Gizmo Task Assignment

IE418

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The Rules

1. You must work on this exam by yourself.
2. You are allowed to examine any external sources that you wish.
3. You **must** cite all external sources.
4. Let me say that again. You **must** cite all external sources. If I even suspect that you have used materials without proper citation, I will give you a zero.

1 Using Your Gizmo

You have a gizmo. There are a set of tasks T that are to be processed using the gizmo. When the gizmo is processing a task, that task cannot be interrupted until it is complete. Each task $j \in T$ requires p_j processing time on the gizmo. In this problem, you will give a number of formulations and solution algorithms for the Gizmo Task Assignment Problem (GTAP), and you will be asked to solve various instances.

Simply writing an AMPL (or Mosel) model and solving the instances will not get you a very high grade. I am looking for you to show off your integer programming knowledge to me. Some items you may wish to discuss to show me how smart you are include the following: formulations, branching and node selection rules, polyhedra (dimension, inequalities, and facets), computational complexity, and decomposition techniques.

1.1 Question

In this instance, each task $j \in T$ has a weight w_j and the goal is to minimize the weighted completion time of all the tasks. Specifically, if job j completes at time t, then it contributes an amount $w_j t$ to the objective. In addition, each task $j \in T$ has a 'release time' r_j before which the job cannot start. In Table 1, I give you an instance you can solve.

1.2 Question

In this instance, we have 'due dates' d_j and the objective is to minimize the number of jobs that are late. The job must be done by the *beginning* of the due date in order to not count as being late. Table 2 is some sample data on which you should try your formulation and solution techniques.

Table 1: Sample Instance Data for Problem 1.1

j	p	w	r
1	1	5	10
2	8	9	21
3	9	5	15
4	5	9	2
5	4	10	5
6	6	2	10
7	1	10	12
8	6	6	29
9	7	4	20
10	10	4	4

Table 2: Sample Instance Data for Problem 1.2

j	p	d	r
1	1	519	84
2	68	526	458
3	72	442	200
4	72	597	525
5	93	494	401
6	6	539	308
7	82	308	226
8	73	685	254
9	21	412	391
10	73	564	491
11	75	349	27
12	31	439	176
13	80	505	425
14	33	380	347
15	8	397	374
16	9	457	296
17	72	502	430
18	94	616	232
19	64	438	374
20	28	413	314