CS 410 Summer 2000
Solutions to Homework 2

Testing

Results of the test cases which were specified in the assignment were counted in the correctness score. In order to get full credit for testing, you needed to, at a minimum, test:

- Duplicate entries: 2 or more jobs of one item placed in the schedule, for example 2 desks.
- Insert, get, insert again: insert some jobs, get some but not all of the jobs, then insert some more.

These are both tasks which will routinely be done, but have not been adequately tested by the required test cases. Further testing of inserting in various orders, over the simple 3-job tests required, is also merited.

Analysis

Story analysis *Complete the sentence: The moral of the story is* _____

The moral of the story is that it's worth the extra time to figure out what order to do your work in. :-)

Some of my favorite responses from students:

The moral of the story is...

- ... dot-coms ain't going nowhere.
- Be careful who you let advertise... we can infer that the company is not overly interested in using its profits to replant affected areas.
- Always satisfy the customer with the most money, uh I mean order, first.
- Prioritize! [ed note: this one wins for brevity]
- Only businesses started in garages make it big.
- Wood chips are more profitable than silicon chips.
- I don't know, but I do know the moral of a different story...
- Woodshop 410: Summer 2000 could make better use of logs.

Algorithm analysis In the scenario for questions 1 and 2, here is the full set of data:

Item	processTime	dueDate	priority	*ratio*
Bed	10	15	10	1.0
Box	4	18	13	0.3077
Chair	5	12	15	0.3333
Chest	5	19	12	0.41666
Desk	10	25	11	0.909090
Door	2	4	20	0.1
Shelf	1	30	5	0.2
Table	6	10	12	0.5
Toy	2	50	2	1.0
Trunk	3	45	8	0.375

Ordered by dueDate:
Door, Table, Chair, Bed, Box, Chest, Desk, Shelf, Trunk, Toy

Ordered by ratio:
Door, Shelf, Box, Chair, Trunk, Chest, Table, Desk, (Bed, Toy)

1. *Using the p_j, d_j, and w_j in the code you are given, and given a week where exactly one of each item is ordered, what is the minimum maximum lateness? Which item(s) achieve this maximum lateness?*

   17, achieved by the desk.

Job	time @ finish	lateness
Door	2	-2
Table	8	-2
Chair	13	1
Bed	23	8
Box	27	9
Chest	32	13
Desk	42	17
Shelf	43	13
Trunk	46	1
Toy	48	-2

2. *Same setup as previous question. How many items are always completed sooner using than ratio rule than they were using the EDD rule? What is the maximum lateness (defined with d_j used for EDD rule) when using the ratio rule? How many jobs are completed by their due date under each of the two rules?*

   The Shelf, Box, Chair, Trunk, Chest, Desk, and (possibly) Toy are finished sooner using ratio rule, so 6 or 7 items, depending on the order in which you do Bed and Toy. The maximum lateness is 31 or 33, under the ratio rule. 3 items were completed on time by the EDD rule, and 6 were completed on time by the ratio rule.

Job	time @ finish	lateness
Door	2	-18
Shelf	3	-27
Box	7	-11
Chair	12	0
Trunk	15	-30
Chest	20	1
Table	26	16
Desk	36	11
Toy	38	-12
Bed	48	33
OR		
Bed	46	31
Toy	48	-2

3. *When will the EDD rule give us the same results as the ratio rule? More specifically, when will the EDD rule give us an optimal solution for the weighted completion time criterion, while the ratio rule gives an optimal solution for the min max lateness rule? For example, if all jobs are the same (same p_j, d_j, and w_j), then all schedules are optimal. Can you think of any other situation? What if we set $d_j = \max_i(w_i) - w_j$ (so more weight gets translated as an earlier due date)? Are there any other modifications we can effect?*

   Essentially, we get the same ordering when the ordering of jobs by EDD is the same as the ordering by ratio. There is no general criterion. One specific is, of course, when each job has the same d_j, w_j, and p_j.

   In the case where we set $d_j = \max_i w_i - w_j$, if all p_j are the same, we get the same ordering.

   If we set each d_j to be p_j/w_j, we get the same ordering, too.