including the heuristics that produce the initial warm start solution. Chapter 5 extends the deterministic formulations and introduces two bilevel minimax models for the worst case scenario RCPSP. Chapter 6 provides an analysis of the computational results that were acquired by executing all of the aforementioned formulations on the PSPLIB test instances. Initially, the two deterministic models are compared and then the analysis focuses on the bilevel formulations and the effect that different inner models have on the overall robustness. This report concludes with an overview of the compared models and an evaluation of our findings.

Chapter 2

Problem Description

The resource-constrained project scheduling problem (RCPSP) consists of scheduling a set A={1,...,n} of activities that consume a constant amount of resources, subject to precedence constraints and limited resource availability. The objective is to minimise the overall project duration, known as the makespan [7]. A source activity 0 and a sink activity $n+1$ are used to represent the beginning and completion of the project respectively. These activities have zero processing time and no resource consumption. An RCPSP instance can be represented as a directed acyclic graph. An example with 6 activities and a single renewable resource is presented below.

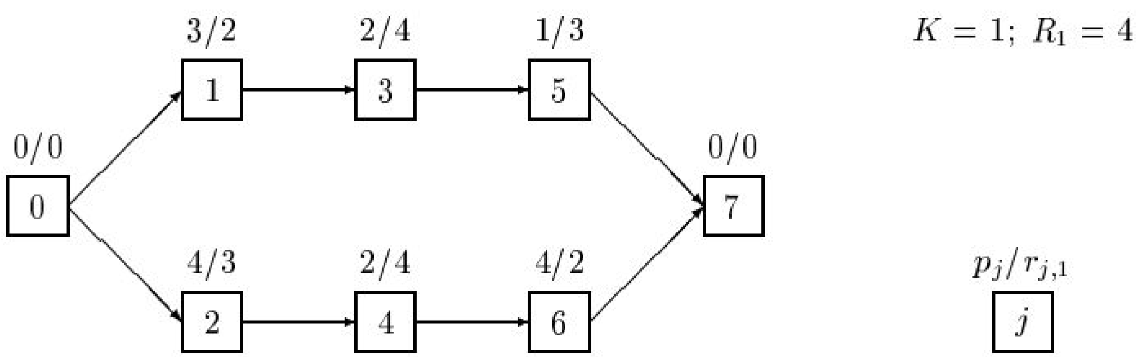

Figure 2.1: RCPSP instance as a directed acyclic graph

A conceptual, continuous-time formulation of the RCPSP as described by Christofides et al. (1987) [1]

$$
\begin{array}{llcll}
\text{minimize} & F_{n+1} & & & (1)\\
\text{subject to} & F_i & \leq & F_j - p_j, \quad i \in P_j,\ j \in A & (2)\\
& \sum_{j \in A_{(t)}} r_{j,k} & \leq & R_k, \quad k \in K,\ t \geq 0 & (3)\\
& F_j & \geq & 0, \quad j \in A & (4)
\end{array}
$$

Where F_j and p_j are the finishing and processing times of activity j, $r_{j,k}$ are the required resources of type k and R_k is the maximum available capacity of resource R. The objective (1) is to minimize the finishing time of the sink activity $n+1$. Constraints (2) enforce that an activity j may only start after its predecessors $h \in P_j$ have finished. Constraints (3) ensure that resource demands of all activities that are being processed at any given time t, do not exceed the available capacity. Finally, constraints (4) define the continuous finishing time decision variables. This formulation is conceptual because resource constraints (3) depend on the definition of function $A_{(t)}$ which calculates all activities that are being actively processed at time t. Therefore, it can't be modelled as a linear programming instance. Alternative linear programming formulations will be presented throughout this report.

Chapter 3

Literature Review

Due to its numerous and highly valuable practical and industrial applications, the resource constrained project scheduling problem has been extensively studied in the literature and many different formulations and solution approaches have been proposed.

The RCPSP is often formulated as a Binary Integer Programming (BIP) or a Mixed Integer Linear Programming (MILP) model and based on the execution scheduling horizon that they define, RCPSP models could be classified into Discrete-Time (DT) and Continuous-Time (CT) [3]. The first DT BIP formulation for the RCPSP was introduced by Pritsker et al. (1969) [8] who based their formulation on binary decision variables x_{jt} that denote whether activity j is completed at time t. Kopanos et al. (2014) [3] proposed a CT MIP formulation that introduces binary decision variables for the relative execution sequence of activities, and continuous decision variables to mark the start and finish times of activities within the horizon. Mingozzi et al. (1998) [2] defined the concept of feasible subsets as sets of activities that can be concurrently executed as they do not exceed resource availability quotas and satisfy precedence relationships. They then proposed a DT BIP formulation that utilizes binary decision variables to represent feasible subset membership of activities currently in progress. Other formulation approaches for the RCPSP include flow formulations that define continuous flow variables f_{ijk} to model the amount of resource type k transferred from activity i to activity j and event approaches that are based on binary decision variables z_{ie} which indicate if activity i starts at a time event e of the horizon [19]. A detailed survey of the deterministic RCPSP can be found in [24].

Realizing the inherent uncertainty of scheduling problems, the research community has been increasingly focusing on developing models that incorporate uncertainty factors into scheduling decisions. In that context, a prevalent concept is that of the uncertainty set defined as the set of all scenarios that can arise in an uncertain optimization problem. Finding a solution that is feasible for all scenarios of the uncertainty set is referred to as robust optimization by Goerigk et al. (2016) [17] who provide an elaborate analysis of different uncertainty set structures mainly based on their convexity. Identifying solutions that are feasible for the entirety of the uncertainty set is a conservative approach because some scenarios might be very unlikely to occur. In that spectre, Betsimas et al. (2004) [13] introduced the concept of budgeted uncertainty where the decision maker can adjust the uncertainty set depending on the level of risk that she is willing to undertake. Bold et al. (2020) [9] structured the robust RCPCP as a bi-stage decision process where resource allocation takes place initially and activity processing times are decided once activity durations become known (i.e. for a specific realization of the uncertainty set). An example of such a bi-stage process is based on the concept of forbidden sets which are defined as sets of activities that cannot be executed concurrently due to resource constraint violations. Bartusch et al. (1988) [22] claimed that an RCPSP solution can be reduced to extending the activity precedence graph with extra edges such that all forbidden sets are abolished and the resulting graph is acyclic. The optimal set of extra precedences is called a sufficient selection. Based on that remark, Bruni et al. (2018) [16] defined the two-stage adjustable RCPSP (TSRCPSP) with the objective to identify a sufficient selection that minimizes the worst case makespan that can arise from the uncertainty set. To solve TSRCPSP they proposed a Benders' decomposition approach which decomposes the TSRCPSP into a sufficient selection master problem and a longest path calculation subproblem. Solutions of the inner problem provide valid cuts that are added to the master problem. This procedure is iteratively executed until the lower and upper bounds in the master problem converge. In this report we assume a bilevel approach for the budgeted robust RCPSP but instead of computing sufficient selections, we optimize every RCPSP subproblem that arises from an uncertainty budget allocation in the outer level.

Many different solution approaches have been proposed for the RCPSP and its variants. Most exact solution approaches are branch and bound based and with the vast improvement of commercial solvers, combined with the recent rise of computational power exact methods are a viable solution for small RCPSP instances. In this report we utilize the IBM ILOG CPLEX (https://www.ibm.com/products/ilog-cplex-optimization-studio) solver that follows a branch and bound approach to solve mixed integer linear programming instances. A thorough survey on exact RCPSP solution approaches can be found in [26]. Nevertheless, the RCPSP is strongly NP hard as shown in Blazewicz et al. (1983) [12], and therefore exact methods are not effective for instances of increasing size. This has guided the interest of the research community towards heuristic and metaheuristic solution methods. Al-Fawzan et.al (2004) [4] proposed a multi objective tabu search algorithm (MOTS) for the robust RCPSP that minimizes the makespan whilst maximizing the total free slack. Mogaadi et al. (2016) [27] designed a Greedy Randomized Adaptive Search Procedure (GRASP) that generates an initial schedule and then performs local search to iteratively improve the robustness of the solution. An overview of heuristic and metaheuristic approaches for the RCPSP is presented by Kolisch R., Hartmann S. (1999) [7].

Chapter 4

Deterministic Formulations

Two mixed integer programming formulations are used to model the RCPSP under a perfect-knowledge assumption. The first model divides the time horizon into discrete, predefined intervals and defines binary variables that indicate whether an activity commences at a specific time period of the horizon. The second model is defined over a continuous horizon and contains continuous variables that mark the start and finish times of activities. An initial solution is obtained using a single pass heuristic that consists of a serial schedule generation scheme and a priority rule. The makespan obtained by the SGS is used an upper bound for the duration of the project. Activity execution time windows are determined in the preprocessing phase and are used to reduce the total number of decision variables and constraints.

4.1 Preprocessing Phase

The preprocessing phase lies between formulation and solution and entails performing certain operations with the aim of constructing a more compact and efficient model. Efficient formulations are particularly important for integer programming models as indicated by Nemhauser and Wolsey (1988) [11]. For RCPSP instances, the preprocessing phase is used to determine the horizon duration as well as the earliest and latest start and finish times of activities. These can be used to define tighter time windows for all activities thus reducing the total amount of variables and constraints of the resulting LP instance. In this report a forward recursion is initially performed to calculate the earliest start and finish times. Then using the sum of activity processing times as an initial, albeit naive upper bound, a backward recursion is initiated from the sink activity to calculate the latest start and finish times of all activities in accordance with Elmaghraby, S. E. (1977) [5]. These latest times are given as input to the serial schedule generation scheme presented in the next section (4.2).

4.2 Initial Solution

Using the latest times calculated in the preprocessing backwards recursion, an initial feasible but suboptimal solution is constructed with a serial schedule generation scheme (Serial - SGS) as presented by Hartmann, S., and R. Kolisch (1998) [7]. This greedy heuristic starts with an empty schedule and iteratively adds activities that satisfy both precedence and resource constraints. The serial schedule generation scheme performs activity incrementation. That is, on each iteration it selects an eligible activity (i.e. one that satisfies all constraints according to the partial schedule) and schedules it on the earliest feasible time point. For that purpose two sets are maintained at every iteration g. Set S_g contains activities that have already been added to the partial schedule. Set D_g holds activities eligible for scheduling at iteration g. Activities in D_g are ranked according to a selected priority rule and an activity j is selected on top of the ranking. A performance analysis of several priority rules can be found in section 6.5. The algorithm terminates after $g = n$ iterations when either all activities have been scheduled or a feasible schedule could not be constructed. The steps of the serial SGS are described in the following pseudocode.

Algorithm 1 Serial Schedule Generation Scheme

Inputs: n, p, P, r, R, LF
Output: F
Initialize: $F, EF = \{\}$, $F_0 = 0, S_0 = 0$

for $g = 1$ *to* n **do**
  $D_g = \{j \in n \mid j \notin S_g, P_j \subset S_g\}$ ▷ Get the activities that are eligible for scheduling
  $j = PR(D_g)$ ▷ Select activity j from eligible set based on the priority rule
  $EF_j = max_{i \in P_j}\{F_i\} + p_j$ ▷ Calculate earliest finish time for j based on predecessors
  $elst = [\,]$
  for $t \in [EF_j - p_j, LF - p_j] \cap F$ **do** ▷ Iterate time window of j and avoid slack times
    for $\tau \in [t, t + p_j]$ **do** ▷ Interval that j will be active if scheduled on t
      $A(\tau) = \{s \in S_g \mid F_s > \tau,\ F_s - p_s \leq \tau\}$ ▷ Get active jobs at time τ
      if $r_{i,k} + \sum_{i \in A(\tau)} r_{i,k} \leq R_k,\ \forall k \in R$ **then** ▷ Check resource requirements at time τ
        elst.append(t) ▷ Add t to list of eligible scheduling times
      end if
      $F_j = min\{elst\} + p_j$ ▷ Schedule at earliest possible, eligible time
      $S_g = S_{g-1} \cup j$ ▷ Add j to the list of scheduled activities
    end for
  end for
end for

SGS will provide an initial feasible solution and the finish time of the last activity will be used as an upper bound to warm-start the branch and bound based, commercial solver. The solver will then attempt to optimally solve the two MILP formulations that are presented in the next sections.

4.3 Discrete Time Formulation

The implemented discrete time model, is based on the formulation given by Mingozzi et al. (1998) [2]. This is a binary integer programming (BIP) model that divides the time horizon of the schedule into discrete time intervals and defines binary decision variables x_{jt} that denote whether activity j is initiated at time t (assuming that period t refers to the time window $[t,\, t+1)$).

$$\begin{array}{llcll}
\text{minimize} & \displaystyle\sum_{t=es_{n+1}}^{ls_{n+1}} t \cdot x_{n+1,t} & & & (5)\\
\text{subject to} & \displaystyle\sum_{t=es_i}^{ls_i} t \cdot x_{i,t} + p_i & \leq & \displaystyle\sum_{t=es_j}^{ls_j} t \cdot x_{j,t}, \quad i \in P_j,\ j \in A\backslash\{0\} & (6)\\
& \displaystyle\sum_{j\in A} r_{j,k} \cdot \sum_{\tau=\max(0,\, t-p_j+1)}^{t} x_{j,\tau} & \leq & R_k, \qquad k \in K & (7)\\
& \displaystyle\sum_{t=es_j}^{ls_j} x_{j,t} & = & 1, \qquad j \in A & (8)
\end{array}$$

$$t = \{0, \ldots, T_{max}\};\ K = \{1, \ldots, R\};\ A = \{0, \ldots, n+1\};\ x_{jt} \in \{0, 1\}$$

The objective is to minimize the finishing time of the sink activity $n+1$ and is defined in equation (5). Precedence constraints (6) define that activity j may only start after its predecessors $i \in P_j$ have been completed. The finish time of each predecessor i is equal to its starting time $t \cdot x_{i,t}$ plus its processing time p_i. Constraints (7) handle the availability of every resource $k \in K$ at any given time point t of the horizon. An activity $j \in A$ is active (i.e. consumes resources) at time t if $x_{j,\tau} = 1$ for any time $\tau \in [t - p_j + 1, t]$. Non preemptive execution is handled by constraints (8) which force that an activity j may only start once within its corresponding execution time window $[es_j, ls_j]$. The time horizon spans from point 0 to an upper bound T_{max} which is obtained through the serial generation scheme defined in section 4.2. Sets K and A define the resource types and activities respectively.

4.4 Continuous Time Formulation

The continuous-time MIP model presented in this report is based on the formulation introduced by G. Kopanos et al. (2014) [3]. Continuous variables s_j and f_j define the start and finish times of every activity $j \in A$ respectively.

A forbidden set $F \subset A$ is a set of activities without precedence constraints that cannot be executed in parallel because there exists one resource k such that $\sum_{j \in F} r_{j,k} > R_k$ [16]. The formulation defines binary decision variables x_{ij} that represent the relative execution sequence of activities. For activities that belong to a forbidden set, $x_{ij} = 1$ if $f_i \leq s_j$. On the other hand, for activities than could be executed in parallel $x_{ij} = 1$ if $s_i \leq s_j$. The formulation also introduces binary variables z_{ij} which are used to define overlapping activities. Activity i overlaps activity j if $s_i < s_j$ and $f_i > s_j$. If both conditions hold, then $z_{ij} = 1$. Different constraints are defined based on whether the activities can overlap or not according to their precedence requirements and resource consumption. G. Kopanos et al. [3] base the definition of their model on specific activity sets that are constructed in the preprocessing phase. The sets are outlined below.

Set	Description
A	Set of all n activities. Does not include dummy source and sink activities
B	Activities sharing at least one resource
C	Transitive closure of precedence relationships
D	Pairs of activities (i, j) $\notin C$ with $LF_i \leq ES_j$
G	Activities that cannot be executed in parallel due to resource violations.
K	Activities in $C \cup D$ and their symmetrical. These are activities with known precedence constraints.
S	Activities in $G \cap K$. Activities in this set cannot overlap.
P	Activities in $B \backslash (G \cup K)$ that can be executed in parallel.

Table 4.1: Continuous formulation custom activity sets

Based on the aforementioned sets, the following continuous-time MIP formulation is provided for the RCPSP.

$$\text{minimize} \quad f_{n+1} \tag{9}$$

$$\text{subject to} \quad f_i = s_i + p_i \qquad \forall i \in A \cup \{n+1\} \tag{10}$$

$$f_i \leq s_j \qquad \forall (i,j) \in (A \times (A \cup \{n+1\})) \mid (i,j) \in K \tag{11}$$

$$x_{ij} + x_{ji} = 1 \qquad \forall (i,j) \in A^2 \mid (i,j) \notin K,\ i > j \tag{12}$$

$$f_i \leq s_j + (LF_i - ES_j) \cdot x_{ji} \qquad \forall (i,j) \in S \mid i \neq j \tag{13}$$

$$
\begin{aligned}
&s_j \leq s_i + (LS_j - ES_i) \cdot x_{ij} && \forall (i,j) \in P \mid i > j && (14)\\
&s_i + \lambda \leq s_j + (LS_i - ES_j + \lambda) \cdot x_{ji} && \forall (i,j) \in P \mid i > j && (15)\\
&f_i - s_j \leq +(LF_i - ES_j) \cdot z_{ik} && \forall (i,j) \in P \mid i \neq j && (16)\\
&r_{ik} + \sum_{(i,j)\in P} r_{j,k} \cdot (z_{ji} - x_{ij}) \leq R_k && \forall i \in A, k \in K \mid r_{ik} > 0 && (17)\\
&x_{ji} \leq z_{ji} && \forall (i,j) \in P \mid i \neq j && (18)\\
&x_{ji} = 1 && \forall (i,j) \in P \mid i \neq j,\ LS_j \leq ES_i && (19)
\end{aligned}
$$

$$
A = \{1, \ldots, n\};\ s_i \geq 0,\ f_i \geq 0;\ x_{ij} \in \{0,1\};\ z_{ij} \in \{0,1\}
$$

The objective of the model is to minimize the finish time of the last activity and is given in (9). The start and finish times of all activities are correlated in constraints (10). Constraints (11) define the execution sequence of all activities with known precedence requirements (i.e. $(i,j) \in k$) by requiring that activity j can only start after its predecessor i has finished. Execution cycles for activities without hard precedence constraints are avoided through constraints (12).

Constraints (13) define precedence for activities that cannot overlap. If i is scheduled before j ($x_{ij} = 1 \implies x_{ji} = 0$) then i must finish before j starts, expressed as $f_i \leq s_j$, because there are not enough resources for them to overlap. If j is scheduled before i ($x_{ji} = 1$) then the inequality $f_i - s_j \leq LF_i - ES_j$ always holds and the constraint is satisfied. Constraints (14, 15) define precedence for activities that can overlap. If i is scheduled before j ($x_{ij} = 1 \implies x_{ji} = 0$) then i must start before j starts, expressed as $s_i \leq s_j$. If j is scheduled before i ($x_{ji} = 1$) then the inequality $s_i - s_j \leq LS_i - ES_j$ always holds and the constraint is satisfied.

Overlapping decision variables are defined through constraints (16). If $z_{ij} = 0$ then i and j are not overlapping meaning that i must finish before j starts, expressed as $f_i \leq s_j$. Resource availabilities are handled in constraints (17). For each activity $i \in A$ the amount of every resource $k \in R$ consumed by all overlapping activities $j \mid (i,j) \in P$ is capped by the maximum availability R_k of that resource. Constraints (18, 19) tighten decision variables.

Chapter 5

Robust Formulations

In the previous chapter a solution approach was presented for the deterministic RCPSP. The problem was represented through two different MIP formulations and solved to optimallity using a commercial solver. However the perfect knowledge assumption is hardly realistic for real life projects. For example, in the construction sector, poor weather conditions might delay excavation and foundation covering [25].

Instead of deterministic activity durations we now thus consider interval uncertainty meaning that durations lie within an uncertainty set [13]. Activities have a nominal duration θ and a worst case deviation denoted as $\hat{\theta}$. We also consider budgeted uncertainty [13] by introducing an uncertainty budget factor Γ that controls the number of activities that can simultaneously attain their worst case durations. The decision maker can adjust the budget of uncertainty depending on the level of risk that she is willing to undertake. If Γ is set to 0 then the formulation is reduced to the deterministic RCPSP. The uncertainty set can be represented as follows.

$$U = \{\theta_i \mid \theta_i = \bar{\theta}_i + \delta_i \cdot \hat{\theta}_i,\ 0 \leq \delta_i \leq 1,\ \sum_{i \in A} \delta_i \leq \Gamma\}$$

In this section we introduce two bilevel formulations for the RCPSP that extend the two corresponding deterministic formulations presented in sections 4.3 and 4.4. These are minimax formulations that aim to minimize the worst case makespan. For both bilevel formulations, the outer decision level (master problem) can be considered as an adversarial problem, where the adversary tries to distribute Γ units of delay with the aim to maximize the minimum makespan amongst all realizations. The outer level continuous decision variables $\delta_i,\ 0 \leq \delta_i \leq 1$ indicate the deviation of the duration of the corresponding activity from its nominal value. The inner level problems are extensions of their deterministic counterparts and the objective is to find the minimum makespan for every realization of the uncertainty set.

The master problem can be represented with the following formulation.

$$
\begin{aligned}
\text{maximize} \quad & min\ f_{n+1} && (20)\\
\text{subject to} \quad & 0 \leq \delta_i \leq 1 \quad \forall i \in A && (21)\\
& \sum_{i \in A} \delta_i = \Gamma && (22)
\end{aligned}
$$

For the continuous sub-problem, decision variables are the continuous activity start and finish times presented in formulation 4.4. The subproblem consists of constraints (9) and (11 - 19). Since the durations are now uncertain, constraint (10) needs to be redefined with the δ variables of the master problem taken into account. The new start-finish correlation constraint is written as,

$$f_i = s_i + (\bar{\theta}_i + \delta_i \cdot \hat{\theta}_i) \quad \forall i \in A \cup \{n+1\} \qquad (23)$$

The discrete sub-problem reuses the binary variables x_{jt} that indicate if activity j begins processing at time t. It consists of constraints (5) and (8) presented in section 4.3. Under duration uncertainty, precedence constraints (6) and resource constraints (7) need to be redefined with the δ variables of the master problem taken into account. The new constraints can be written as,

$$
\begin{aligned}
\sum_{t=es_i}^{ls_i} t \cdot x_{i,t} + (\bar{\theta}_i + \delta_i \cdot \hat{\theta}_i) \quad & \leq \sum_{t=es_j}^{ls_j} t \cdot x_{j,t}, \quad i \in P_j,\ j \in A \backslash \{0\} && (24)\\
\sum_{j \in A} r_{j,k} \cdot \sum_{\tau=\max(0,\ t-(\bar{\theta}_i+\delta_i \cdot \hat{\theta}_i)+1)}^{t} x_{j,\tau} \quad & \leq R_k, \qquad k \in K && (25)
\end{aligned}
$$

All set and variable definitions are as described in section 4.3.

The capabilities of the mixed integer programming commercial solver that was leveraged to solve the deterministic RCPSP formulations, are not suitable for the bilevel minimax formulations. In order to use CPLEX for the bilevel instances, they must first undergo a series of model transformations using duality and constraint linearization. The pyomo.bilevel package includes the bilevel linear duality metasolver, that performs the required model transformations before invoking CPLEX. As the uncertainty set is a polytope and the minimax problem is convex, we can invoke a strong duality relationship [14]. The objective function (20) can then be rewritten as follows.

$$\text{maximize} \quad \sum (\bar{\theta}_i + \delta_i \cdot \hat{\theta}_i) a_{ij} \quad \forall (i,j) \in (A \times (A \cup \{n+1\})) \mid (i,j) \in K \qquad (26)$$

Where binary variables a_{ij} represent the duality multipliers. Finding the optimal multipliers in the best case dual problem is the same as optimizing the worst case primal [15]. Bilinear terms $\theta_i \cdot a_{ij}$ can be linearized using big-M transformations. This is handled internally by the gdp.bigm transformation package of the bilevel linear duality metasolver that comes with the pyomo bilevel module. It is worth noting that the quality of the transformed model is strongly dependent on the big-M values used in the bilinearization transformations. Several experiments were performed and the optimal value was determined as the makespan of the warm-start solution computed in the preprocessing step described below. The pyomo bilevel documentation can be found in this link (pyomo bilevel docs)

An upper cut can be provided to the inner minimization problem by calculating an initial feasible solution with the serial SGS presented in section 4.2. However, the activity durations are now uncertain meaning that valid time windows can only be obtained from extreme scenarios. A lower bound for the earliest start and finish times is computed with a best-case forward recursion. Initial latest start and finish times are then calculated using the worst case durations and then tightened with the serial SGS. This warm start procedure produces time windows that are feasible for any duration vector corresponding to a realization of the uncertainty set.

Chapter 6

Computational Analysis

All formulations presented throughout this report were tested against the PSPLIB instances (http://www.om-db.wi.tum.de/psplib/) which are the most broadly used problem instances for the RCPSP. This chapter initially provides an overview of the PSPLIB instances, analyzing their size, parameters and relative difficulty. It then proceeds with a comparison of the two deterministic formulations in terms of performance, execution time as well as the number of constraints and decision variables created. Following the comparison of the deterministic models, the two bilevel robust formulations are compared. The most important and insightful metric in this case is the worst case absolute regret defined as the objective function difference between the robust solution and the best solution that would have been possible in a scenario realization [17]. A solution quality comparison of three different priority rules used as part of the serial schedule generation scheme presented in section 4.2 is also provided. The chapter concludes with an analysis of the aforementioned results.

6.1 PSPLIB Test Instances

The project scheduling project library (PSPLIB) created by Kolisch and Sprecher [18] has become the most commonly used collection of benchmark instances in the RCPSP research bibliography. It consists of four data sets namely j30, j60, j90 and j120. Each of these sets contains 480 instances with the corresponding number of activities and four non-renewable resources. The difficulty of the instances essentially depends on the following parameters, as defined in [18]

- Network Complexity (NC). Defined as the average number of non-redundant arcs per node including the dummy activities.
- Resource Factor (RF). Measuring the average amount of resources consumed by the activities of the instance. A larger RF means that activities require all types of resources.
- Resource Strength (RS). Which considers concurrent peak resource usage and is a measure of resource conflicts within the instance. If the RS is 0 at least one of the activities uses all the amount available of a resource. On the other hand, a RS equal to 1 means that the instance is trivial [16].

6.2 Methodology

The instances were transformed from the default SM format of the ProGen generator to JSON which is natively supported by the dataloader class used to instantiate the models created in the pyomo optimization modeling library (http://www.pyomo.org). All models have been designed and implemented in pyomo as abstract, meaning that they are not bound to any specific data and instead require the dataloader to concretise them. The SM files capture activity precedence relationships using a successor format. We found that a predecessor list is more intuitive and reversed the successor list using backwards recursion. For every formulation we implement a pyomo abstract model and a corresponding solver class that instantiates the model, runs the preprocessing phase described in section 4.1 and invokes CPLEX using the SolverFactory wrapper.

To measure the regret for the minimax bilevel models, we have perturbed the original instances by randomizing the activity durations in a $[\frac{\theta}{2},\ \frac{3\theta}{2}]$ interval where θ is the nominal duration of the activities as discussed in chapter 5. For each of the deterministic instances, we have produced robust schedules using values for the budgeted uncertainty factor Γ in the interval $[\frac{n}{2},\ n]$ where n is the number of non dummy activities in the instance. A time limit of 20 minutes has been imposed to the commercial solver both for the single-objective deterministic formulations and for the bilevel ones. All test instance results are stored by the commercial solver in JSON format. A custom script is used to gather and summarize the results in CSV files that are then passed to Tableau which is the tool used to create the visualizations. All computational experiments were done on an Apple M1 processor with 16GB of ram)

6.3 Deterministic Formulation Comparison

In this section we present the test instance results for the two perfect-knowledge formulations. We initially perform a comparison of the average running times per instance set as well as the best objective value (minimum makespan) attained by the two models. We also showcase the percentage of instances that were solved to optimality. We then perform a fractional relaxation of all binary decision variables and compare the solution quality of the relaxed models. The amount of constraints and variables produced by the models is also plotted and a trend line is derived for all instances.

6.3.1 Execution time comparison

Figure 6.1 depicts the average execution time (measured in seconds) required by the solver of each formulation to find the optimal solution on the instances of the j30 instance set. As evident by the consistently higher discrete execution curve, the discrete time BIP formulation seems to be outperformed by the continuous MIP formulation on these smaller instances. Most notably, there are several instance groups such as j3029 and j3045 where only the continuous model managed to produce a feasible solution in the specified 20 minute execution period. Both models timed out on the instances of the j3013 group which is the hardest within the j30 set. On larger instances however, the discrete model is clearly superior even achieving sub second optimal results on instances where the continuous formulation fails to produce a solution whatsoever. This is evident in the instance groups of the j60 instance set presented in figure 6.2 and especially on groups j606 and j6046.

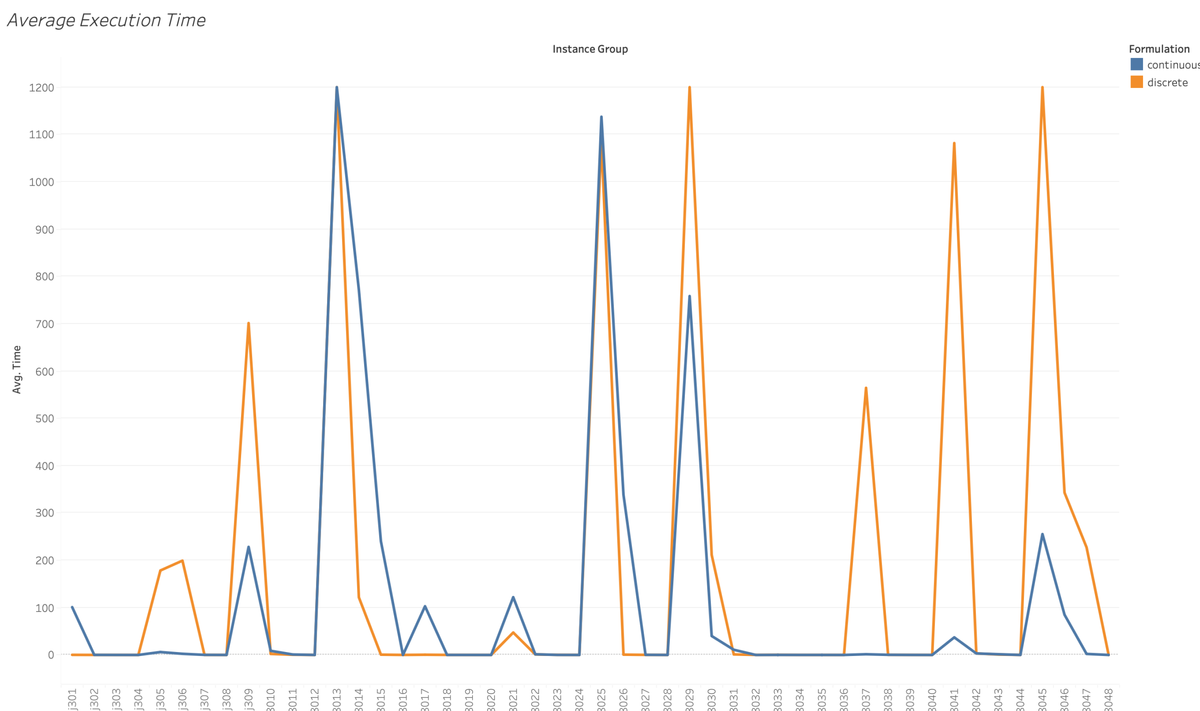

Figure 6.1: Average execution time on j30 instances

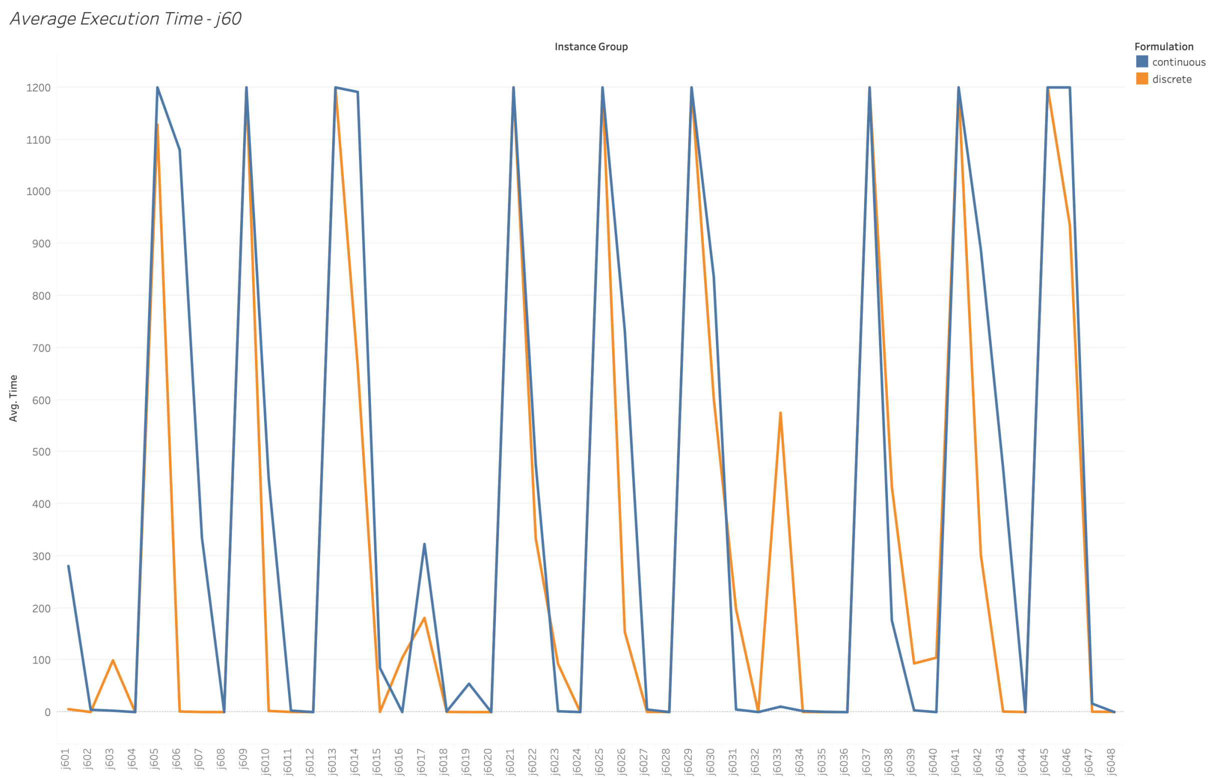

Figure 6.2: Average execution time on j60 instances

6.3.2 Number of constraints and decision variables

The average number of constraints and decision variables created by the CPLEX solver for each of the two formulations is displayed in figure 6.3. On the j30 instance set, the continuous formulation produced a larger number of constraints but a substantially smaller number of decision variables than the discrete counterpart. This seems to explain the larger average execution times required by the solver of the discrete model to reach optimality, as the number of decision variables increases the possible branching decisions at each step of the branch and bound algorithm.

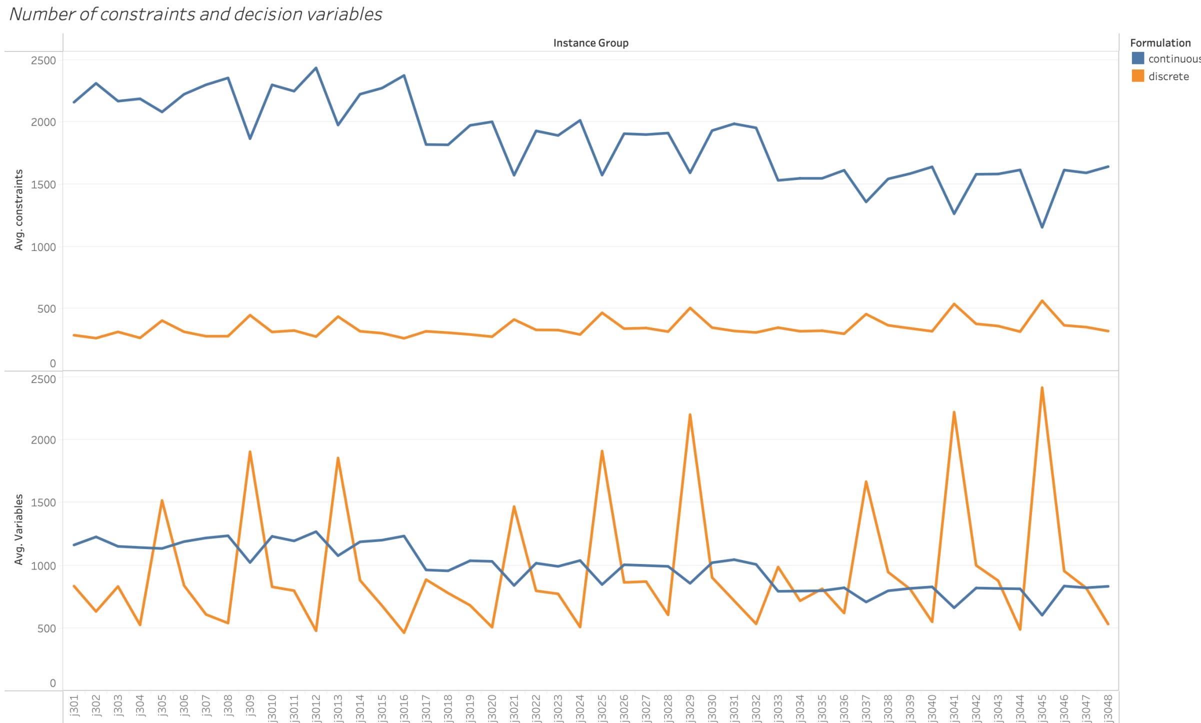

Figure 6.3: Number of constraints and decision variables on j30 instances

On the instances of the j60 set however, the number of sequencing decision variables x_{ij} and overlapping decision variables z_{ij} produced by the continuous formulation increases dramatically as evident in the lower part of figure 6.4. Generally, increasing the number of activities entails an exponential increase of decision variables in the continuous model. On the other hand, we observe in accordance with Kopanos et al. [3], that the computational performance of the discrete formulation is affected less due to the fact that the number of decision variables primarily depends on the number of time points considered. The upper part of figure 6.4 presents an analogous trend regarding the number of created constraints with the discrete model scaling much better than the continuous counterpart.

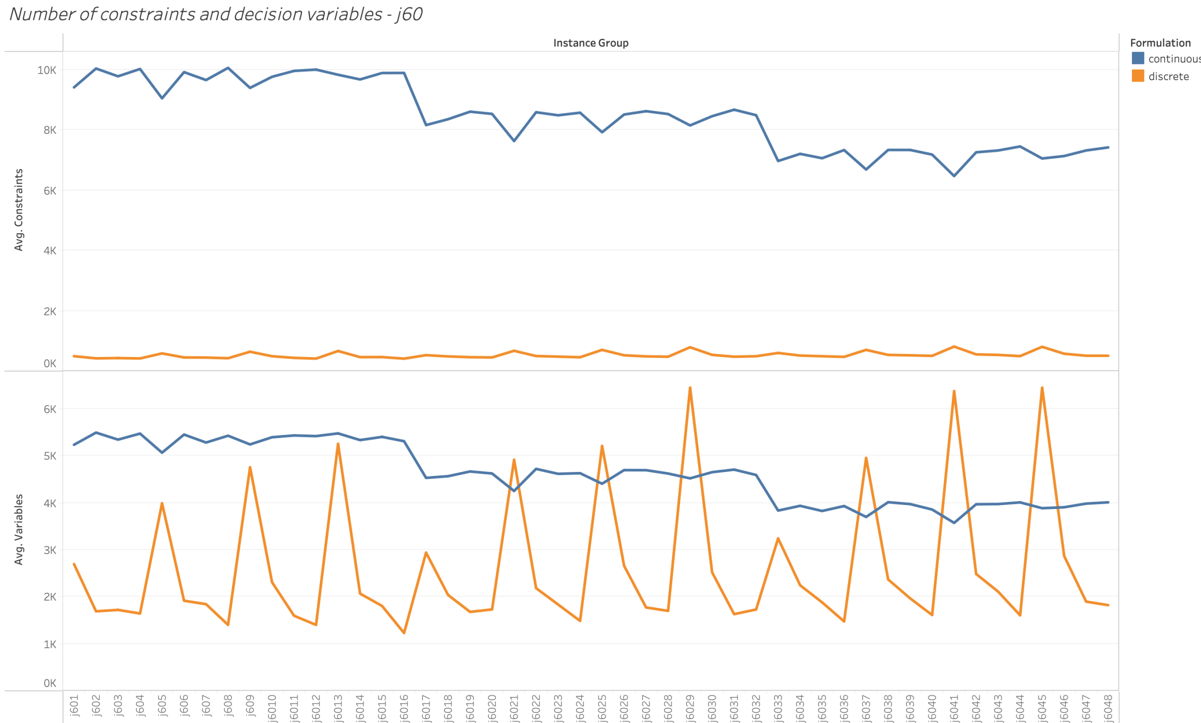

Figure 6.4: Number of constraints and decision variables on j60 instances

6.3.3 Objective value and optimality

We now compare the objective value (i.e. minimum makespan) calculated by the solver for each of the two deterministic formulations. Figure 6.5 presents the percentage of instances within the j30 set that were solved to optimality within the specified 20 minute period. Optimal solutions for the PSPLIB instances are published in (http://www.om-db.wi.tum.de/psplib/getdata_sm.html). The continuous model is superior on this smaller instance set with 93.5% of instances solved optimally as opposed to 87.9% for the discrete model.

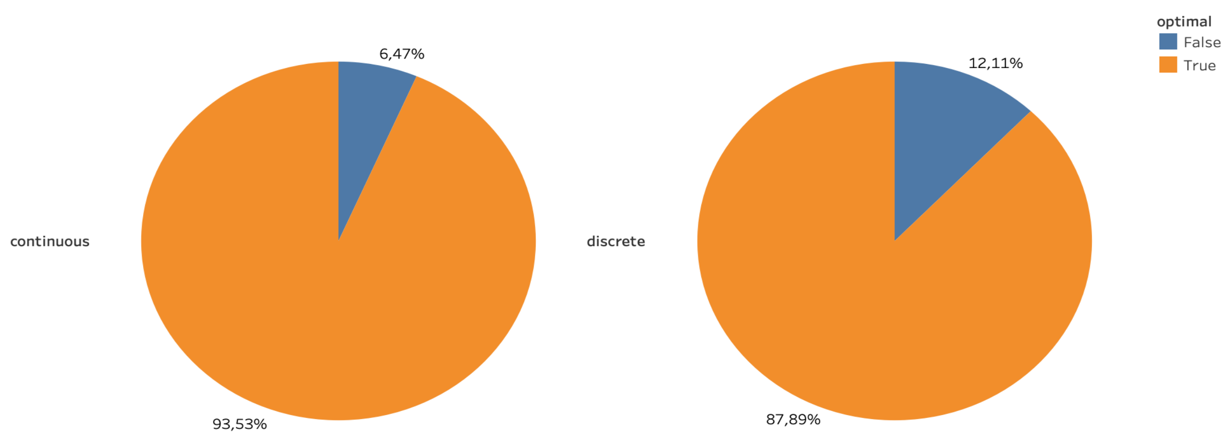

Figure 6.5: Percentage of j30 instances solved optimally

Delving into the suboptimal instances of this set, figure 6.6 presents the best upper bounds calculated by the branch and bound algorithm. The continuous model consistently outperforms the discrete counterpart having calculated lower makespans at the end of the specified execution timeframe.

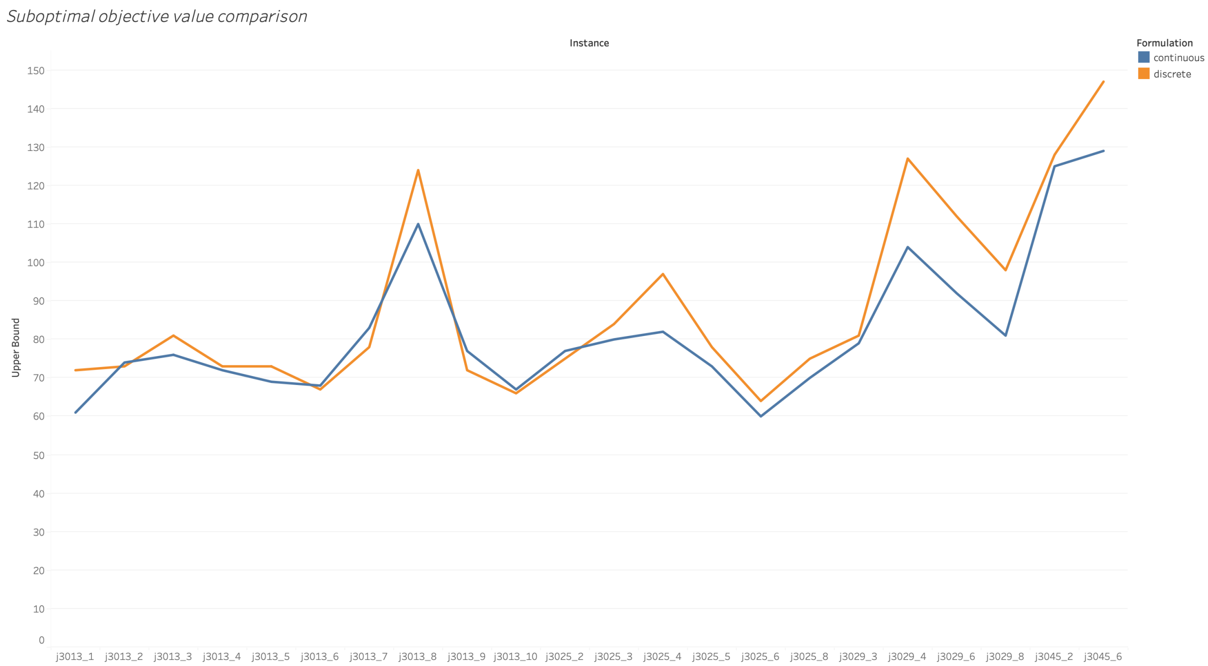

Figure 6.6: Best upper bounds attained on suboptimal j30 instances.

As with the execution time comparison, the performance of the models changes drastically as the size of the instances increases. Figure 6.7 depicts the percentage of instances within the j60 set that were solved to optimality within the specified 20 minute period. On these larger instances the discrete formulation is superior and the solver managed to calculate the optimal solution on 76.4% of the instances, 10% fewer than the j30 set. The continuous formulation solved optimally only 66.4% of the j60 instances marking a significant 27% decrease.

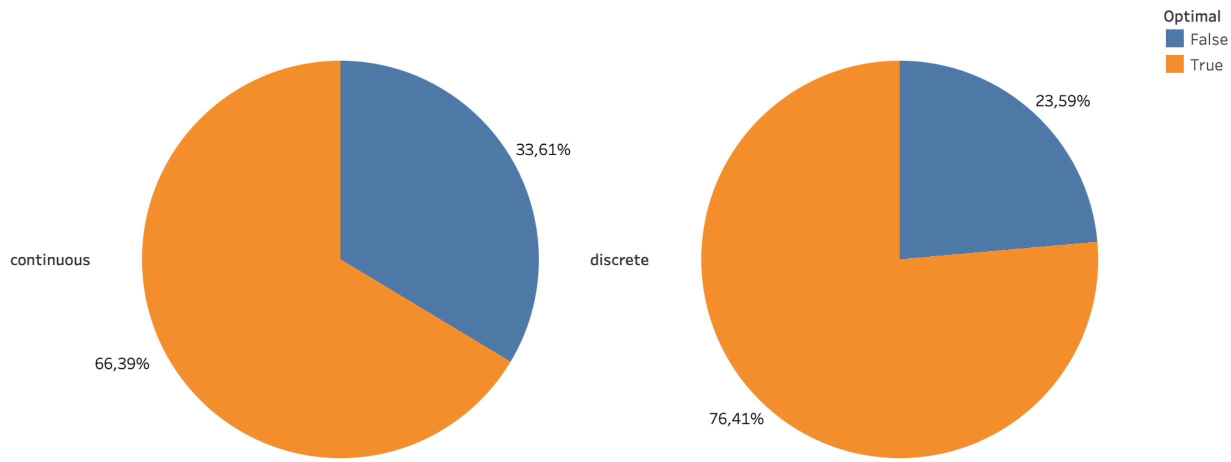

Figure 6.7: Percentage of j60 instances solved optimally

Figure 6.8 depicts the best upper bounds attained by the branch and bound algorithm. Despite the fact that the discrete model solved many more instances of the j60 optimally and achieved faster execution times, the continuous model achieved better (lower) upper bounds on the common suboptimal instances meaning that a better feasible solution was discovered within the specified execution timeframe. This is an indication that the continuous model be might a better choice for a fast feasible solution especially on smaller instances.

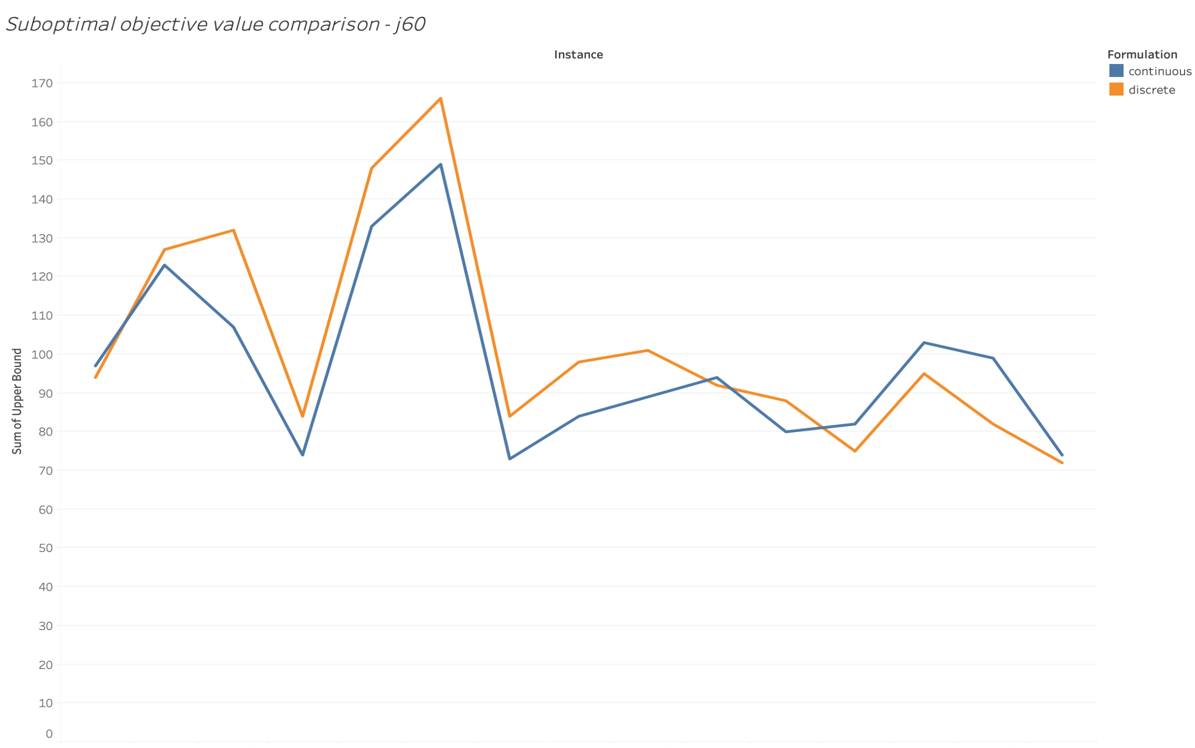

Figure 6.8: Best upper bounds attained on suboptimal j60 instances.

6.3.4 Quality of fractional relaxation

As a further indication of overall formulation quality we now perform a fractional relaxation by changing the domain of the decision variables of the two deterministic formulations from binary to continuous. For the discrete BIP formulation, decision variables x_{jt} that indicate if activity j commences at time period t are now made continuous in the interval $[0, 1]$. Within pyomo this corresponds to changing the variable domain from binary to NonNegativeReal. For the continuous MIP formulation the relative sequence variables x_{ij} and the overlapping variables z_{ij} are updated in a similar manner. The relaxed formulations are then tested against the instances of the j30, j60 and j120 sets. The objective values produced by the solver are compared in figure 6.9.

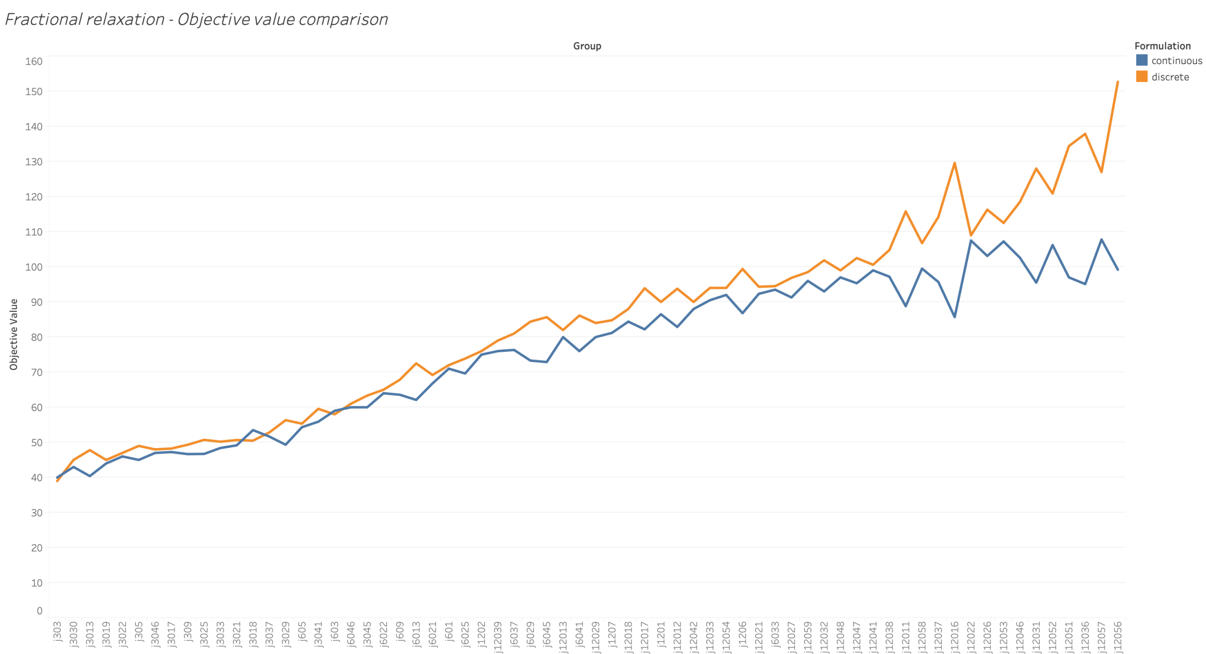

Figure 6.9: Objective value comparison on relaxed instances.

On the horizontal axis, all instance subsets of the j30, j60 and j120 sets have been aggregated according to their average objective value. The axis starts with values from the smaller instance groups of the j30 sets and moves to the larger j120 instances. On smaller instances the performance gap between the two relaxed models is not significant, however as the size of the RCPSP instances increases, the gap between the discrete and continuous model also increases. On the j12016, j12036 and j12056 instance groups, the continuous model outperforms the discrete counterpart by calculating solutions with a 52% shorter makespan.

6.4 Robust Formulation Comparison

In section 6.3 the performance and characteristics of the two deterministic formulations were compared and analyzed. The continuous model seems to be more efficient on smaller instances while the discrete formulation scales better. This finding was not corroborated in the fractional relaxation analysis where the relaxed continuous model scaled much better on larger instances. In this section we compare the two bilevel formulations for the worst case RCPSP presented in chapter 5, with the aim to identify the effect that the inner level formulations have on the overall performance of the bilevel model.

The worst case makespan RCPSP was modelled as a minimax problem. The outer decision level (master problem) can be considered as an adversarial problem, where the adversary tries to distribute Γ units of delay with the aim to maximize the minimum makespan amongst all realizations. The inner decision level is a makespan minimization RCPSP instance which considers the duration vector that is realized in the outer level. An inner level formulation which produces higher quality solutions will increase the robustness of the entire bilevel formulation. To investigate this intuition and as a robustness measure we use the worst case absolute regret defined as the difference to the objective function of the best solution that would have been possible in a scenario [17]. In the methodology section (6.2) we have described how we derived perturbed instances from the original PSPLIB instances by changing the nominal activity durations. The perturbed instances were initially solved optimally both with the continuous and the discrete deterministic formulations. Considering the perturbed instances as the true realizations, we then solved the worst case deterministic counterparts with both bilevel formulations and using different values for the budgeted uncertainty factor Γ.

The remainder of this section is structured as follows. We initially plot the absolute regret between the perturbed instances of the j30 and j60 instance sets (which are considered as true) and the worst case baseline makespan obtained by the bilevel formulations. The worst case makespan obtained by the models is depicted in figure 6.10. The two bilevel models are compared according to how the regret scales as the instances get larger. We then proceed to analyze the effect that the uncertainty budget factor Γ has on the worst case makespan. This is depicted in figure 6.11 and is an indication of the price of robustness as adjusting the model to embed more uncertainty, causes an increase to the absolute regret.

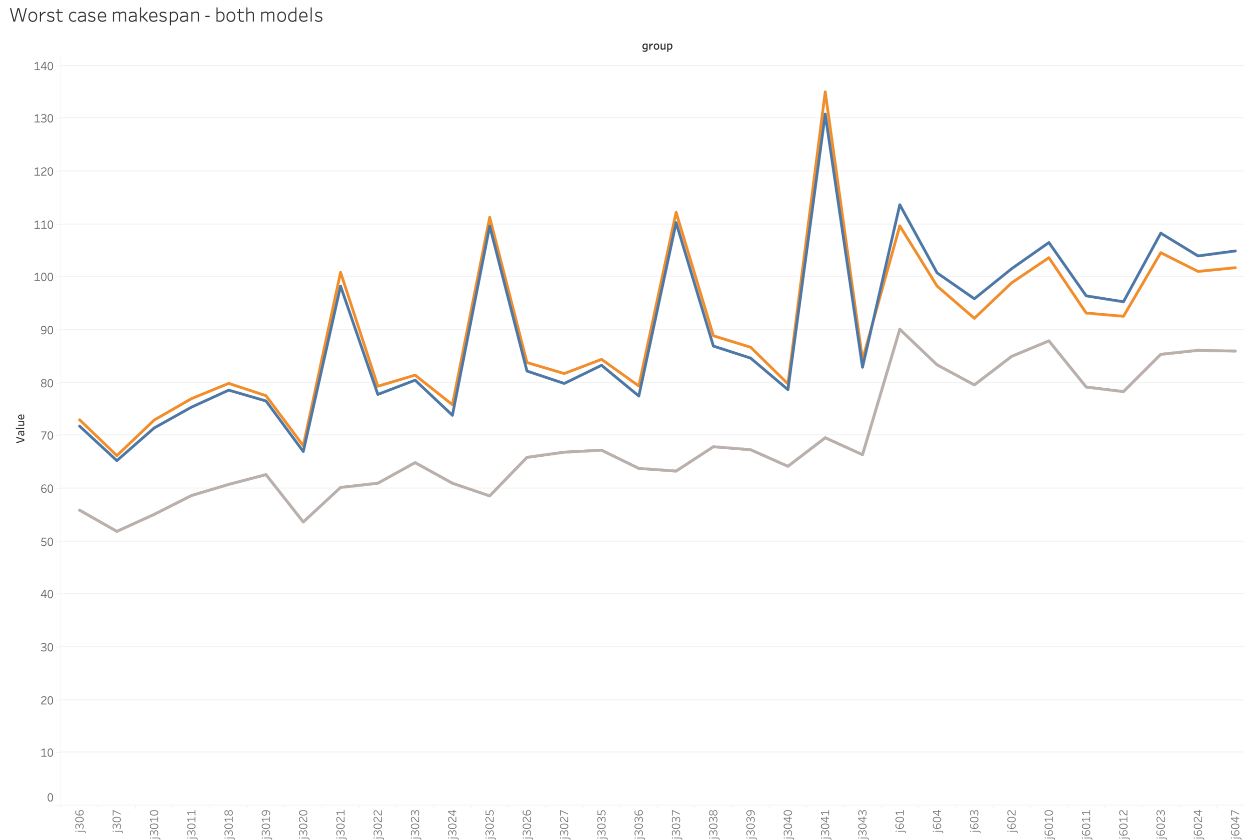

Figure 6.10: Worst case makespan - bilevel formulation comparison

Figure 6.10 depicts the worst case makespan obtained by running the two bilevel formulations on subsets of the j30 and j60 instance sets. The *Gamma* uncertainty budget is equal to the number of activities corresponding to the most pessimistic scenario where all activities can simultaneously be delayed by the maximum possible amount. The true makespan that corresponds to the optimal solution of the perturbed instance is plotted in gray. The worst-case duration of the continuous bilevel formulation is drawn in blue while the corresponding discrete bilevel model is drawn in orange. The area between the true makespan and the worst case makespan is the regret. The leftmost values of the x axis correspond to the j30 instances and the instance size increases towards the right part of the axis. On smaller instances the worst case makespan of the discrete model is on average 2.5% larger than the one of the continuous model. In other words, the average regret of the discrete model is 2.5% more. As the instances get larger the continuous bilevel model is outperformed. On the instances of the j60 set corresponding to the rightmost part of the x axis, the regret of the discrete bilevel model is on average 3.4% less than the regret of the continuous model.

In section 6.3 the continuous model was found to be more efficient on smaller instances, while the discrete model scales better. This is further supported by the performance of the two bilevel formulations. On smaller instances the continuous based bilevel model produced baseline schedules that deviated less from the true instances. As the instances got larger, the schedules of the discrete bilevel model produced lesser amounts of absolute regret. For this worst case experiment, the average regret across all instances was 28%.

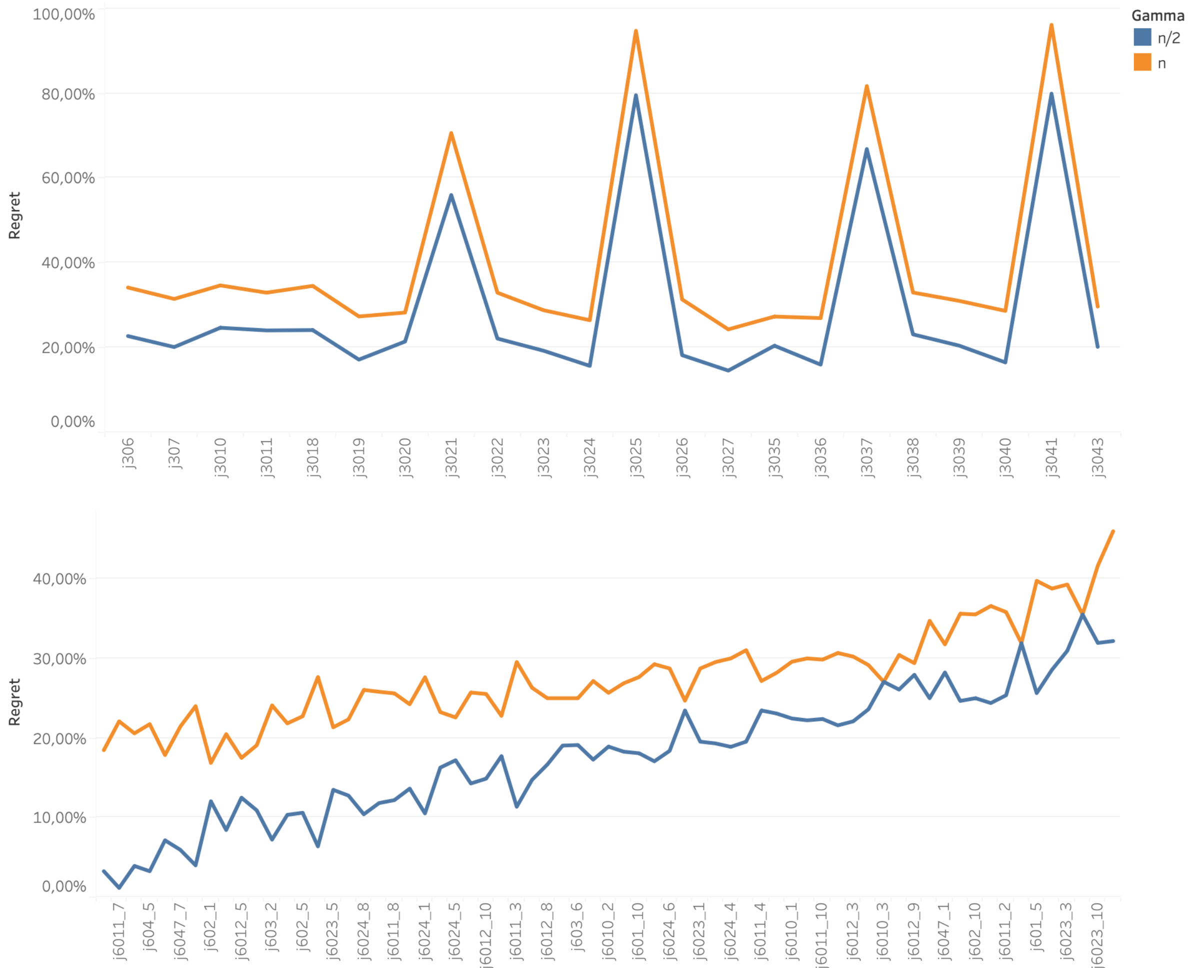

Figure 6.11: Absolute regret and uncertainty budget

As we increase the uncertainty budget and thus add more uncertainty to the model, the regret rises. This is evident in figure 6.11. The j30 instances are depicted in the upper half of the diagram and the j60 in the lower part. The blue curves correspond to an uncertainty budget $\Gamma = \frac{n}{2}$ meaning that at most half of the activities can simultaneously take their worst case duration. The orange curves correspond to the worst case scenario, which is the one analyzed in figure 6.10. On all instances the regret corresponding to more uncertainty is consistently higher. This is a manifestation of the price of robustness [13], which states that proactively planning with more uncertainty causes a penalty in the quality of the solution.

6.5 Priority Rule Comparison

We conclude the computational experiments, with an analysis of the performance of several different priority rules incorporated within the serial schedule generation scheme (SSGS) that was presented in section 4.1. The heuristic of the preprocessing phase, is used to derive an initial feasible, albeit suboptimal solution that is used to relax the upper bounds of the branch and bound algorithm executed by the commercial solver. As described in section 4.2, the serial schedule generation scheme performs activity incrementation and selects on each iteration an eligible activity for scheduling (eligible with respect to precedence and resource constraints). The activity that is selected from the eligible set, depends on a priority rule which is a measurable criterion derived from the attributes of that activity. In this section we compare the solution quality obtained by the SSGS when used along with the following priority rules: minimum latest finish time (LFT), minimum latest starting time (LST) and maximum immediate successors (SUC). The makespan acquired by selecting an activity at random is also included for reference. The priority rules were tested on all instance sets of the PSPLIB and the makespan comparison per instance group is depicted in figure 6.12.

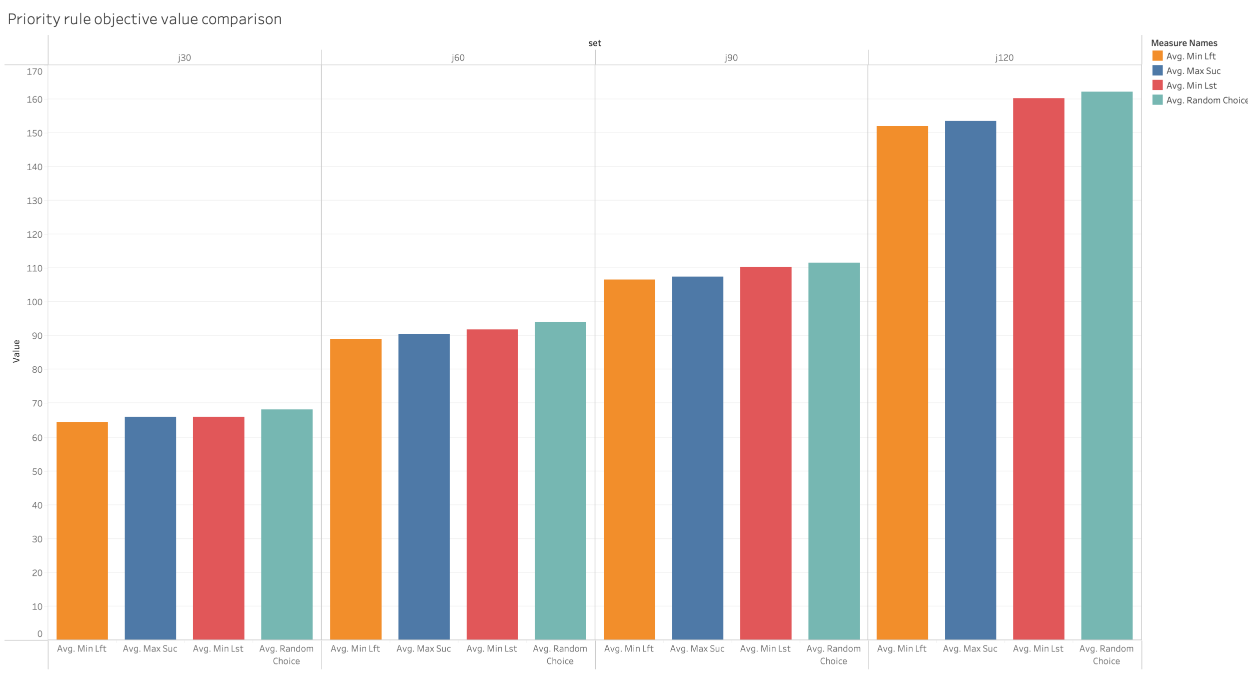

Figure 6.12: Priority rule makespan comparison

The results are consistent across all instance groups of the PSPLIB. The best objective value (i.e. lowest makespan) is obtained by the minimum LFT priority rule. The maximum number of successors gives the second best results with the minimum LST following third. As expected, the random choice approach produces the worst quality solutions. One could argue that the objective value difference between the random choice and the priority rules is not significant and therefore might not justify the computational cost of applying the rule. However the computational experiments showed that the cost is negligible (few milliseconds in an apple M1 processor with 16GB of ram) and the makespan is reduced on average by 2.3% which can be a significant improvement when warm-starting the branch and bound algorithm. An elaborate analysis on several priority rules and their performance can be found in [20].

Chapter 7

Professional Issues

The software developed in scope of this project aims at providing high quality, robust solutions for the resource constrained project scheduling problem. Since the RCPSP is a problem with numerous practical and industrial applications this software can be used to tackle real life scheduling problems. However, this software is not intended for production use and aspects such as security and scalability have not been explicitly designed as they exceed the scope of this project. Commercial use in business related decision making is therefore discouraged. This software does not require or retain any sensitive data and the instances used in the computational experiments are publicly available as described in section 6.1. In support of the open-source approach to software development, this software is publicly accessible through the Github repository listed in appendix A and may be freely used and altered.

Chapter 8

Conclusions

8.1 Summary and evaluation

The aim of this project was to investigate the effect of different MILP formulations on the overall solution quality and robustness of the resource constrained project scheduling problem. Under the perfect knowledge assumption we presented in chapter 4 a continuous time MIP and a discrete time BIP formulation for the deterministic RCPSP. The computational experiments revealed that the continuous model performs better on smaller instances while the discrete model scales better on instances of increasing size. We attribute this to the number of decision variables produced by each model. The continuous formulation defines binary decision variables that represent the execution sequence of activities. These variables are not affected by the length of the horizon but are quadratic to the number of activities. The discrete formulation on the other hand, defines decision variables for every time point of the horizon. These are linear both to the size of the activity set and to the length of the horizon. On smaller instances, the number of decision variables produced by the continuous model was found to be substantially lower than the discrete counterpart but this changes drastically as the instances get larger directly affecting model performance.

In chapter 5, the hardly realistic perfect knowledge assumption was dropped and uncertainty was introduced to our models. Following a conservative approach, we proposed two minimax bilevel formulations with the objective to minimize the worst case makespan that can arise from all scenarios of the uncertainty set. For both bilevel formulations, the outer decision level was designed as an adversarial problem, where the adversary tries to distribute Γ units of delay with the aim to maximize the minimum makespan amongst all realizations. The inner level problems are extensions of the deterministic formulations presented in chapter 4. The computational results revealed that the scalability issue of the continuous model, directly affects the performance of the bilevel formulation on instances of increasing size. To measure this we used the absolute regret defined as the difference between the true realization and the robust baseline schedule. On smaller instances the regret of the continuous bilevel model is lower than the discrete model but rises abruptly as the activity set gets larger. The effect that the uncertainty budget factor Γ has on the worst case makespan was also analyzed. Imbuing the model with more uncertainty causes an increase to the absolute regret, a phenomenon referred to as the price of robustness [13].

The computational experiments were concluded with a performance analysis of three priority rules that were used inside the schedule generation scheme presented in section 4.2. This heuristic was used to obtain an initial feasible solution and warm start the branch and bound algorithm of the commercial solver. The minimum latest finishing time (LFT) rule yielded the best results across all instances.

8.2 Future work

As future work, the performance of the bilevel formulations can be improved by developing a tailored heuristic in the preprocessing phase that apart from a priority rule, also considers the robustness of the partial schedule. As a robustness measure the maximum free slack which is defined as the difference between the latest finish time and the earliest finish time of an activity is seen as a promising alternative.

Further research could also be directed at developing an automated process for the selection of the most appropriate formulation to model an RCPSP instance according to its characteristics (e.g. size, network complexity). The findings of this report could be used as a training guideline for this self-adjusting model.

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Appendix A

Source code and user guide

The source code of the project can be found in the following repository: https://github.com/AlkisPlas/MPRJ_RCPSP.git).

Below is the structure of the project.

```
.
├── README.md
├── data
│   └── instances
│       ├── json
│       │   ├── j120
│       │   ├── j30
│       │   ├── j60
│       │   └── j90
│       └── sm
│           ├── j120
│           ├── j30
│           ├── j60
│           └── j90
└── rcpsp
    ├── formulations
    │   ├── perfect_knowledge
    │   │   ├── continuous
    │   │   │   ├── rcpsp_con.py
    │   │   │   └── solver_con.py
    │   │   └── discrete
    │   │       ├── rcpsp_dis.py
    │   │       └── solver_dis.py
    │   └── robust
    │       ├── continuous
    │       │   └── worst_case_makespan
    │       │       ├── robust_rcpsp_con.py
    │       │       └── robust_solver_con.py
    │       └── discrete
    │           └── worst_case_makespan
    │               ├── robust_rcpsp_dis.py
    │               └── robust_solver_dis.py
    ├── heuristics
    │   ├── backward_recursion.py
    │   ├── forward_recursion.py
    │   └── sgs.py
    └── util
        ├── instance_execution
        │   ├── run_instances.sh
        │   └── worst_case_regret.sh
        ├── instance_postprocessing
        │   └── process_instance_results_extract_csv.py
        ├── instance_preprocessing
        │   ├── convert_sm.sh
        │   └── psplibconverter.py
        └── priority_rule_evaluation
            ├── run_pr.sh
            └── run_sgs.py
```

The data directory contains all PSPLIB test instances. SM is the native format and the json directory contains the converted instances as described in section 6.1. rcpsp is the source directory and contains the formulations, the heuristics and the scripts that were used in the experiments. The formulation directory contains the perfect knowledge formulations of section 5 and their robust counterparts presented in section 6. For every formulation we implement a pyomo model (identified by the rcpsp keyword) and a corresponding solver class that instantiates the model, computes a warm start solution using the serial schedule generation scheme found under rcpsp/heuristics/sgs.py and invokes CPLEX using the SolverFactory wrapper. The util directory contains all the shell scripts that were used to automate instance execution and result collection.

All models can be executed by running the corresponding solver script with python3. The solvers are configured with argparse and accept the following parameters:

Argument	Description	Default
dir	Instance directory (e.g j30)	required
instance	Instance name (e.g j301_8)	required
-p	Perturbs activity durations. Used for regret calculations.	false
-d	Displays the decision variables of the solution.	false
-s	Stores the solution in json format under the results directory.	false
-theta	Worst case duration deviation. Used in bilevel models.	0
-gamma	Uncertainty budget. Used in bilevel models.	0

As an example the following command can be issued to run the bilevel continuous model for the j301_1 instance.

```
$ python3 robust_solver_con.py j30 j301_1 --gamma 20 --theta 0.5
```

Appendix B

Instance execution results

Table B.1: j30 instances

Instance	Formulation	Lower Bound	Upper Bound	Execution Time	Variables	Constraints
j3010_10	discrete	41	41	0.7	628	263
j3010_10	continuous	41	41	21.7	1309	2440
j3010_1	discrete	42	42	0.25	825	305
j3010_1	continuous	42	42	1.18	1237	2296
j3010_2	discrete	56	56	2.4	867	341
j3010_2	continuous	56	56	3.55	1129	2121
j3010_3	discrete	62	62	6.51	1131	389
j3010_3	continuous	62	62	11.08	1123	2090
j3010_4	discrete	58	58	3.78	1180	369
j3010_4	continuous	58	58	5.38	1165	2167
j3010_5	discrete	41	41	0.56	608	269
j3010_5	continuous	41	41	3.19	1313	2461
j3010_6	discrete	44	44	1.95	720	293
j3010_6	continuous	44	44	29.54	1225	2282
j3010_7	discrete	49	49	0.45	678	309
j3010_7	continuous	49	49	2.67	1237	2329
j3010_8	discrete	54	54	5.62	946	329
j3010_8	continuous	54	54	9.25	1269	2362
j3010_9	discrete	49	49	0.08	708	277
j3010_9	continuous	49	49	0.04	1309	2451
j3011_10	discrete	38	38	0.13	560	261
j3011_10	continuous	38	38	0.35	1257	2387
j3011_1	discrete	54	54	1.58	1025	357

j3011_1	continuous	54	54	1.78	1125	2103
j3011_2	discrete	56	56	0.25	726	337
j3011_2	continuous	56	56	1.24	1253	2367
j3011_3	discrete	81	81	0.16	1154	405
j3011_3	continuous	81	81	0.04	1145	2139
j3011_4	discrete	63	63	0.29	783	353
j3011_4	continuous	63	63	0.42	1061	2000
j3011_5	discrete	49	49	1.08	823	309
j3011_5	continuous	49	49	2.24	1203	2247
j3011_6	discrete	44	44	0.17	595	277
j3011_6	continuous	44	44	0.75	1253	2366
j3011_7	discrete	36	36	0.24	466	245
j3011_7	continuous	36	36	2.32	1341	2544
j3011_8	discrete	62	62	0.34	869	353
j3011_8	continuous	62	62	0.57	1201	2252
j3011_9	discrete	67	67	0.18	986	365
j3011_9	continuous	67	67	0.24	1113	2088
j3012_10	discrete	57	57	0.11	665	309
j3012_10	continuous	57	57	0.04	1289	2444
j3012_1	discrete	47	47	0.05	371	269
j3012_1	continuous	-inf	inf	0.01	1265	2451
j3012_2	discrete	46	46	0.06	412	273
j3012_2	continuous	46	46	0.11	1261	2428
j3012_3	discrete	37	37	0.05	339	229
j3012_3	continuous	37	37	0.03	1265	2448
j3012_4	discrete	63	63	0.09	616	328
j3012_4	continuous	63	63	0.04	1217	2333
j3012_5	discrete	47	47	0.11	615	269
j3012_5	continuous	47	47	0.04	1341	2508
j3012_6	discrete	53	53	0.07	476	293
j3012_6	continuous	53	53	0.04	1265	2430
j3012_7	discrete	55	55	0.09	456	301

j3012_7	continuous	55	55	0.04	1245	2409
j3012_8	discrete	35	35	0.03	258	213
j3012_8	continuous	35	35	0.03	1333	2612
j3012_9	discrete	52	52	0.09	577	289
j3012_9	continuous	52	52	0.04	1209	2299
j3013_10	discrete	61	66	1200	1440	381
j3013_10	continuous	54	67	1200	1109	2035
j3013_1	discrete	50	72	1200	1677	397
j3013_1	continuous	45	61	1200	1123	2078
j3013_2	discrete	50	73	1200	1567	377
j3013_2	continuous	39	74	1200	1187	2175
j3013_3	discrete	67	81	1200	2028	465
j3013_3	continuous	69	76	1200.0	1035	1889
j3013_4	discrete	66	73	1200.0	1713	437
j3013_4	continuous	70	72	1200	997	1830
j3013_5	discrete	59	73	1200	1654	409
j3013_5	continuous	49	69	1200.0	1219	2246
j3013_6	discrete	58	67	1200.0	1380	373
j3013_6	continuous	48	68	1200	1195	2209
j3013_7	discrete	68	78	1200	2237	481
j3013_7	continuous	61	83	1200	961	1755
j3013_8	discrete	80	124	1200	2830	581
j3013_8	continuous	75	110	1200	887	1604
j3013_9	discrete	66	72	1200	2037	481
j3013_9	continuous	61	77	1200	1061	1948
j3014_10	discrete	61	61	0.68	841	349
j3014_10	continuous	61	61	0.88	1161	2192
j3014_1	discrete	50	50	3.79	692	305
j3014_1	continuous	48	50	1200.0	1065	2017
j3014_2	discrete	53	53	183.1	886	325
j3014_2	continuous	46	56	1200	1221	2277
j3014_3	discrete	58	58	1.59	1268	389

j3014_3	continuous	58	58	513.69	1205	2236
j3014_4	discrete	50	50	968.39	758	305
j3014_4	continuous	49	52	1200	1209	2260
j3014_5	discrete	52	52	1.92	1308	353
j3014_5	continuous	52	52	4.0	1133	2110
j3014_6	discrete	35	35	0.69	410	233
j3014_6	continuous	34	35	1200	1281	2421
j3014_7	discrete	50	50	50.34	979	325
j3014_7	continuous	47	56	1200	1173	2181
j3014_8	discrete	54	54	0.26	658	305
j3014_8	continuous	54	54	0.25	1205	2276
j3014_9	discrete	46	46	7.16	1010	313
j3014_9	continuous	44	48	1200	1229	2281
j3015_10	discrete	65	65	0.11	658	341
j3015_10	continuous	65	65	0.04	1061	2025
j3015_1	discrete	46	46	0.07	505	265
j3015_1	continuous	46	46	0.13	1269	2439
j3015_2	discrete	47	47	0.12	525	277
j3015_2	continuous	47	47	0.17	1241	2355
j3015_3	discrete	48	48	0.18	644	289
j3015_3	continuous	48	48	0.35	1189	2233
j3015_4	discrete	48	48	0.09	550	273
j3015_4	continuous	48	48	0.05	1225	2336
j3015_5	discrete	58	58	4.72	708	337
j3015_5	continuous	56	60	1200	1193	2262
j3015_6	discrete	67	67	0.14	960	349
j3015_6	continuous	67	67	0.05	1257	2364
j3015_7	discrete	47	47	0.19	597	281
j3015_7	continuous	47	47	1.75	1181	2247
j3015_8	discrete	50	50	0.61	882	321
j3015_8	continuous	50	50	1.54	1173	2193
j3015_9	discrete	54	54	0.22	756	313

j3015_9	continuous	54	54	1198.48	1225	2287
j3016_10	discrete	51	51	0.11	582	285
j3016_10	continuous	51	51	0.05	1281	2409
j3016_1	discrete	51	51	0.12	500	285
j3016_1	continuous	51	51	0.04	1225	2374
j3016_2	discrete	48	48	0.11	415	273
j3016_2	continuous	48	48	0.04	1237	2393
j3016_3	discrete	36	36	0.06	240	225
j3016_3	continuous	36	36	0.03	1229	2433
j3016_4	discrete	47	47	0.09	583	269
j3016_4	continuous	47	47	0.04	1197	2264
j3016_5	discrete	51	51	0.08	438	285
j3016_5	continuous	51	51	0.04	1213	2349
j3016_6	discrete	51	51	0.12	597	285
j3016_6	continuous	51	51	0.04	1253	2349
j3016_7	discrete	34	34	0.05	308	217
j3016_7	continuous	34	34	0.03	1233	2417
j3016_8	discrete	44	44	0.07	540	257
j3016_8	continuous	44	44	0.04	1305	2482
j3016_9	discrete	44	44	0.09	430	257
j3016_9	continuous	44	44	0.04	1169	2286
j3017_10	discrete	66	66	0.14	1145	396
j3017_10	continuous	66	66	1028.0	955	1794
j3017_1	discrete	64	64	3.03	1153	347
j3017_1	continuous	64	64	0.46	1075	1997
j3017_2	discrete	68	68	0.15	794	339
j3017_2	continuous	68	68	0.09	949	1808
j3017_3	discrete	60	60	0.03	519	299
j3017_3	continuous	60	60	0.02	955	1856
j3017_4	discrete	49	49	0.09	715	261
j3017_4	continuous	49	49	0.1	903	1708
j3017_5	discrete	47	47	0.43	775	284

j3017_5	continuous	47	47	0.23	955	1797
j3017_6	discrete	63	63	0.08	957	329
j3017_6	continuous	63	63	0.07	901	1711
j3017_7	discrete	57	57	0.7	1084	328
j3017_7	continuous	57	57	0.19	1007	1889
j3017_8	discrete	61	61	0.12	822	310
j3017_8	continuous	61	61	0.15	963	1813
j3017_9	discrete	48	48	0.29	905	305
j3017_9	continuous	48	48	0.16	975	1833
j3018_10	discrete	49	49	0.33	894	301
j3018_10	continuous	49	49	0.17	1061	1989
j3018_1	discrete	53	53	0.1	736	292
j3018_1	continuous	53	53	0.08	999	1888
j3018_2	discrete	55	55	0.02	482	286
j3018_2	continuous	55	55	0.02	857	1675
j3018_3	discrete	56	56	0.15	893	348
j3018_3	continuous	56	56	0.12	901	1712
j3018_4	discrete	70	70	0.1	781	333
j3018_4	continuous	70	70	0.03	913	1738
j3018_5	discrete	52	52	0.07	695	302
j3018_5	continuous	52	52	0.08	973	1870
j3018_6	discrete	62	62	0.29	1100	358
j3018_6	continuous	62	62	0.19	1001	1882
j3018_7	discrete	48	48	0.07	684	280
j3018_7	continuous	48	48	0.09	869	1661
j3018_8	discrete	52	52	0.03	674	285
j3018_8	continuous	52	52	0.02	1015	1928
j3018_9	discrete	47	47	0.1	856	300
j3018_9	continuous	47	47	0.11	979	1841
j3019_10	discrete	47	47	0.11	808	289
j3019_10	continuous	47	47	0.09	1073	2028
j3019_1	discrete	40	40	0.05	358	227

j3019_1	continuous	40	40	0.09	1097	2117
j3019_2	discrete	58	58	0.04	660	299
j3019_2	continuous	58	58	0.02	1045	1984
j3019_3	discrete	83	83	0.14	1145	430
j3019_3	continuous	83	83	0.09	909	1727
j3019_4	discrete	39	39	0.08	615	272
j3019_4	continuous	39	39	0.1	1117	2105
j3019_5	discrete	48	48	0.07	597	286
j3019_5	continuous	48	48	0.09	1009	1923
j3019_6	discrete	49	49	0.06	681	286
j3019_6	continuous	49	49	0.1	959	1819
j3019_7	discrete	57	57	0.06	776	301
j3019_7	continuous	57	57	0.03	1033	1952
j3019_8	discrete	55	55	0.1	735	308
j3019_8	continuous	55	55	0.11	1061	2024
j3019_9	discrete	38	38	0.07	442	248
j3019_9	continuous	38	38	0.07	1069	2066
j301_10	discrete	45	45	0.2	773	283
j301_10	continuous	45	45	0.26	1161	2151
j301_1	discrete	43	43	0.17	820	272
j301_1	continuous	43	43	0.11	1171	2163
j301_2	discrete	47	47	0.12	692	259
j301_2	continuous	47	47	0.18	1239	2284
j301_3	discrete	47	47	0.1	742	278
j301_3	continuous	47	47	0.19	1143	2145
j301_4	discrete	62	62	0.26	1069	343
j301_4	continuous	62	62	0.3	1171	2161
j301_5	discrete	39	39	0.4	697	236
j301_5	continuous	39	39	0.26	1171	2160
j301_6	discrete	48	48	0.59	984	308
j301_6	continuous	48	48	0.26	1073	1988
j301_7	discrete	60	60	0.1	1074	343

j301_7	continuous	60	60	0.13	1109	2065
j301_8	discrete	53	53	0.08	738	273
j301_8	continuous	53	53	1008.23	1267	2394
j301_9	discrete	49	49	0.38	761	291
j301_9	continuous	49	49	0.31	1125	2096
j3020_10	discrete	37	37	0.02	298	219
j3020_10	continuous	37	37	0.02	1009	2012
j3020_1	discrete	57	57	0.03	529	303
j3020_1	continuous	57	57	0.03	1029	1997
j3020_2	discrete	70	70	0.04	688	349
j3020_2	continuous	70	70	0.03	997	1917
j3020_3	discrete	49	49	0.02	442	256
j3020_3	continuous	49	49	0.02	1127	2182
j3020_4	discrete	43	43	0.01	241	238
j3020_4	continuous	43	43	0.02	1115	2228
j3020_5	discrete	61	61	0.03	678	322
j3020_5	continuous	61	61	0.02	889	1725
j3020_6	discrete	51	51	0.05	694	292
j3020_6	continuous	51	51	0.06	1013	1916
j3020_7	discrete	42	42	0.02	451	250
j3020_7	continuous	42	42	0.02	1073	2064
j3020_8	discrete	51	51	0.03	702	291
j3020_8	continuous	51	51	0.02	1045	1984
j3020_9	discrete	41	41	0.02	347	246
j3020_9	continuous	41	41	0.02	1025	2010
j3021_10	discrete	69	69	34.61	1392	415
j3021_10	continuous	69	69	982.74	881	1642
j3021_1	discrete	84	84	25.47	1686	479
j3021_1	continuous	84	84	0.42	705	1337
j3021_2	discrete	59	59	39.08	1237	374
j3021_2	continuous	59	59	0.65	829	1556
j3021_3	discrete	76	76	3.71	1313	423

j3021_3	continuous	76	76	0.39	851	1597
j3021_4	discrete	70	70	161.3	1492	422
j3021_4	continuous	70	70	1.27	789	1492
j3021_5	discrete	55	55	23.29	1423	391
j3021_5	continuous	55	55	0.53	877	1643
j3021_6	discrete	76	76	57.66	1417	410
j3021_6	continuous	76	76	0.73	911	1694
j3021_7	discrete	65	65	39.32	1423	394
j3021_7	continuous	65	65	1.08	835	1558
j3021_8	discrete	62	62	8.3	1342	376
j3021_8	continuous	62	62	1.47	827	1555
j3021_9	discrete	69	69	81.5	1963	462
j3021_9	continuous	69	69	231.72	895	1664
j3022_10	discrete	55	55	0.58	676	339
j3022_10	continuous	55	55	1.28	1095	2084
j3022_1	discrete	42	42	0.14	391	261
j3022_1	continuous	42	42	0.12	1027	1999
j3022_2	discrete	45	45	0.4	886	325
j3022_2	continuous	45	45	0.11	925	1755
j3022_3	discrete	63	63	0.33	629	339
j3022_3	continuous	63	63	0.13	1015	1934
j3022_4	discrete	42	42	0.47	954	327
j3022_4	continuous	42	42	0.46	1057	1988
j3022_5	discrete	52	52	0.39	788	318
j3022_5	continuous	52	52	0.37	1109	2084
j3022_6	discrete	52	52	1.17	838	335
j3022_6	continuous	52	52	1.67	1057	1988
j3022_7	discrete	60	60	2.9	955	358
j3022_7	continuous	60	60	2.17	961	1819
j3022_8	discrete	55	55	4.53	838	316
j3022_8	continuous	55	55	7.92	1031	1935
j3022_9	discrete	76	76	0.2	1016	395

j3022_9	continuous	76	76	0.03	899	1716
j3023_10	discrete	61	61	0.08	463	333
j3023_10	continuous	61	61	0.02	937	1849
j3023_1	discrete	63	63	0.17	730	343
j3023_1	continuous	63	63	0.04	1017	1946
j3023_2	discrete	53	53	0.2	775	306
j3023_2	continuous	53	53	0.11	1023	1949
j3023_3	discrete	46	46	0.24	750	291
j3023_3	continuous	46	46	0.19	1021	1926
j3023_4	discrete	65	65	0.3	991	366
j3023_4	continuous	65	65	0.18	865	1649
j3023_5	discrete	52	52	0.25	882	325
j3023_5	continuous	52	52	0.2	1001	1888
j3023_6	discrete	48	48	0.3	778	316
j3023_6	continuous	48	48	0.18	1033	1956
j3023_7	discrete	60	60	0.33	1002	370
j3023_7	continuous	60	60	0.16	925	1753
j3023_8	discrete	48	48	0.14	411	283
j3023_8	continuous	48	48	0.03	1097	2129
j3023_9	discrete	63	63	0.71	953	367
j3023_9	continuous	63	63	0.23	1003	1889
j3024_10	discrete	53	53	0.15	625	299
j3024_10	continuous	53	53	0.03	1047	1999
j3024_1	discrete	53	53	0.09	575	293
j3024_1	continuous	53	53	0.02	1025	1962
j3024_2	discrete	58	58	0.1	670	317
j3024_2	continuous	58	58	0.03	1007	1921
j3024_3	discrete	69	69	0.14	582	367
j3024_3	continuous	69	69	0.03	953	1864
j3024_4	discrete	53	53	0.12	519	302
j3024_4	continuous	53	53	0.03	1065	2069
j3024_5	discrete	51	51	0.09	511	293

j3024_5	continuous	51	51	0.03	1065	2052
j3024_6	discrete	56	56	0.12	555	306
j3024_6	continuous	56	56	0.03	1071	2074
j3024_7	discrete	44	44	0.05	443	267
j3024_7	continuous	44	44	0.03	955	1863
j3024_8	discrete	38	38	0.05	361	239
j3024_8	continuous	38	38	0.02	1137	2210
j3024_9	discrete	43	43	0.02	243	258
j3024_9	continuous	43	43	0.02	1065	2136
j3025_10	discrete	58	58	87.3	1401	391
j3025_10	continuous	58	58	1011.2	847	1590
j3025_1	discrete	87	96	1200.0	2582	571
j3025_1	continuous	93	93	921.03	815	1506
j3025_2	discrete	67	75	1200	1762	451
j3025_2	continuous	68	77	1200	701	1305
j3025_3	discrete	71	84	1200	2261	499
j3025_3	continuous	59	80	1200	957	1776
j3025_4	discrete	67	97	1200	2021	491
j3025_4	continuous	70	82	1200	811	1489
j3025_5	discrete	64	78	1200	1624	415
j3025_5	continuous	60	73	1200	899	1672
j3025_6	discrete	51	64	1200	1351	379
j3025_6	continuous	49	60	1200	943	1755
j3025_7	discrete	80	99	1200	2267	551
j3025_7	continuous	89	95	1200	771	1441
j3025_8	discrete	57	75	1200	1936	439
j3025_8	continuous	62	70	1200	943	1742
j3025_9	discrete	79	93	1200	1912	499
j3025_9	continuous	84	84	1043.26	785	1471
j3026_10	discrete	49	49	0.55	873	327
j3026_10	continuous	49	49	978.76	1041	1972
j3026_1	discrete	59	59	0.46	1147	379

j3026_1	continuous	59	59	0.38	871	1648
j3026_2	discrete	40	40	0.11	510	263
j3026_2	continuous	40	40	0.17	1081	2082
j3026_3	discrete	58	58	0.24	821	339
j3026_3	continuous	58	58	0.31	977	1863
j3026_4	discrete	62	62	0.28	727	343
j3026_4	continuous	62	62	0.25	1089	2082
j3026_5	discrete	74	74	1.28	1108	416
j3026_5	continuous	74	74	1.0	963	1815
j3026_6	discrete	53	53	1.01	797	315
j3026_6	continuous	53	53	946.71	945	1802
j3026_7	discrete	56	56	0.25	1022	375
j3026_7	continuous	56	56	930.81	973	1840
j3026_8	discrete	66	66	0.34	901	359
j3026_8	continuous	66	66	0.19	1025	1934
j3026_9	discrete	43	43	2.47	738	295
j3026_9	continuous	43	43	526.68	1087	2039
j3027_10	discrete	62	62	0.08	774	339
j3027_10	continuous	62	62	0.03	1009	1935
j3027_1	discrete	43	43	0.13	564	279
j3027_1	continuous	43	43	0.22	1047	2013
j3027_2	discrete	58	58	0.08	697	323
j3027_2	continuous	58	58	0.04	1061	2031
j3027_3	discrete	60	60	0.2	1087	355
j3027_3	continuous	60	60	0.21	993	1877
j3027_4	discrete	64	64	0.22	1091	386
j3027_4	continuous	64	64	0.26	883	1682
j3027_5	discrete	49	49	0.25	860	335
j3027_5	continuous	49	49	0.88	1019	1921
j3027_6	discrete	59	59	0.25	1044	372
j3027_6	continuous	59	59	0.2	945	1792
j3027_7	discrete	49	49	0.34	615	311

j3027_7	continuous	49	49	0.54	1037	1975
j3027_8	discrete	66	66	0.3	1268	427
j3027_8	continuous	66	66	0.35	967	1829
j3027_9	discrete	55	55	0.21	712	335
j3027_9	continuous	55	55	0.3	1029	1952
j3028_10	discrete	59	59	0.16	758	327
j3028_10	continuous	59	59	0.03	993	1885
j3028_1	discrete	69	69	0.08	604	364
j3028_1	continuous	69	69	0.03	985	1898
j3028_2	discrete	57	57	0.12	748	319
j3028_2	continuous	57	57	0.03	1009	1925
j3028_3	discrete	40	40	0.08	415	259
j3028_3	continuous	40	40	0.23	1085	2097
j3028_4	discrete	49	49	0.07	488	287
j3028_4	continuous	49	49	0.03	1029	1990
j3028_5	discrete	73	73	0.11	697	383
j3028_5	continuous	73	73	0.03	937	1813
j3028_6	discrete	55	55	0.09	524	311
j3028_6	continuous	55	55	0.03	905	1761
j3028_7	discrete	48	48	0.07	445	283
j3028_7	continuous	48	48	0.03	1029	2004
j3028_8	discrete	53	53	0.09	650	303
j3028_8	continuous	53	53	0.03	1053	2021
j3028_9	discrete	62	62	0.11	727	339
j3028_9	continuous	62	62	0.03	901	1733
j3029_10	discrete	68	78	1200	1903	447
j3029_10	continuous	76	76	3.22	729	1370
j3029_1	discrete	82	93	1200	1940	471
j3029_1	continuous	85	85	446.75	913	1697
j3029_2	discrete	72	98	1200	2461	539
j3029_2	continuous	90	90	267.37	903	1672
j3029_3	discrete	66	81	1200	1648	435

j3029_3	continuous	57	79	1200	825	1529
j3029_4	discrete	80	127	1200	2740	603
j3029_4	continuous	92	104	1200	763	1409
j3029_5	discrete	87	118	1200	2546	563
j3029_5	continuous	98	98	38.17	815	1506
j3029_6	discrete	70	112	1200	2419	543
j3029_6	continuous	77	92	1200.0	897	1673
j3029_7	discrete	61	78	1200	1783	431
j3029_7	continuous	73	73	1192.53	891	1668
j3029_8	discrete	70	98	1200	2002	483
j3029_8	continuous	66	81	1200.0	1019	1903
j3029_9	discrete	81	117	1200	2581	559
j3029_9	continuous	97	97	837.15	815	1505
j302_10	discrete	43	43	0.11	699	270
j302_10	continuous	43	43	0.33	1125	2096
j302_1	discrete	38	38	0.11	605	253
j302_1	continuous	38	38	0.19	1245	2324
j302_2	discrete	51	51	0.09	729	277
j302_2	continuous	51	51	0.18	1309	2436
j302_3	discrete	43	43	0.04	395	239
j302_3	continuous	43	43	0.13	1279	2469
j302_4	discrete	43	43	0.05	386	229
j302_4	continuous	43	43	0.05	1221	2331
j302_5	discrete	51	51	0.11	860	300
j302_5	continuous	51	51	0.24	1147	2142
j302_6	discrete	47	47	0.03	651	258
j302_6	continuous	47	47	0.04	1179	2215
j302_7	discrete	47	47	0.07	540	239
j302_7	continuous	47	47	0.17	1275	2413
j302_8	discrete	54	54	0.13	888	304
j302_8	continuous	54	54	0.37	1209	2244
j302_9	discrete	54	54	0.03	573	279

j302_9	continuous	54	54	0.03	1285	2453
j3030_10	discrete	53	53	7.21	849	343
j3030_10	continuous	53	53	97.97	1033	1952
j3030_1	discrete	47	47	6.43	845	307
j3030_1	continuous	47	47	40.81	1085	2039
j3030_2	discrete	68	68	21.61	1350	427
j3030_2	continuous	68	68	27.32	997	1882
j3030_3	discrete	55	55	1.68	776	327
j3030_3	continuous	55	55	32.86	985	1878
j3030_4	discrete	53	53	1.02	762	331
j3030_4	continuous	53	53	6.75	961	1825
j3030_5	discrete	54	54	962.82	866	359
j3030_5	continuous	54	54	9.75	985	1865
j3030_6	discrete	62	62	1100.37	1006	375
j3030_6	continuous	62	62	62.62	1025	1940
j3030_7	discrete	68	68	8.58	1135	415
j3030_7	continuous	68	68	9.75	933	1770
j3030_8	discrete	46	46	1.94	786	303
j3030_8	continuous	46	46	49.68	1093	2056
j3030_9	discrete	46	46	2.34	660	307
j3030_9	continuous	46	46	63.03	1121	2120
j3031_10	discrete	55	55	8.17	704	327
j3031_10	continuous	55	55	74.74	981	1865
j3031_1	discrete	43	43	0.15	589	275
j3031_1	continuous	43	43	0.28	1125	2117
j3031_2	discrete	63	63	0.12	870	343
j3031_2	continuous	63	63	0.05	1117	2111
j3031_3	discrete	58	58	0.21	641	331
j3031_3	continuous	58	58	0.18	1049	2022
j3031_4	discrete	50	50	0.11	652	291
j3031_4	continuous	50	50	0.08	1081	2037
j3031_5	discrete	52	52	0.83	971	347

j3031_5	continuous	52	52	4.79	973	1840
j3031_6	discrete	53	53	0.28	701	307
j3031_6	continuous	53	53	0.19	1105	2078
j3031_7	discrete	61	61	0.18	717	355
j3031_7	continuous	61	61	0.5	993	1910
j3031_8	discrete	58	58	0.19	617	335
j3031_8	continuous	58	58	0.65	1013	1943
j3031_9	discrete	50	50	1.39	723	315
j3031_9	continuous	50	50	28.62	1021	1950
j3032_10	discrete	51	51	0.1	539	295
j3032_10	continuous	51	51	0.04	1041	2016
j3032_1	discrete	61	61	0.11	580	335
j3032_1	continuous	61	61	0.03	905	1751
j3032_2	discrete	60	60	0.11	559	331
j3032_2	continuous	60	60	0.04	1041	2011
j3032_3	discrete	57	57	0.14	597	319
j3032_3	continuous	57	57	0.05	1045	2012
j3032_4	discrete	68	68	0.13	587	363
j3032_4	continuous	68	68	0.05	1025	1999
j3032_5	discrete	54	54	0.13	486	307
j3032_5	continuous	54	54	0.04	1045	2037
j3032_6	discrete	44	44	0.06	450	267
j3032_6	continuous	44	44	0.03	997	1943
j3032_7	discrete	35	35	0.04	334	231
j3032_7	continuous	-inf	inf	0.02	993	1950
j3032_8	discrete	54	54	0.09	508	307
j3032_8	continuous	54	54	0.05	1069	2051
j3032_9	discrete	65	65	0.16	699	351
j3032_9	continuous	65	65	0.05	921	1777
j3033_10	discrete	53	53	0.04	607	291
j3033_10	continuous	53	53	0.03	825	1606
j3033_1	discrete	65	65	0.1	645	342

j3033_1	continuous	65	65	0.11	749	1474
j3033_2	discrete	60	60	0.37	1059	350
j3033_2	continuous	60	60	0.16	779	1501
j3033_3	discrete	55	55	0.57	916	331
j3033_3	continuous	55	55	0.1	785	1513
j3033_4	discrete	77	77	0.12	961	380
j3033_4	continuous	77	77	0.13	801	1549
j3033_5	discrete	53	53	0.3	1075	319
j3033_5	continuous	53	53	0.15	837	1600
j3033_6	discrete	59	59	0.08	709	324
j3033_6	continuous	59	59	0.04	777	1503
j3033_7	discrete	58	58	0.12	965	344
j3033_7	continuous	58	58	0.12	821	1575
j3033_8	discrete	61	61	1.0	1486	397
j3033_8	continuous	61	61	0.19	759	1466
j3033_9	discrete	65	65	0.81	1448	416
j3033_9	continuous	65	65	0.26	803	1539
j3034_10	discrete	47	47	0.03	401	259
j3034_10	continuous	47	47	0.04	861	1707
j3034_1	discrete	68	68	0.09	753	356
j3034_1	continuous	68	68	0.07	841	1636
j3034_2	discrete	44	44	0.04	520	253
j3034_2	continuous	44	44	0.04	723	1424
j3034_3	discrete	69	69	0.1	844	367
j3034_3	continuous	69	69	0.06	723	1413
j3034_4	discrete	67	67	0.13	904	370
j3034_4	continuous	67	67	0.07	709	1387
j3034_5	discrete	63	63	0.14	877	349
j3034_5	continuous	63	63	0.11	843	1617
j3034_6	discrete	52	52	0.13	781	328
j3034_6	continuous	52	52	0.09	817	1574
j3034_7	discrete	58	58	0.14	887	316

j3034_7	continuous	58	58	0.1	807	1557
j3034_8	discrete	58	58	0.07	551	288
j3034_8	continuous	58	58	0.09	853	1659
j3034_9	discrete	60	60	0.03	662	317
j3034_9	continuous	60	60	0.04	777	1515
j3035_10	discrete	59	59	0.04	644	320
j3035_10	continuous	59	59	0.03	767	1496
j3035_1	discrete	57	57	0.1	982	340
j3035_1	continuous	57	57	0.14	849	1632
j3035_2	discrete	53	53	0.03	587	283
j3035_2	continuous	53	53	0.03	879	1704
j3035_3	discrete	60	60	0.09	848	340
j3035_3	continuous	60	60	0.08	803	1552
j3035_4	discrete	50	50	0.09	816	306
j3035_4	continuous	50	50	0.09	865	1662
j3035_5	discrete	60	60	0.09	704	340
j3035_5	continuous	60	60	0.09	797	1548
j3035_6	discrete	58	58	0.14	1125	359
j3035_6	continuous	58	58	0.1	733	1425
j3035_7	discrete	61	61	0.07	738	313
j3035_7	continuous	61	61	0.08	713	1397
j3035_8	discrete	63	63	0.05	740	300
j3035_8	continuous	63	63	0.02	851	1651
j3035_9	discrete	59	59	0.1	952	345
j3035_9	continuous	59	59	0.09	723	1421
j3036_10	discrete	59	59	0.04	707	327
j3036_10	continuous	59	59	0.02	801	1556
j3036_1	discrete	66	66	0.04	852	331
j3036_1	continuous	66	66	0.03	831	1607
j3036_2	discrete	44	44	0.02	434	244
j3036_2	continuous	-inf	inf	0.01	877	1732
j3036_3	discrete	61	61	0.04	757	321

j3036_3	continuous	61	61	0.02	791	1533
j3036_4	discrete	59	59	0.02	508	304
j3036_4	continuous	59	59	0.02	783	1565
j3036_5	discrete	64	64	0.05	754	320
j3036_5	continuous	64	64	0.02	853	1673
j3036_6	discrete	46	46	0.01	298	251
j3036_6	continuous	46	46	0.02	849	1697
j3036_7	discrete	56	56	0.02	595	301
j3036_7	continuous	56	56	0.02	819	1619
j3036_8	discrete	63	63	0.05	691	291
j3036_8	continuous	63	63	0.06	719	1415
j3036_9	discrete	59	59	0.04	605	312
j3036_9	continuous	59	59	0.02	895	1742
j3037_10	discrete	81	81	10.07	1811	488
j3037_10	continuous	81	81	2.75	693	1333
j3037_1	discrete	71	82	1200	1820	465
j3037_1	continuous	79	79	2.28	751	1437
j3037_2	discrete	69	69	20.01	1304	417
j3037_2	continuous	69	69	0.59	793	1513
j3037_3	discrete	77	86	1200	1895	493
j3037_3	continuous	81	81	1.35	731	1397
j3037_4	discrete	83	83	20.14	1730	472
j3037_4	continuous	83	83	1.81	733	1405
j3037_5	discrete	80	80	992.44	1536	467
j3037_5	continuous	80	80	1.26	705	1360
j3037_6	discrete	73	73	977.93	1990	489
j3037_6	continuous	73	73	0.56	603	1182
j3037_7	discrete	83	92	1200.0	2032	493
j3037_7	continuous	92	92	3.48	725	1379
j3037_8	discrete	72	72	19.68	1554	457
j3037_8	continuous	72	72	0.49	673	1286
j3037_9	discrete	57	57	4.82	1003	339

j3037_9	continuous	57	57	0.78	675	1303
j3038_10	discrete	60	60	0.08	576	341
j3038_10	continuous	60	60	0.08	763	1503
j3038_1	discrete	48	48	0.09	548	301
j3038_1	continuous	48	48	0.32	783	1529
j3038_2	discrete	54	54	0.14	774	333
j3038_2	continuous	54	54	0.41	819	1588
j3038_3	discrete	59	59	0.24	806	342
j3038_3	continuous	59	59	0.26	839	1610
j3038_4	discrete	59	59	0.21	951	363
j3038_4	continuous	59	59	0.17	753	1463
j3038_5	discrete	71	71	0.86	1077	407
j3038_5	continuous	71	71	0.55	799	1543
j3038_6	discrete	63	63	0.26	1559	464
j3038_6	continuous	63	63	0.15	723	1406
j3038_7	discrete	65	65	0.26	969	376
j3038_7	continuous	65	65	0.37	881	1688
j3038_8	discrete	61	61	0.52	1122	384
j3038_8	continuous	61	61	0.34	793	1531
j3038_9	discrete	63	63	0.34	1084	369
j3038_9	continuous	63	63	0.55	823	1584
j3039_10	discrete	60	60	0.12	867	339
j3039_10	continuous	60	60	0.06	761	1480
j3039_1	discrete	55	55	0.16	762	337
j3039_1	continuous	55	55	0.14	839	1625
j3039_2	discrete	54	54	0.07	603	317
j3039_2	continuous	54	54	0.04	835	1638
j3039_3	discrete	54	54	0.24	816	357
j3039_3	continuous	54	54	0.24	805	1559
j3039_4	discrete	53	53	0.12	718	334
j3039_4	continuous	53	53	0.25	913	1758
j3039_5	discrete	55	55	0.09	841	323

j3039_5	continuous	55	55	0.11	839	1620
j3039_6	discrete	69	69	0.46	1168	387
j3039_6	continuous	69	69	0.16	765	1482
j3039_7	discrete	56	56	0.1	773	323
j3039_7	continuous	56	56	0.06	835	1605
j3039_8	discrete	67	67	0.07	857	363
j3039_8	continuous	67	67	0.03	847	1654
j3039_9	discrete	64	64	0.11	707	356
j3039_9	continuous	64	64	0.05	727	1448
j303_10	discrete	59	59	0.11	918	308
j303_10	continuous	59	59	0.15	1135	2115
j303_1	discrete	72	72	0.19	1462	418
j303_1	continuous	72	72	0.18	1083	2018
j303_2	discrete	40	40	0.03	403	227
j303_2	continuous	40	40	0.03	1247	2380
j303_3	discrete	57	57	0.04	785	298
j303_3	continuous	57	57	0.04	1175	2220
j303_4	discrete	98	98	0.06	1354	466
j303_4	continuous	98	98	0.04	909	1724
j303_5	discrete	53	53	0.04	636	281
j303_5	continuous	53	53	0.04	1171	2199
j303_6	discrete	54	54	0.04	603	283
j303_6	continuous	54	54	0.06	1129	2164
j303_7	discrete	48	48	0.03	549	256
j303_7	continuous	48	48	0.03	1277	2397
j303_8	discrete	54	54	0.02	632	287
j303_8	continuous	54	54	0.03	1219	2301
j303_9	discrete	65	65	0.07	977	329
j303_9	continuous	65	65	0.08	1171	2174
j3040_10	discrete	51	51	0.03	418	300
j3040_10	continuous	51	51	0.02	809	1611
j3040_1	discrete	51	51	0.04	378	305

j3040_1	continuous	51	51	0.03	857	1715
j3040_2	discrete	56	56	0.04	509	320
j3040_2	continuous	56	56	0.02	877	1758
j3040_3	discrete	57	57	0.06	798	329
j3040_3	continuous	57	57	0.03	881	1699
j3040_4	discrete	57	57	0.04	453	329
j3040_4	continuous	57	57	0.02	817	1635
j3040_5	discrete	65	65	0.04	629	338
j3040_5	continuous	-inf	inf	0.01	793	1577
j3040_6	discrete	60	60	0.04	656	341
j3040_6	continuous	60	60	0.03	709	1394
j3040_7	discrete	46	46	0.03	347	280
j3040_7	continuous	46	46	0.02	853	1707
j3040_8	discrete	57	57	0.05	673	329
j3040_8	continuous	57	57	0.02	871	1696
j3040_9	discrete	64	64	0.08	644	332
j3040_9	continuous	64	64	0.03	821	1620
j3041_10	discrete	85	119	1200	2727	609
j3041_10	continuous	99	99	149.46	683	1287
j3041_1	discrete	-inf	inf	1200	2114	517
j3041_1	continuous	86	86	1.75	607	1171
j3041_2	discrete	72	92	1200.0	1900	501
j3041_2	continuous	89	89	22.84	659	1267
j3041_3	discrete	85	85	534.39	2025	521
j3041_3	continuous	85	85	2.29	667	1270
j3041_4	discrete	77	78	1200	2407	524
j3041_4	continuous	78	78	5.18	683	1306
j3041_5	discrete	93	103	1200.0	2362	577
j3041_5	continuous	99	99	3.56	601	1169
j3041_6	discrete	100	104	1200.0	2004	533
j3041_6	continuous	103	103	145.36	627	1189
j3041_7	discrete	87	97	1200.0	2270	537

j3041_7	continuous	92	92	7.14	669	1277
j3041_8	discrete	77	90	1200	2120	541
j3041_8	continuous	88	88	30.55	747	1416
j3041_9	discrete	92	92	684.2	2291	537
j3041_9	continuous	92	92	3.55	679	1290
j3042_10	discrete	75	75	0.47	1118	404
j3042_10	continuous	75	75	0.27	795	1543
j3042_1	discrete	58	58	0.27	829	353
j3042_1	continuous	58	58	0.61	873	1679
j3042_2	discrete	50	50	1.23	707	333
j3042_2	continuous	50	50	7.5	863	1661
j3042_3	discrete	60	60	14.34	1117	392
j3042_3	continuous	60	60	7.19	787	1524
j3042_4	discrete	49	49	7.96	822	329
j3042_4	continuous	49	49	8.25	871	1671
j3042_5	discrete	52	52	0.32	1084	369
j3042_5	continuous	52	52	0.85	847	1629
j3042_6	discrete	66	66	1.35	983	389
j3042_6	continuous	66	66	2.18	767	1492
j3042_7	discrete	66	66	0.76	945	409
j3042_7	continuous	66	66	0.42	779	1510
j3042_8	discrete	82	82	3.13	1548	449
j3042_8	continuous	82	82	0.43	739	1428
j3042_9	discrete	60	60	3.2	849	369
j3042_9	continuous	60	60	4.04	877	1680
j3043_10	discrete	60	60	0.21	742	349
j3043_10	continuous	60	60	0.66	775	1518
j3043_1	discrete	55	55	3.59	1017	373
j3043_1	continuous	55	55	4.91	833	1603
j3043_2	discrete	43	43	0.28	892	321
j3043_2	continuous	43	43	0.2	885	1696
j3043_3	discrete	57	57	1.17	766	361

j3043_3	continuous	57	57	1.82	873	1689
j3043_4	discrete	67	67	0.18	947	383
j3043_4	continuous	67	67	0.21	823	1589
j3043_5	discrete	64	64	1.78	1390	413
j3043_5	continuous	64	64	2.66	821	1585
j3043_6	discrete	58	58	0.74	1114	393
j3043_6	continuous	58	58	0.47	717	1402
j3043_7	discrete	52	52	0.13	675	329
j3043_7	continuous	52	52	0.37	865	1672
j3043_8	discrete	62	62	0.47	742	369
j3043_8	continuous	62	62	1.01	705	1398
j3043_9	discrete	57	57	0.27	500	333
j3043_9	continuous	57	57	3.07	865	1685
j3044_10	discrete	63	63	0.15	602	353
j3044_10	continuous	63	63	0.05	805	1586
j3044_1	discrete	50	50	0.1	516	301
j3044_1	continuous	50	50	0.03	885	1724
j3044_2	discrete	54	54	0.09	393	317
j3044_2	continuous	54	54	0.03	841	1702
j3044_3	discrete	51	51	0.16	539	305
j3044_3	continuous	51	51	0.04	873	1700
j3044_4	discrete	57	57	0.06	507	329
j3044_4	continuous	57	57	0.03	685	1386
j3044_5	discrete	55	55	0.16	506	321
j3044_5	continuous	55	55	0.04	905	1785
j3044_6	discrete	56	56	0.11	568	325
j3044_6	continuous	56	56	0.03	733	1456
j3044_7	discrete	42	42	0.03	296	269
j3044_7	continuous	42	42	0.03	845	1719
j3044_8	discrete	49	49	0.12	492	297
j3044_8	continuous	49	49	0.04	861	1686
j3044_9	discrete	64	64	0.07	471	357

j3044_9	continuous	64	64	0.02	701	1422
j3045_10	discrete	84	94	1200	2292	537
j3045_10	continuous	90	90	36.93	541	1048
j3045_1	discrete	73	85	1200	2258	517
j3045_1	continuous	82	82	34.16	611	1163
j3045_2	discrete	99	128	1200	3306	661
j3045_2	continuous	115	125	1200.0	533	1015
j3045_3	discrete	86	102	1200.0	2307	533
j3045_3	continuous	92	92	2.04	593	1140
j3045_4	discrete	73	96	1200	1969	501
j3045_4	continuous	84	84	13.16	717	1373
j3045_5	discrete	80	86	1200.0	1946	509
j3045_5	continuous	86	86	3.17	623	1204
j3045_6	discrete	94	147	1200	3663	765
j3045_6	continuous	118	129	1200.0	547	1037
j3045_7	discrete	83	128	1200	2410	613
j3045_7	continuous	101	101	6.93	567	1083
j3045_8	discrete	75	107	1200	2138	537
j3045_8	continuous	94	94	34.3	587	1132
j3045_9	discrete	63	95	1200	1887	481
j3045_9	continuous	82	82	23.72	711	1358
j3046_10	discrete	51	56	1200	1043	369
j3046_10	continuous	55	55	73.28	865	1661
j3046_1	discrete	59	59	4.23	1092	377
j3046_1	continuous	59	59	21.13	853	1640
j3046_2	discrete	67	67	4.28	1013	397
j3046_2	continuous	67	67	34.89	801	1552
j3046_3	discrete	65	65	22.24	1079	385
j3046_3	continuous	65	65	176.23	865	1669
j3046_4	discrete	64	64	51.87	842	381
j3046_4	continuous	64	64	4.55	793	1547
j3046_5	discrete	57	57	0.51	650	353

j3046_5	continuous	57	57	3.07	849	1655
j3046_6	discrete	59	59	4.27	997	361
j3046_6	continuous	59	59	41.26	853	1648
j3046_7	discrete	54	68	1200	1103	373
j3046_7	continuous	59	59	467.24	813	1570
j3046_8	discrete	58	58	941.89	898	361
j3046_8	continuous	58	58	23.02	801	1551
j3046_9	discrete	49	49	1.52	835	321
j3046_9	continuous	49	49	5.65	861	1660
j3047_10	discrete	60	60	1101.18	1095	397
j3047_10	continuous	60	60	11.71	833	1606
j3047_1	discrete	58	58	0.23	816	361
j3047_1	continuous	58	58	0.24	713	1396
j3047_2	discrete	59	59	0.2	709	345
j3047_2	continuous	59	59	0.17	837	1624
j3047_3	discrete	55	55	0.26	731	353
j3047_3	continuous	55	55	0.41	813	1578
j3047_4	discrete	49	49	0.39	660	321
j3047_4	continuous	49	49	1.34	801	1554
j3047_5	discrete	47	47	0.4	682	305
j3047_5	continuous	47	47	2.04	865	1671
j3047_6	discrete	53	53	1.85	950	377
j3047_6	continuous	53	53	4.39	853	1641
j3047_7	discrete	66	66	1168.79	1020	377
j3047_7	continuous	66	66	1.13	861	1662
j3047_8	discrete	48	48	0.21	709	325
j3047_8	continuous	48	48	0.22	841	1633
j3047_9	discrete	65	65	0.28	829	377
j3047_9	continuous	65	65	0.29	801	1564
j3048_10	discrete	54	54	0.08	514	317
j3048_10	continuous	54	54	0.03	881	1725
j3048_1	discrete	63	63	0.11	904	353

j3048_1	continuous	-inf	inf	0.01	773	1510
j3048_2	discrete	54	54	0.1	616	317
j3048_2	continuous	54	54	0.03	757	1477
j3048_3	discrete	50	50	0.06	429	301
j3048_3	continuous	50	50	0.03	909	1770
j3048_4	discrete	57	57	0.09	469	329
j3048_4	continuous	57	57	0.03	821	1622
j3048_5	discrete	58	58	0.09	453	333
j3048_5	continuous	58	58	0.04	917	1807
j3048_6	discrete	58	58	0.1	692	333
j3048_6	continuous	-inf	inf	0.01	813	1594
j3048_7	discrete	55	55	0.09	368	321
j3048_7	continuous	55	55	0.03	825	1658
j3048_8	discrete	44	44	0.06	403	277
j3048_8	continuous	44	44	0.02	777	1565
j3048_9	discrete	59	59	0.1	478	337
j3048_9	continuous	-inf	inf	0.01	857	1703
j304_10	discrete	48	48	0.03	532	257
j304_10	continuous	48	48	0.03	1191	2255
j304_1	discrete	49	49	0.05	511	250
j304_1	continuous	49	49	0.02	1023	1965
j304_2	discrete	60	60	0.03	636	297
j304_2	continuous	60	60	0.03	1085	2077
j304_3	discrete	47	47	0.02	492	249
j304_3	continuous	47	47	0.03	1227	2316
j304_4	discrete	57	57	0.02	639	293
j304_4	continuous	57	57	0.02	983	1878
j304_5	discrete	59	59	0.03	674	299
j304_5	continuous	59	59	0.03	1211	2283
j304_6	discrete	45	45	0.02	307	236
j304_6	continuous	45	45	0.02	1143	2279
j304_7	discrete	56	56	0.03	547	289

j304_7	continuous	56	56	0.03	1205	2296
j304_8	discrete	55	55	0.03	515	281
j304_8	continuous	-inf	inf	0.01	1121	2148
j304_9	discrete	38	38	0.02	401	216
j304_9	continuous	38	38	0.03	1237	2385
j305_10	discrete	70	70	13.42	1548	431
j305_10	continuous	70	70	2.16	1151	2114
j305_1	discrete	53	53	16.37	954	328
j305_1	continuous	53	53	3.12	1137	2091
j305_2	discrete	82	82	49.04	1735	448
j305_2	continuous	82	82	2.47	1117	2047
j305_3	discrete	76	76	197.29	1992	465
j305_3	continuous	76	76	7.59	1093	2002
j305_4	discrete	63	63	221.01	1162	355
j305_4	continuous	63	63	15.54	1209	2219
j305_5	discrete	76	76	24.8	2047	495
j305_5	continuous	76	76	1.86	1037	1907
j305_6	discrete	64	64	2.87	1326	367
j305_6	continuous	64	64	1.66	1177	2158
j305_7	discrete	76	76	58.38	2100	477
j305_7	continuous	76	76	15.1	1225	2233
j305_8	discrete	60	73	1200	1362	384
j305_8	continuous	67	67	8.4	1039	1902
j305_9	discrete	49	49	1.96	951	311
j305_9	continuous	49	49	3.68	1165	2149
j306_10	discrete	61	61	2.0	1312	396
j306_10	continuous	61	61	3.31	1171	2174
j306_1	discrete	59	59	981.16	764	320
j306_1	continuous	59	59	6.14	1169	2182
j306_2	discrete	51	51	1.07	1072	339
j306_2	continuous	51	51	3.14	1147	2130
j306_3	discrete	48	48	0.43	501	293

j306_3	continuous	48	48	0.56	1173	2247
j306_4	discrete	42	42	1006.73	516	261
j306_4	continuous	42	42	3.91	1271	2410
j306_5	discrete	67	67	0.9	1198	385
j306_5	continuous	67	67	0.97	1175	2186
j306_6	discrete	37	37	0.16	704	269
j306_6	continuous	37	37	1.5	1247	2317
j306_7	discrete	46	46	0.23	824	309
j306_7	continuous	46	46	0.39	1123	2092
j306_8	discrete	39	39	0.19	700	265
j306_8	continuous	39	39	3.87	1309	2432
j306_9	discrete	51	51	0.33	811	323
j306_9	continuous	51	51	0.68	1113	2074
j307_10	discrete	49	49	0.14	711	285
j307_10	continuous	49	49	0.24	1125	2109
j307_1	discrete	55	55	0.06	671	301
j307_1	continuous	55	55	0.04	1203	2248
j307_2	discrete	42	42	0.08	466	262
j307_2	continuous	42	42	0.27	1249	2369
j307_3	discrete	42	42	0.17	698	273
j307_3	continuous	42	42	0.36	1217	2273
j307_4	discrete	44	44	0.0	351	254
j307_4	continuous	44	44	0.04	1225	2376
j307_5	discrete	44	44	0.28	541	277
j307_5	continuous	44	44	0.42	1279	2439
j307_6	discrete	35	35	0.07	441	224
j307_6	continuous	35	35	0.13	1305	2467
j307_7	discrete	50	50	0.17	779	320
j307_7	continuous	50	50	0.13	1189	2231
j307_8	discrete	44	44	0.21	625	280
j307_8	continuous	44	44	0.22	1217	2294
j307_9	discrete	60	60	0.14	804	325

j307_9	continuous	60	60	0.18	1181	2201
j308_10	discrete	67	67	0.06	722	349
j308_10	continuous	67	67	0.04	1095	2102
j308_1	discrete	44	44	0.05	577	265
j308_1	continuous	44	44	0.12	1185	2241
j308_2	discrete	51	51	0.04	489	285
j308_2	continuous	51	51	0.03	1193	2283
j308_3	discrete	53	53	0.05	530	289
j308_3	continuous	53	53	0.04	1335	2539
j308_4	discrete	48	48	0.06	496	271
j308_4	continuous	48	48	0.04	1247	2366
j308_5	discrete	58	58	0.09	692	307
j308_5	continuous	58	58	0.04	1169	2222
j308_6	discrete	47	47	0.05	498	268
j308_6	continuous	47	47	0.04	1281	2454
j308_7	discrete	41	41	0.04	375	241
j308_7	continuous	41	41	0.03	1269	2433
j308_8	discrete	51	51	0.06	648	296
j308_8	continuous	51	51	0.13	1253	2364
j308_9	discrete	39	39	0.05	372	236
j308_9	continuous	39	39	0.04	1337	2552
j309_1	discrete	83	83	66.06	1987	481
j309_1	continuous	83	83	69.29	999	1824
j309_2	discrete	89	97	1200	2696	553
j309_2	continuous	77	92	1200	905	1640
j309_3	discrete	68	68	83.33	1812	441
j309_3	continuous	68	68	509.21	1063	1932
j309_4	discrete	65	77	1200	1690	417
j309_4	continuous	71	71	39.12	1115	2039
j309_5	discrete	70	70	52.27	1662	421
j309_5	continuous	70	70	1.66	941	1723
j309_6	discrete	59	59	110.71	1419	365

j309_6	continuous	59	59	36.06	1077	1970
j309_7	discrete	59	65	1200	1707	417
j309_7	continuous	63	63	108.27	1093	2009
j309_8	discrete	81	108	1200	2322	529
j309_8	continuous	91	91	13.88	987	1800
j309_9	discrete	60	64	1200.0	1860	421
j309_9	continuous	63	63	77.68	1025	1869

Table B.2: j60 instances

Instance	Formulation	Lower Bound	Upper Bound	Execution Time	Variables	Constraints
j6010_10	discrete	73	73	0.71	1945	460
j6010_10	continuous	73	73	13.75	5493	9970
j6010_1	discrete	85	85	1.05	2817	520
j6010_1	continuous	85	85	12.6	5509	9915
j6010_2	discrete	62	62	0.85	2008	456
j6010_2	continuous	62	62	36.57	5533	9960
j6010_3	discrete	72	72	2.38	1992	480
j6010_3	continuous	72	72	654.91	5413	9857
j6010_4	discrete	80	80	0.84	2364	500
j6010_4	continuous	80	80	10.22	5493	9933
j6010_5	discrete	79	79	1.51	2348	500
j6010_5	continuous	79	79	111.93	5301	9600
j6010_6	discrete	67	67	1.27	2186	492
j6010_6	continuous	67	67	43.31	5089	9213
j6010_7	discrete	69	69	6.51	2035	492
j6010_7	continuous	69	73	1200	5433	9842
j6010_8	discrete	65	65	2.43	3133	524
j6010_8	continuous	64	65	1200	5453	9795
j6010_9	discrete	73	73	5.47	2288	516
j6010_9	continuous	73	79	1200	5273	9524
j6011_10	discrete	58	58	0.47	1525	400
j6011_10	continuous	58	58	3.05	5645	10280
j6011_1	discrete	71	71	0.48	1766	472
j6011_1	continuous	71	71	5.73	5469	10061
j6011_2	discrete	61	61	0.46	1648	420
j6011_2	continuous	61	61	2.27	5381	9766
j6011_3	discrete	76	76	0.28	1497	460
j6011_3	continuous	76	76	0.18	5277	9774
j6011_4	discrete	69	69	0.98	2074	481
j6011_4	continuous	69	69	6.82	5181	9330

j6011_5	discrete	65	65	0.56	1689	432
j6011_5	continuous	65	65	2.54	5557	10095
j6011_6	discrete	70	70	0.35	1349	452
j6011_6	continuous	70	70	7.07	5413	10012
j6011_7	discrete	70	70	0.32	1287	436
j6011_7	continuous	70	70	0.7	5481	10169
j6011_8	discrete	69	69	0.27	1588	432
j6011_8	continuous	69	69	0.18	5465	10050
j6011_9	discrete	62	62	0.41	1564	412
j6011_9	continuous	62	62	1.09	5501	10021
j6012_10	discrete	79	79	0.43	1861	472
j6012_10	continuous	79	79	0.19	5161	9493
j6012_1	discrete	59	59	0.23	1182	392
j6012_1	continuous	59	59	0.16	5561	10227
j6012_2	discrete	58	58	0.23	1414	388
j6012_2	continuous	58	58	0.15	5621	10287
j6012_3	discrete	75	75	0.29	1469	456
j6012_3	continuous	75	75	0.17	5301	9820
j6012_4	discrete	69	69	0.46	1655	432
j6012_4	continuous	69	69	0.17	5365	9797
j6012_5	discrete	63	63	0.22	1370	408
j6012_5	continuous	63	63	0.16	5629	10388
j6012_6	discrete	54	54	0.16	1001	372
j6012_6	continuous	54	54	0.16	5649	10572
j6012_7	discrete	71	71	0.37	1826	440
j6012_7	continuous	71	71	0.16	5265	9585
j6012_8	discrete	60	60	0.3	1293	396
j6012_8	continuous	60	60	0.16	5249	9618
j6012_9	discrete	59	59	0.19	966	392
j6012_9	continuous	59	59	0.14	5429	10206
j6013_10	discrete	82	144	1200	6396	736
j6013_10	continuous	-	-	1200	5423	9737

j6013_1	discrete	86	139	1200	5966	712
j6013_1	continuous	-	-	1200	5315	9512
j6013_2	discrete	-	-	1200.0	5071	664
j6013_2	continuous	-	-	1200.0	5527	9913
j6013_3	discrete	81	102	1200	4371	584
j6013_3	continuous	-	-	1200	5601	10049
j6013_4	discrete	94	128	1200	5198	680
j6013_4	continuous	-	-	1200	5561	9979
j6013_5	discrete	75	125	1200	5312	660
j6013_5	continuous	-	-	1200	5681	10189
j6013_6	discrete	85	111	1200	4334	600
j6013_6	continuous	-	-	1200	5645	10126
j6013_7	discrete	73	115	1200	4984	616
j6013_7	continuous	-	-	1200	5609	10063
j6013_8	discrete	104	149	1200	6051	756
j6013_8	continuous	-	-	1200	5143	9190
j6013_9	discrete	90	128	1200	4919	668
j6013_9	continuous	-	-	1200	5305	9531
j6014_10	discrete	69	79	1200.0	2682	516
j6014_10	continuous	-	-	1200	5077	9146
j6014_1	discrete	60	61	1200	1424	428
j6014_1	continuous	-	-	1200	5425	9877
j6014_2	discrete	65	65	2.19	1816	436
j6014_2	continuous	-	-	1200	5381	9790
j6014_3	discrete	61	67	1200	2180	452
j6014_3	continuous	-	-	1200	5225	9431
j6014_4	discrete	65	76	1200	2043	468
j6014_4	continuous	-	-	1200	5241	9484
j6014_5	discrete	59	59	3.09	2300	460
j6014_5	continuous	-	-	1200	5473	9858
j6014_6	discrete	65	65	909.91	1543	436
j6014_6	continuous	-	-	1200	5341	9808

j6014_7	discrete	69	69	3.09	2330	484
j6014_7	continuous	-	-	1200	5273	9523
j6014_8	discrete	88	88	0.42	2204	508
j6014_8	continuous	88	88	1112.99	5221	9495
j6014_9	discrete	61	61	926.26	2179	456
j6014_9	continuous	61	69	1200	5729	10316
j6015_10	discrete	61	61	0.73	2230	452
j6015_10	continuous	61	61	790.27	5429	9781
j6015_1	discrete	84	84	0.46	1931	492
j6015_1	continuous	84	84	0.21	5129	9402
j6015_2	discrete	89	89	0.59	2079	516
j6015_2	continuous	89	89	10.5	5313	9753
j6015_3	discrete	72	72	0.48	1884	444
j6015_3	continuous	72	72	0.25	5621	10194
j6015_4	discrete	75	75	0.44	1620	456
j6015_4	continuous	75	75	2.67	5241	9584
j6015_5	discrete	70	70	0.64	1781	460
j6015_5	continuous	70	70	12.9	5349	9700
j6015_6	discrete	76	76	0.7	1807	484
j6015_6	continuous	76	76	4.21	5485	10059
j6015_7	discrete	64	64	1.08	1581	436
j6015_7	continuous	64	64	25.85	5637	10316
j6015_8	discrete	79	79	0.47	1976	472
j6015_8	continuous	79	79	0.39	5377	9888
j6015_9	discrete	72	72	0.26	1183	444
j6015_9	continuous	72	72	0.2	5489	10192
j6016_10	discrete	68	68	0.39	1318	428
j6016_10	continuous	68	68	0.21	5389	9989
j6016_1	discrete	64	64	0.3	928	412
j6016_1	continuous	64	64	0.16	5353	10159
j6016_2	discrete	64	64	0.32	1101	412
j6016_2	continuous	64	64	0.17	5285	9867

j6016_3	discrete	53	53	0.2	1017	368
j6016_3	continuous	53	53	0.17	5185	9669
j6016_4	discrete	60	60	0.25	1238	396
j6016_4	continuous	60	60	0.21	5325	9884
j6016_5	discrete	66	66	1041.33	1647	420
j6016_5	continuous	66	66	0.22	5349	9722
j6016_6	discrete	66	66	0.3	1048	420
j6016_6	continuous	66	66	0.15	5265	9874
j6016_7	discrete	82	82	0.47	1782	484
j6016_7	continuous	82	82	0.87	5157	9440
j6016_8	discrete	68	68	0.29	1348	428
j6016_8	continuous	-	-	0.08	5345	9975
j6016_9	discrete	54	54	0.15	887	372
j6016_9	continuous	54	54	0.17	5493	10309
j6017_10	discrete	72	72	12.09	2786	520
j6017_10	continuous	72	72	15.23	4627	8338
j6017_1	discrete	84	88	1200	3249	549
j6017_1	continuous	86	86	15.02	4393	7903
j6017_2	discrete	69	69	2.11	2942	518
j6017_2	continuous	67	69	1200	4555	8194
j6017_3	discrete	89	89	2.99	3466	592
j6017_3	continuous	89	89	164.06	4665	8381
j6017_4	discrete	71	71	0.35	2532	498
j6017_4	continuous	71	71	2.76	4285	7730
j6017_5	discrete	59	59	3.41	1681	424
j6017_5	continuous	59	59	594.01	4597	8300
j6017_6	discrete	69	69	0.93	2580	487
j6017_6	continuous	69	69	17.77	4487	8090
j6017_7	discrete	83	83	5.07	3726	597
j6017_7	continuous	83	83	9.21	4719	8472
j6017_8	discrete	85	85	578.76	3241	553
j6017_8	continuous	74	87	1200	4751	8531

j6017_9	discrete	76	76	5.58	3229	559
j6017_9	continuous	76	76	11.53	4257	7660
j6018_10	discrete	97	97	0.13	1800	558
j6018_10	continuous	97	97	0.1	4401	8118
j6018_1	discrete	81	81	0.52	3321	545
j6018_1	continuous	81	81	2.55	4563	8250
j6018_2	discrete	69	69	0.28	1703	455
j6018_2	continuous	69	69	1.73	4847	8902
j6018_3	discrete	77	77	0.33	1907	470
j6018_3	continuous	77	77	0.84	4623	8464
j6018_4	discrete	71	71	0.57	2002	480
j6018_4	continuous	71	71	5.34	4887	8894
j6018_5	discrete	80	80	0.27	1975	473
j6018_5	continuous	80	80	0.95	4657	8517
j6018_6	discrete	61	61	0.08	1326	401
j6018_6	continuous	61	61	0.11	4493	8252
j6018_7	discrete	93	93	2.19	2641	553
j6018_7	continuous	93	93	2.35	4211	7620
j6018_8	discrete	78	78	0.15	1848	477
j6018_8	continuous	78	78	0.11	4567	8432
j6018_9	discrete	69	69	0.26	1880	468
j6018_9	continuous	69	69	1.15	4445	8096
j6019_10	discrete	78	78	0.09	1525	471
j6019_10	continuous	78	78	0.12	4463	8256
j6019_1	discrete	62	62	0.18	1199	417
j6019_1	continuous	62	62	0.49	4943	9204
j6019_2	discrete	83	83	0.13	2008	494
j6019_2	continuous	83	83	0.11	4547	8310
j6019_3	discrete	83	83	0.23	1726	486
j6019_3	continuous	83	83	0.85	4791	8831
j6019_4	discrete	67	67	0.27	1763	453
j6019_4	continuous	67	67	0.98	4925	8935

j6019_5	discrete	73	73	0.26	1850	469
j6019_5	continuous	73	73	0.73	4581	8416
j6019_6	discrete	69	69	0.12	1035	442
j6019_6	continuous	69	69	0.31	4603	8760
j6019_7	discrete	60	60	0.23	1331	405
j6019_7	continuous	60	60	0.88	4871	8973
j6019_8	discrete	87	87	0.34	2587	520
j6019_8	continuous	87	87	0.63	4437	8065
j6019_9	discrete	69	69	0.35	1780	464
j6019_9	continuous	69	69	541.1	4541	8292
j601_10	discrete	80	80	0.29	2194	481
j601_10	continuous	80	80	2.67	5145	9291
j601_1	discrete	77	77	0.4	2095	465
j601_1	continuous	77	77	2.94	5393	9774
j601_2	discrete	68	68	5.02	2223	461
j601_2	continuous	68	68	19.41	5217	9382
j601_3	discrete	68	68	0.74	2750	506
j601_3	continuous	68	68	327.77	5389	9655
j601_4	discrete	91	91	1.01	3334	541
j601_4	continuous	91	91	12.27	5213	9346
j601_5	discrete	73	73	1.38	2547	475
j601_5	continuous	73	73	18.17	5111	9183
j601_6	discrete	66	66	1.39	2082	422
j601_6	continuous	64	66	1200	5469	9793
j601_7	discrete	72	72	36.25	2764	476
j601_7	continuous	64	76	1200	5423	9687
j601_8	discrete	75	75	9.45	4451	615
j601_8	continuous	75	75	14.9	4861	8703
j601_9	discrete	85	85	2.0	2539	514
j601_9	continuous	85	85	8.18	5167	9289
j6020_10	discrete	70	70	0.23	1767	441
j6020_10	continuous	70	70	0.11	4619	8432

j6020_1	discrete	60	60	0.14	1115	403
j6020_1	continuous	60	60	0.1	4713	8833
j6020_2	discrete	78	78	0.18	2083	473
j6020_2	continuous	78	78	0.12	4361	7952
j6020_3	discrete	69	69	0.12	1278	425
j6020_3	continuous	-	-	0.03	4633	8664
j6020_4	discrete	86	86	0.17	2302	497
j6020_4	continuous	86	86	0.1	4833	8805
j6020_5	discrete	71	71	0.24	1547	429
j6020_5	continuous	71	71	0.1	4819	8846
j6020_6	discrete	97	97	0.36	3229	560
j6020_6	continuous	97	97	0.12	4275	7768
j6020_7	discrete	74	74	0.14	1467	441
j6020_7	continuous	74	74	0.1	4641	8595
j6020_8	discrete	65	65	0.15	1219	417
j6020_8	continuous	65	65	0.15	4871	9007
j6020_9	discrete	74	74	0.14	1324	449
j6020_9	continuous	74	74	0.1	4509	8404
j6021_10	discrete	-	-	1200	4140	583
j6021_10	continuous	66	94	1200	4543	8133
j6021_1	discrete	91	127	1200	4991	704
j6021_1	continuous	88	123	1200	4089	7313
j6021_2	discrete	-	-	1200	5720	748
j6021_2	continuous	99	127	1200.0	3997	7138
j6021_3	discrete	-	-	1200	4952	658
j6021_3	continuous	78	100	1200	4339	7796
j6021_4	discrete	-	-	1200	5751	711
j6021_4	continuous	81	105	1200	3791	6793
j6021_5	discrete	-	-	1200	4047	628
j6021_5	continuous	75	101	1200	4475	8054
j6021_6	discrete	-	-	1200	5222	673
j6021_6	continuous	71	93	1200	4397	7884

j6021_7	discrete	94	132	1200	5200	710
j6021_7	continuous	88	107	1200	4105	7374
j6021_8	discrete	-	-	1200	5286	731
j6021_8	continuous	91	116	1200	4079	7312
j6021_9	discrete	-	-	1200	3898	598
j6021_9	continuous	-	-	1200	4731	8506
j6022_10	discrete	70	70	0.58	1911	487
j6022_10	continuous	70	70	11.44	4805	8708
j6022_1	discrete	64	64	1.55	1625	459
j6022_1	continuous	63	64	1200	4581	8323
j6022_2	discrete	83	83	0.64	2952	559
j6022_2	continuous	83	83	1083.35	4605	8338
j6022_3	discrete	70	70	1038.67	1732	475
j6022_3	continuous	70	73	1200	4623	8404
j6022_4	discrete	70	84	1200	2838	538
j6022_4	continuous	69	74	1200.0	4499	8134
j6022_5	discrete	76	76	0.54	1647	477
j6022_5	continuous	76	76	6.88	4817	8910
j6022_6	discrete	79	79	1.07	2986	569
j6022_6	continuous	79	79	14.63	4677	8454
j6022_7	discrete	69	69	0.42	2224	499
j6022_7	continuous	69	69	10.22	4829	8781
j6022_8	discrete	59	59	1090.56	1864	457
j6022_8	continuous	59	59	16.8	4837	8800
j6022_9	discrete	65	65	0.76	2079	483
j6022_9	continuous	65	65	8.1	4981	9004
j6023_10	discrete	68	68	0.38	1818	459
j6023_10	continuous	68	68	1.72	4589	8344
j6023_1	discrete	75	75	0.5	1991	511
j6023_1	continuous	75	75	2.05	4765	8639
j6023_2	discrete	69	69	0.19	1348	442
j6023_2	continuous	-	-	0.04	4717	8765

j6023_3	discrete	78	78	923.45	2523	539
j6023_3	continuous	78	78	2.14	4479	8109
j6023_4	discrete	83	83	0.56	2296	535
j6023_4	continuous	83	83	1.51	4689	8536
j6023_5	discrete	72	72	0.5	2463	515
j6023_5	continuous	72	72	3.04	4761	8619
j6023_6	discrete	81	81	0.22	1972	499
j6023_6	continuous	81	81	0.76	4323	8021
j6023_7	discrete	60	60	0.31	1313	425
j6023_7	continuous	60	60	5.31	4645	8594
j6023_8	discrete	72	72	0.18	1680	461
j6023_8	continuous	72	72	0.14	4509	8290
j6023_9	discrete	64	64	0.09	975	426
j6023_9	continuous	64	64	0.41	4725	8924
j6024_10	discrete	66	66	0.17	1038	439
j6024_10	continuous	-	-	0.03	4533	8527
j6024_1	discrete	65	65	0.12	1222	451
j6024_1	continuous	65	65	0.98	4589	8515
j6024_2	discrete	55	55	0.16	1197	391
j6024_2	continuous	55	55	0.11	4701	8700
j6024_3	discrete	67	67	0.2	1167	439
j6024_3	continuous	67	67	0.14	4477	8396
j6024_4	discrete	78	78	0.28	1873	487
j6024_4	continuous	78	78	0.14	4665	8572
j6024_5	discrete	76	76	0.26	1814	478
j6024_5	continuous	76	76	0.13	4813	8846
j6024_6	discrete	75	75	0.23	2108	475
j6024_6	continuous	75	75	0.14	4733	8590
j6024_7	discrete	68	68	0.17	1211	446
j6024_7	continuous	68	68	0.14	4565	8504
j6024_8	discrete	81	81	0.19	1389	499
j6024_8	continuous	81	81	0.14	4585	8494

j6024_9	discrete	80	80	0.24	1862	494
j6024_9	continuous	80	80	0.36	4669	8561
j6025_10	discrete	-	-	1200	5074	712
j6025_10	continuous	-	-	1200	4263	7704
j6025_1	discrete	80	148	1200	5949	767
j6025_1	continuous	86	133	1200	3959	7056
j6025_2	discrete	-	-	1200	4816	679
j6025_2	continuous	-	-	1200	4625	8347
j6025_3	discrete	91	143	1200	5397	747
j6025_3	continuous	-	-	1200	4207	7561
j6025_4	discrete	-	-	1200	6041	755
j6025_4	continuous	-	-	1200	4295	7735
j6025_5	discrete	-	-	1200	5019	659
j6025_5	continuous	-	-	1200	4541	8141
j6025_6	discrete	-	-	1200	5263	727
j6025_6	continuous	-	-	1200	4535	8138
j6025_7	discrete	-	-	1200	3996	615
j6025_7	continuous	-	-	1200	4443	7982
j6025_8	discrete	-	-	1200	5285	688
j6025_8	continuous	-	-	1200	4851	8724
j6025_9	discrete	83	123	1200.0	5296	695
j6025_9	continuous	-	-	1200	4375	7835
j6026_10	discrete	85	85	0.99	2708	543
j6026_10	continuous	85	85	28.91	4269	7761
j6026_1	discrete	80	80	1.15	3120	563
j6026_1	continuous	80	82	1200	4849	8767
j6026_2	discrete	66	66	88.13	2454	503
j6026_2	continuous	63	70	1200	4781	8645
j6026_3	discrete	76	76	450.26	2999	555
j6026_3	continuous	71	81	1200	4929	8899
j6026_4	discrete	67	67	461.8	2744	527
j6026_4	continuous	65	73	1200	4525	8186

j6026_5	discrete	61	61	2.67	2093	471
j6026_5	continuous	61	61	50.81	4729	8555
j6026_6	discrete	74	74	20.82	3159	552
j6026_6	continuous	73	77	1200	4885	8816
j6026_7	discrete	72	72	1.17	2122	487
j6026_7	continuous	72	72	12.86	4625	8428
j6026_8	discrete	89	89	1.57	2823	547
j6026_8	continuous	89	89	36.77	4517	8211
j6026_9	discrete	65	65	513.06	2396	503
j6026_9	continuous	62	67	1200	4881	8828
j6027_10	discrete	57	57	0.62	1211	411
j6027_10	continuous	57	57	5.83	4989	9208
j6027_1	discrete	96	96	0.54	2131	559
j6027_1	continuous	96	96	0.92	4361	8029
j6027_2	discrete	74	74	0.41	1793	483
j6027_2	continuous	74	74	10.17	4265	7822
j6027_3	discrete	76	76	0.78	2067	503
j6027_3	continuous	76	76	7.44	4797	8774
j6027_4	discrete	60	60	0.36	1260	431
j6027_4	continuous	60	60	8.19	4761	8755
j6027_5	discrete	78	78	0.49	1917	487
j6027_5	continuous	78	78	0.19	4669	8553
j6027_6	discrete	64	64	0.46	1370	443
j6027_6	continuous	64	64	8.44	4969	9179
j6027_7	discrete	83	83	0.93	1791	511
j6027_7	continuous	83	83	1.19	4821	8810
j6027_8	discrete	88	88	0.37	1999	527
j6027_8	continuous	88	88	1.38	4677	8576
j6027_9	discrete	76	76	0.4	2209	535
j6027_9	continuous	76	76	7.64	4669	8498
j6028_10	discrete	74	74	0.31	1267	465
j6028_10	continuous	74	74	0.14	4869	9111

j6028_1	discrete	92	92	0.46	2085	543
j6028_1	continuous	92	92	0.17	4221	7715
j6028_2	discrete	64	64	0.33	1230	431
j6028_2	continuous	64	64	0.14	4929	9113
j6028_3	discrete	72	72	0.4	1790	463
j6028_3	continuous	72	72	0.16	4173	7641
j6028_4	discrete	84	84	0.43	2068	511
j6028_4	continuous	84	84	0.17	4753	8698
j6028_5	discrete	71	71	0.3	1541	459
j6028_5	continuous	71	71	0.15	4749	8736
j6028_6	discrete	89	89	0.76	2328	531
j6028_6	continuous	89	89	0.17	4401	8035
j6028_7	discrete	75	75	0.68	1880	475
j6028_7	continuous	75	75	0.16	4541	8336
j6028_8	discrete	62	62	0.36	1228	423
j6028_8	continuous	62	62	0.16	4989	9308
j6028_9	discrete	74	74	0.55	1604	471
j6028_9	continuous	74	74	0.15	4641	8567
j6029_10	discrete	98	153	1200	6587	787
j6029_10	continuous	-	-	1200	4901	8824
j6029_1	discrete	91	144	1200	6441	751
j6029_1	continuous	-	-	1200.0	4607	8321
j6029_2	discrete	108	166	1200	6564	839
j6029_2	continuous	92	149	1200	3871	6918
j6029_3	discrete	107	143	1200	6247	779
j6029_3	continuous	-	-	1200.0	4727	8537
j6029_4	discrete	108	160	1200	6970	839
j6029_4	continuous	-	-	1200	4637	8327
j6029_5	discrete	93	141	1200	5811	739
j6029_5	continuous	-	-	1200.0	4541	8210
j6029_6	discrete	-	-	1200	8117	915
j6029_6	continuous	-	-	1200	4393	7901

j6029_7	discrete	-	-	1200	6674	795
j6029_7	continuous	-	-	1200.0	4245	7651
j6029_8	discrete	94	122	1200	4691	683
j6029_8	continuous	-	-	1200.0	4789	8647
j602_10	discrete	69	69	0.5	1542	415
j602_10	continuous	69	69	4.76	5561	10185
j602_1	discrete	65	65	0.18	1589	430
j602_1	continuous	65	65	8.68	5499	10019
j602_2	discrete	82	82	0.11	1763	465
j602_2	continuous	82	82	0.12	5217	9534
j602_3	discrete	78	78	0.13	1590	425
j602_3	continuous	78	78	0.15	5387	9916
j602_4	discrete	78	78	0.32	2574	482
j602_4	continuous	78	78	5.16	5285	9516
j602_5	discrete	54	54	0.24	1087	365
j602_5	continuous	54	54	6.43	5627	10460
j602_6	discrete	64	64	0.39	2437	462
j602_6	continuous	64	64	9.11	5559	9968
j602_7	discrete	53	53	0.23	1284	372
j602_7	continuous	53	53	7.67	5765	10573
j602_8	discrete	66	66	0.07	1379	393
j602_8	continuous	66	66	0.12	5637	10294
j602_9	discrete	65	65	0.26	1682	425
j602_9	continuous	65	65	4.17	5441	9888
j6030_10	discrete	83	92	1200	3149	611
j6030_10	continuous	81	94	1200	4901	8857
j6030_1	discrete	70	70	5.2	1747	491
j6030_1	continuous	70	71	1200	4557	8322
j6030_2	discrete	65	84	1200	2421	511
j6030_2	continuous	65	73	1200.0	4581	8285
j6030_3	discrete	80	98	1200	2666	567
j6030_3	continuous	80	84	1200	4637	8418

j6030_4	discrete	76	76	0.43	1758	479
j6030_4	continuous	76	76	1.1	4745	8746
j6030_5	discrete	73	83	1200	1982	515
j6030_5	continuous	-	-	1200	4621	8438
j6030_6	discrete	68	68	1.02	2456	487
j6030_6	continuous	68	68	460.21	4773	8629
j6030_7	discrete	80	101	1200	2800	579
j6030_7	continuous	78	89	1200	4613	8343
j6030_8	discrete	63	63	3.6	2367	487
j6030_8	continuous	63	63	148.81	4729	8544
j6030_9	discrete	98	98	4.6	3887	667
j6030_9	continuous	98	98	549.83	4397	7961
j6031_10	discrete	56	56	0.61	1333	439
j6031_10	continuous	56	56	15.47	4945	9045
j6031_1	discrete	65	65	989.9	1311	435
j6031_1	continuous	65	65	0.19	4849	8975
j6031_2	discrete	74	74	0.67	1548	495
j6031_2	continuous	74	74	4.51	4641	8633
j6031_3	discrete	66	66	0.59	1597	455
j6031_3	continuous	66	66	3.4	4929	9004
j6031_4	discrete	68	68	0.48	1296	451
j6031_4	continuous	68	68	3.1	4741	8816
j6031_5	discrete	72	72	0.23	1527	463
j6031_5	continuous	72	72	0.21	4989	9214
j6031_6	discrete	72	72	0.9	1600	495
j6031_6	continuous	72	72	8.26	4773	8857
j6031_7	discrete	76	76	0.91	2088	511
j6031_7	continuous	76	76	6.83	4161	7596
j6031_8	discrete	75	75	1.27	2077	519
j6031_8	continuous	75	75	9.15	4345	7906
j6031_9	discrete	86	86	981.38	1951	519
j6031_9	continuous	86	86	0.21	4729	8652

j6032_10	discrete	77	77	0.36	1532	483
j6032_10	continuous	77	77	0.17	4637	8549
j6032_1	discrete	69	69	0.45	1759	451
j6032_1	continuous	69	69	0.22	5029	9165
j6032_2	discrete	114	114	0.66	3041	631
j6032_2	continuous	114	114	0.18	4469	8153
j6032_3	discrete	85	85	0.44	1481	515
j6032_3	continuous	85	85	0.17	4477	8378
j6032_4	discrete	56	56	0.21	947	399
j6032_4	continuous	56	56	0.17	4725	8918
j6032_5	discrete	77	77	0.46	1693	483
j6032_5	continuous	77	77	0.22	4417	8123
j6032_6	discrete	93	93	0.58	2129	547
j6032_6	continuous	-	-	0.05	4293	7903
j6032_7	discrete	76	76	0.44	1659	479
j6032_7	continuous	76	76	0.21	4605	8448
j6032_8	discrete	76	76	0.43	1687	479
j6032_8	continuous	76	76	0.18	4685	8606
j6032_9	discrete	74	74	0.32	1385	471
j6032_9	continuous	74	74	0.18	4621	8634
j6033_10	discrete	-	-	1200	3782	598
j6033_10	continuous	84	84	14.41	3831	6957
j6033_1	discrete	105	105	925.92	3087	621
j6033_1	continuous	105	105	2.05	3831	6954
j6033_2	discrete	100	100	0.53	3400	628
j6033_2	continuous	100	100	2.79	3829	6950
j6033_3	discrete	79	79	0.46	2432	557
j6033_3	continuous	79	79	7.15	3837	6972
j6033_4	discrete	81	81	0.37	2299	524
j6033_4	continuous	81	81	5.17	3863	7034
j6033_5	discrete	105	118	1200	4067	666
j6033_5	continuous	108	108	4.59	3577	6498

j6033_6	discrete	72	83	1200	2237	545
j6033_6	continuous	75	75	35.12	4019	7296
j6033_7	discrete	73	88	1200	2986	576
j6033_7	continuous	78	78	15.25	3969	7187
j6033_8	discrete	79	79	14.54	3611	602
j6033_8	continuous	79	79	14.08	3861	7005
j6033_9	discrete	108	108	9.77	4563	706
j6033_9	continuous	108	108	5.59	3759	6828
j6034_10	discrete	92	92	0.44	3173	604
j6034_10	continuous	92	92	2.41	3771	6876
j6034_1	discrete	72	72	0.85	1990	493
j6034_1	continuous	72	72	5.52	3739	6816
j6034_2	discrete	68	68	0.3	1944	487
j6034_2	continuous	68	68	0.46	4019	7335
j6034_3	discrete	61	61	0.28	2163	484
j6034_3	continuous	61	61	3.75	4123	7512
j6034_4	discrete	83	83	0.2	2138	518
j6034_4	continuous	83	83	0.12	4117	7611
j6034_5	discrete	80	80	0.43	2745	531
j6034_5	continuous	80	80	1.64	3765	6875
j6034_6	discrete	81	81	0.43	2076	532
j6034_6	continuous	81	81	1.1	3939	7229
j6034_7	discrete	85	85	0.7	2622	550
j6034_7	continuous	85	85	3.27	3687	6725
j6034_8	discrete	63	63	0.25	1635	458
j6034_8	continuous	63	63	1.92	4149	7607
j6034_9	discrete	77	77	0.33	1988	505
j6034_9	continuous	77	77	1.4	4079	7467
j6035_10	discrete	71	71	0.13	1246	455
j6035_10	continuous	71	71	0.1	3893	7266
j6035_1	discrete	78	78	0.27	2499	535
j6035_1	continuous	78	78	0.81	3975	7247

j6035_2	discrete	77	77	0.19	1628	470
j6035_2	continuous	77	77	0.36	3885	7217
j6035_3	discrete	89	89	0.33	2402	554
j6035_3	continuous	89	89	1.24	3853	7043
j6035_4	discrete	72	72	0.18	1781	464
j6035_4	continuous	72	72	0.36	3759	6918
j6035_5	discrete	76	76	0.22	1833	502
j6035_5	continuous	76	76	1.55	3655	6748
j6035_6	discrete	79	79	0.19	1912	501
j6035_6	continuous	79	79	0.57	3855	7076
j6035_7	discrete	73	73	0.09	1520	457
j6035_7	continuous	73	73	0.12	3617	6761
j6035_8	discrete	78	78	0.27	1944	512
j6035_8	continuous	78	78	0.92	4193	7723
j6035_9	discrete	76	76	0.25	2072	493
j6035_9	continuous	76	76	0.59	3607	6608
j6036_10	discrete	77	77	0.16	1936	491
j6036_10	continuous	77	77	0.11	3975	7340
j6036_1	discrete	61	61	0.09	1168	419
j6036_1	continuous	-	-	0.03	3959	7399
j6036_2	discrete	75	75	0.11	1463	468
j6036_2	continuous	-	-	0.03	3667	6883
j6036_3	discrete	81	81	0.11	1619	511
j6036_3	continuous	81	81	0.12	3937	7306
j6036_4	discrete	85	85	0.14	1968	524
j6036_4	continuous	85	85	0.12	3859	7075
j6036_5	discrete	57	57	0.07	974	401
j6036_5	continuous	57	57	0.1	3987	7527
j6036_6	discrete	76	76	0.09	1433	484
j6036_6	continuous	76	76	0.1	3977	7399
j6036_7	discrete	71	71	0.09	1305	452
j6036_7	continuous	-	-	0.03	4109	7696

j6036_8	discrete	69	69	0.1	1222	449
j6036_8	continuous	69	69	0.1	4073	7602
j6036_9	discrete	86	86	0.11	1682	530
j6036_9	continuous	86	86	0.1	3801	7083
j6037_10	discrete	-	-	1200.0	4760	708
j6037_10	continuous	93	99	1200	4085	7377
j6037_1	discrete	-	-	1200	4668	678
j6037_1	continuous	84	102	1200	3605	6513
j6037_2	discrete	-	-	1200	4689	662
j6037_2	continuous	80	105	1200	3659	6623
j6037_3	discrete	-	-	1200	6688	870
j6037_3	continuous	-	-	1200	3405	6142
j6037_4	discrete	-	-	1200	5059	698
j6037_4	continuous	91	126	1200	3765	6810
j6037_5	discrete	-	-	1200	5041	695
j6037_5	continuous	87	100	1200.0	3501	6314
j6037_6	discrete	-	-	1200	4342	646
j6037_6	continuous	76	109	1200	3843	6948
j6037_7	discrete	-	-	1200	5836	764
j6037_7	continuous	88	113	1200	3597	6493
j6037_8	discrete	-	-	1200	3992	650
j6037_8	continuous	84	97	1200.0	3887	6997
j6037_9	discrete	-	-	1200	4524	678
j6037_9	continuous	87	96	1200	3673	6646
j6038_10	discrete	66	66	976.17	2108	517
j6038_10	continuous	66	66	143.88	4077	7426
j6038_1	discrete	73	73	0.78	2299	530
j6038_1	continuous	73	73	16.77	3933	7169
j6038_2	discrete	71	88	1200	2821	569
j6038_2	continuous	71	80	1200	4163	7570
j6038_3	discrete	77	77	3.95	2795	574
j6038_3	continuous	77	77	39.32	4031	7338

j6038_4	discrete	58	58	0.79	1928	464
j6038_4	continuous	58	58	56.08	4329	7921
j6038_5	discrete	103	103	0.76	2485	610
j6038_5	continuous	103	103	4.01	3857	7080
j6038_6	discrete	86	86	0.54	2294	555
j6038_6	continuous	86	86	16.82	4003	7321
j6038_7	discrete	74	74	946.47	1779	505
j6038_7	continuous	74	74	13.52	4009	7376
j6038_8	discrete	71	74	1200	2621	544
j6038_8	continuous	71	71	217.66	3805	6947
j6038_9	discrete	66	66	0.47	2588	510
j6038_9	continuous	66	66	55.01	3949	7202
j6039_10	discrete	74	74	0.14	1471	487
j6039_10	continuous	74	74	0.19	4049	7523
j6039_1	discrete	80	80	0.48	1934	515
j6039_1	continuous	80	80	1.19	3733	6916
j6039_2	discrete	84	84	0.33	1892	532
j6039_2	continuous	84	84	0.84	4025	7525
j6039_3	discrete	83	83	0.23	1874	522
j6039_3	continuous	83	83	0.97	4001	7431
j6039_4	discrete	92	92	932.63	3195	607
j6039_4	continuous	92	92	7.02	3813	6963
j6039_5	discrete	73	73	0.53	1607	518
j6039_5	continuous	73	73	6.61	4129	7596
j6039_6	discrete	84	84	0.59	1903	538
j6039_6	continuous	84	84	9.73	3713	6842
j6039_7	discrete	68	68	0.35	1976	505
j6039_7	continuous	68	68	3.38	4209	7671
j6039_8	discrete	77	77	0.48	2043	529
j6039_8	continuous	77	77	3.8	4205	7709
j6039_9	discrete	72	72	0.27	1796	493
j6039_9	continuous	72	72	0.99	3885	7175

j603_10	discrete	69	69	0.17	1601	419
j603_10	continuous	69	69	1.91	5195	9501
j603_1	discrete	60	60	0.11	1015	391
j603_1	continuous	60	60	1.14	5405	10125
j603_2	discrete	69	69	0.08	1560	424
j603_2	continuous	69	69	0.16	5467	9967
j603_3	discrete	105	105	0.22	2975	563
j603_3	continuous	105	105	0.16	5357	9680
j603_4	discrete	81	81	0.12	1930	461
j603_4	continuous	81	81	0.21	4871	8913
j603_5	discrete	83	83	0.12	1975	466
j603_5	continuous	83	83	0.18	5201	9504
j603_6	discrete	57	57	0.18	1562	416
j603_6	continuous	57	57	13.12	5531	10080
j603_7	discrete	59	59	0.09	1393	383
j603_7	continuous	59	59	0.21	5715	10503
j603_8	discrete	55	55	994.35	1378	376
j603_8	continuous	55	55	9.45	5487	9997
j603_9	discrete	67	67	0.17	1843	427
j603_9	continuous	67	67	1.41	5251	9501
j6040_10	discrete	73	73	0.18	1467	484
j6040_10	continuous	-	-	0.04	3937	7346
j6040_1	discrete	86	86	0.19	1747	534
j6040_1	continuous	86	86	0.17	3593	6690
j6040_2	discrete	81	81	0.19	1321	518
j6040_2	continuous	81	81	0.13	3909	7369
j6040_3	discrete	70	70	0.19	1524	472
j6040_3	continuous	70	70	0.22	4009	7466
j6040_4	discrete	87	87	0.34	2252	535
j6040_4	continuous	87	87	0.23	3887	7120
j6040_5	discrete	83	83	0.25	1624	525
j6040_5	continuous	83	83	0.17	3785	7063

j6040_6	discrete	69	69	1045.02	1391	469
j6040_6	continuous	-	-	0.08	4049	7576
j6040_7	discrete	68	68	0.16	1407	464
j6040_7	continuous	68	68	0.22	3973	7346
j6040_8	discrete	80	80	0.23	1542	514
j6040_8	continuous	80	80	0.24	3965	7364
j6040_9	discrete	90	90	0.27	1866	554
j6040_9	continuous	90	90	0.22	3493	6474
j6041_10	discrete	-	-	1200	5529	738
j6041_10	continuous	-	-	1200	3911	7123
j6041_1	discrete	-	-	1200	7062	864
j6041_1	continuous	99	128	1200	3587	6480
j6041_2	discrete	-	-	1200	5147	754
j6041_2	continuous	91	123	1200.0	3745	6786
j6041_3	discrete	-	-	1200	5600	710
j6041_3	continuous	-	-	1200	4031	7305
j6041_4	discrete	-	-	1200	6516	826
j6041_4	continuous	115	146	1200	3311	5976
j6041_5	discrete	-	-	1200	5380	742
j6041_5	continuous	-	-	1200	3817	6888
j6041_6	discrete	-	-	1200	6394	836
j6041_6	continuous	102	150	1200	3159	5729
j6041_7	discrete	-	-	1200	8077	934
j6041_7	continuous	100	153	1200	3029	5464
j6041_8	discrete	-	-	1200	7564	914
j6041_8	continuous	112	144	1200	3499	6305
j6041_9	discrete	-	-	1200.0	6551	826
j6041_9	continuous	-	-	1200	3667	6641
j6042_10	discrete	87	87	1.96	3001	586
j6042_10	continuous	87	87	342.96	4393	7998
j6042_1	discrete	83	83	0.8	2032	562
j6042_1	continuous	83	83	98.28	3925	7175

j6042_2	discrete	68	68	1.49	2372	498
j6042_2	continuous	68	68	41.39	4233	7715
j6042_3	discrete	75	83	1200	2884	570
j6042_3	continuous	73	81	1200	4017	7315
j6042_4	discrete	103	103	569.01	3327	686
j6042_4	continuous	99	109	1200	3893	7100
j6042_5	discrete	73	73	0.83	1808	514
j6042_5	continuous	73	74	1200	3713	6860
j6042_6	discrete	82	82	7.09	2554	570
j6042_6	continuous	82	89	1200	3349	6162
j6042_7	discrete	59	59	983.54	1886	474
j6042_7	continuous	-	-	1200	4117	7491
j6042_8	discrete	82	82	228.65	2772	574
j6042_8	continuous	-	-	1200	4121	7517
j6042_9	discrete	71	71	19.9	2239	514
j6042_9	continuous	70	74	1200	3961	7239
j6043_10	discrete	78	78	0.56	2227	518
j6043_10	continuous	78	78	1.18	4117	7554
j6043_1	discrete	108	108	0.81	3606	678
j6043_1	continuous	108	108	2.08	3681	6731
j6043_2	discrete	85	85	1.38	2584	590
j6043_2	continuous	85	85	1200	3989	7285
j6043_3	discrete	74	74	0.28	1301	490
j6043_3	continuous	74	74	0.21	3909	7290
j6043_4	discrete	75	75	5.84	2099	542
j6043_4	continuous	74	76	1200	4041	7387
j6043_5	discrete	64	64	0.6	1550	462
j6043_5	continuous	64	64	2.42	4021	7418
j6043_6	discrete	84	84	0.55	2089	538
j6043_6	continuous	84	84	1072.17	4073	7478
j6043_7	discrete	89	89	0.65	2308	566
j6043_7	continuous	89	89	2.61	3669	6735

j6043_8	discrete	69	69	0.25	1309	490
j6043_8	continuous	69	69	0.64	4273	8009
j6043_9	discrete	70	70	0.69	2046	505
j6043_9	continuous	70	71	1200	3993	7290
j6044_10	discrete	65	65	0.14	974	454
j6044_10	continuous	-	-	0.03	4013	7619
j6044_1	discrete	84	84	0.31	1770	530
j6044_1	continuous	84	84	0.13	4105	7602
j6044_2	discrete	68	68	0.15	1016	466
j6044_2	continuous	68	68	0.11	3969	7534
j6044_3	discrete	87	87	0.43	2306	542
j6044_3	continuous	87	87	0.15	4073	7455
j6044_4	discrete	77	77	0.26	1447	502
j6044_4	continuous	77	77	0.13	3913	7280
j6044_5	discrete	74	74	0.32	1527	490
j6044_5	continuous	74	74	0.14	3729	6929
j6044_6	discrete	81	81	0.3	1752	518
j6044_6	continuous	81	81	0.14	4021	7462
j6044_7	discrete	76	76	0.42	1973	498
j6044_7	continuous	76	76	0.15	3873	7093
j6044_8	discrete	83	83	0.39	2009	526
j6044_8	continuous	83	83	0.14	4117	7566
j6044_9	discrete	65	65	0.25	1299	454
j6044_9	continuous	65	65	0.12	4305	7963
j6045_10	discrete	94	145	1200	6480	774
j6045_10	continuous	-	-	1200	4027	7300
j6045_1	discrete	-	-	1200	4566	654
j6045_1	continuous	-	-	1200	4151	7544
j6045_2	discrete	114	162	1200	7135	874
j6045_2	continuous	-	-	1200	3773	6820
j6045_3	discrete	119	184	1200	7677	930
j6045_3	continuous	-	-	1200	3749	6773

j6045_4	discrete	94	126	1200	5817	734
j6045_4	continuous	-	-	1200	3847	6985
j6045_5	discrete	91	123	1200	5929	746
j6045_5	continuous	-	-	1200	4123	7488
j6045_6	discrete	-	-	1200	7687	918
j6045_6	continuous	-	-	1200	3697	6685
j6045_7	discrete	104	139	1200	5881	766
j6045_7	continuous	-	-	1200	3861	7000
j6045_8	discrete	107	163	1200	7276	870
j6045_8	continuous	-	-	1200	3709	6757
j6045_9	discrete	98	147	1200	6100	798
j6045_9	continuous	-	-	1200	3947	7166
j6046_10	discrete	84	98	1200.0	2941	602
j6046_10	continuous	-	-	1200	3621	6622
j6046_1	discrete	79	79	106.59	3175	570
j6046_1	continuous	78	92	1200	3853	7028
j6046_2	discrete	78	78	4.19	2370	538
j6046_2	continuous	-	-	1200	4141	7559
j6046_3	discrete	79	81	1200.0	2810	578
j6046_3	continuous	-	-	1200	4129	7516
j6046_4	discrete	72	75	1200.0	2343	546
j6046_4	continuous	71	82	1200	4037	7357
j6046_5	discrete	87	95	1200.0	3654	634
j6046_5	continuous	83	103	1200	3625	6629
j6046_6	discrete	88	91	1200.0	3651	634
j6046_6	continuous	-	-	1200	3685	6734
j6046_7	discrete	75	82	1200.0	3388	598
j6046_7	continuous	75	99	1200	3965	7224
j6046_8	discrete	75	75	838.2	2314	554
j6046_8	continuous	72	84	1200	4065	7428
j6046_9	discrete	66	72	1200.0	2076	510
j6046_9	continuous	60	74	1200.0	3961	7229

j6047_10	discrete	66	66	1.09	1783	490
j6047_10	continuous	66	66	6.21	3961	7269
j6047_1	discrete	75	75	0.46	1780	494
j6047_1	continuous	75	75	0.18	4265	7826
j6047_2	discrete	66	66	0.77	1732	506
j6047_2	continuous	66	66	6.76	4305	7900
j6047_3	discrete	69	69	1.39	1760	498
j6047_3	continuous	69	69	12.42	3937	7242
j6047_4	discrete	76	76	0.78	1911	522
j6047_4	continuous	76	76	2.89	3837	7089
j6047_5	discrete	87	87	1.59	2431	574
j6047_5	continuous	87	87	38.28	3817	6982
j6047_6	discrete	76	76	0.49	1731	498
j6047_6	continuous	76	76	1.13	4029	7436
j6047_7	discrete	68	68	0.66	1740	498
j6047_7	continuous	68	68	2.34	3981	7298
j6047_8	discrete	71	71	1.19	1854	502
j6047_8	continuous	71	71	88.99	3681	6755
j6047_9	discrete	76	76	0.86	2269	526
j6047_9	continuous	76	76	4.83	4049	7384
j6048_10	discrete	70	70	0.24	1212	474
j6048_10	continuous	70	70	0.14	3989	7501
j6048_1	discrete	71	71	0.43	1414	478
j6048_1	continuous	71	71	0.17	4149	7667
j6048_2	discrete	87	87	0.52	2367	542
j6048_2	continuous	87	87	0.16	3801	6958
j6048_3	discrete	84	84	0.48	1812	530
j6048_3	continuous	84	84	0.19	4109	7531
j6048_4	discrete	62	62	0.57	1300	442
j6048_4	continuous	62	62	0.15	4041	7580
j6048_5	discrete	101	101	0.9	2814	598
j6048_5	continuous	101	101	0.21	3805	6959

j6048_6	discrete	66	66	0.4	1237	458
j6048_6	continuous	66	66	0.15	4101	7689
j6048_7	discrete	77	77	0.42	1565	502
j6048_7	continuous	77	77	0.15	4025	7471
j6048_8	discrete	88	88	0.71	2110	546
j6048_8	continuous	88	88	0.18	4057	7429
j6048_9	discrete	82	82	0.64	2410	522
j6048_9	continuous	82	82	0.16	4053	7402
j604_10	discrete	77	77	0.18	1772	452
j604_10	continuous	77	77	0.73	5163	9420
j604_1	discrete	84	84	0.17	1889	467
j604_1	continuous	84	84	0.12	5537	10146
j604_2	discrete	60	60	0.09	1269	370
j604_2	continuous	60	60	0.11	5409	9986
j604_3	discrete	58	58	0.1	1440	378
j604_3	continuous	58	58	0.12	5741	10509
j604_4	discrete	65	65	0.1	1378	403
j604_4	continuous	65	65	0.11	5321	9836
j604_5	discrete	75	75	0.13	1626	437
j604_5	continuous	-	-	0.03	5317	9718
j604_6	discrete	71	71	0.12	1923	431
j604_6	continuous	71	71	0.15	5717	10349
j604_7	discrete	67	67	0.19	1832	415
j604_7	continuous	67	67	0.12	5645	10284
j604_8	discrete	65	65	0.08	1527	406
j604_8	continuous	65	65	0.1	5445	9976
j604_9	discrete	75	75	0.12	1805	441
j604_9	continuous	75	75	0.14	5475	9977
j605_10	discrete	79	86	1200	3549	558
j605_10	continuous	-	-	1200	5443	9746
j605_1	discrete	72	94	1200	3841	558
j605_1	continuous	64	97	1200	5171	9237

j605_2	discrete	-	-	1200	4633	652
j605_2	continuous	-	-	1200	4851	8647
j605_3	discrete	77	85	1200.0	3662	564
j605_3	continuous	-	-	1200	5317	9504
j605_4	discrete	64	79	1200	3620	532
j605_4	continuous	-	-	1200	5297	9435
j605_5	discrete	92	138	1200	4908	716
j605_5	continuous	-	-	1200	4195	7480
j605_6	discrete	71	77	1200	4073	580
j605_6	continuous	-	-	1200	5173	9232
j605_7	discrete	58	93	1200	3461	527
j605_7	continuous	-	-	1200	5025	8930
j605_8	discrete	69	94	1200	4239	600
j605_8	continuous	-	-	1200	5341	9529
j605_9	discrete	83	83	483.86	3957	590
j605_9	continuous	-	-	1200	4889	8737
j606_10	discrete	74	74	0.48	2424	471
j606_10	continuous	74	74	1200	5437	9803
j606_1	discrete	60	60	2.05	1652	426
j606_1	continuous	60	64	1200	5581	10152
j606_2	discrete	67	67	1.15	1544	433
j606_2	continuous	66	71	1200	5375	9849
j606_3	discrete	72	72	0.91	2038	472
j606_3	continuous	72	72	1200	5285	9584
j606_4	discrete	67	67	0.52	1842	441
j606_4	continuous	-	-	1200	5421	9811
j606_5	discrete	78	78	0.3	1506	464
j606_5	continuous	78	78	0.82	5281	9796
j606_6	discrete	55	55	4.61	1911	426
j606_6	continuous	53	66	1200	5601	10065
j606_7	discrete	61	61	1.6	1324	418
j606_7	continuous	60	66	1200	5525	10178

j606_8	discrete	72	72	1.0	2706	516
j606_8	continuous	72	74	1200	5469	9834
j606_9	discrete	64	64	0.4	2239	468
j606_9	continuous	64	67	1200	5585	10087
j607_10	discrete	82	82	0.21	2146	474
j607_10	continuous	82	82	0.15	5277	9577
j607_1	discrete	77	77	0.51	1829	468
j607_1	continuous	77	77	0.69	4961	9077
j607_2	discrete	85	85	0.53	3108	564
j607_2	continuous	85	85	1029.97	5437	9771
j607_3	discrete	62	62	0.37	1319	408
j607_3	continuous	62	62	1.28	5565	10218
j607_4	discrete	63	63	0.2	1268	407
j607_4	continuous	63	63	0.15	5421	10033
j607_5	discrete	71	71	0.17	1708	432
j607_5	continuous	71	71	0.14	4693	8603
j607_6	discrete	65	65	0.34	1609	429
j607_6	continuous	65	69	1200	5381	9787
j607_7	discrete	89	89	0.51	3160	550
j607_7	continuous	89	89	1.66	5357	9640
j607_8	discrete	66	66	0.19	1294	410
j607_8	continuous	66	66	0.57	5157	9493
j607_9	discrete	44	44	0.17	1013	356
j607_9	continuous	44	44	1115.69	5613	10331
j608_10	discrete	97	97	0.39	2270	544
j608_10	continuous	97	97	0.15	5109	9275
j608_1	discrete	64	64	0.15	1357	411
j608_1	continuous	-	-	0.04	5257	9742
j608_2	discrete	61	61	0.14	882	392
j608_2	continuous	61	61	0.13	5601	10507
j608_3	discrete	79	79	0.13	1527	470
j608_3	continuous	79	79	0.15	5449	10147

j608_4	discrete	64	64	0.18	1111	405
j608_4	continuous	64	64	0.12	5245	9863
j608_5	discrete	83	83	0.28	1908	479
j608_5	continuous	83	83	0.15	5537	10060
j608_6	discrete	56	56	0.14	929	368
j608_6	continuous	56	56	0.15	5581	10481
j608_7	discrete	62	62	0.17	1080	398
j608_7	continuous	62	62	0.12	5541	10375
j608_8	discrete	66	66	0.18	1502	419
j608_8	continuous	66	66	0.15	5357	9802
j608_9	discrete	58	58	0.23	1478	387
j608_9	continuous	58	58	0.14	5637	10306
j609_10	discrete	84	121	1200	5705	680
j609_10	continuous	-	-	1200	5361	9601
j609_1	discrete	81	109	1200	4373	596
j609_1	continuous	-	-	1200	5577	10002
j609_2	discrete	75	90	1200.0	4325	604
j609_2	continuous	-	-	1200	4981	8906
j609_3	discrete	86	115	1200.0	4875	652
j609_3	continuous	-	-	1200	4967	8822
j609_4	discrete	80	104	1200	4140	596
j609_4	continuous	-	-	1200	5245	9387
j609_5	discrete	73	112	1200	4598	604
j609_5	continuous	-	-	1200	5201	9316
j609_6	discrete	-	-	1200.0	4772	692
j609_6	continuous	-	-	1200	5161	9247
j609_7	discrete	99	130	1200.0	5483	704
j609_7	continuous	-	-	1200	5477	9819
j609_8	discrete	86	121	1200	4818	644
j609_8	continuous	-	-	1200	5255	9415
j609_9	discrete	91	117	1200	4516	664
j609_9	continuous	-	-	1200	5237	9412