5DV022 Problem Exercise 4 Fall 2008

Solutions to this assignment are due on October 2, 2008 at 1700 (5pm). The signed cover sheet must be turned in with your solutions.

Turn in your solutions to the course instructor. Do not put them in the red mailboxes for laboratory reports.

Given are the following two instances of the $0/1$–knapsack problem.
Capacity $M = 17$ in both cases.
Number of objects $n = 7$ in both cases.

Instance 1:

i	1	2	3	4	5	6	7
p_i	3	8	8	11	1	2	2
w_i	6	10	12	17	2	3	5

Instance 2:

i	1	2	3	4	5	6	7
p_i	3	2	2	1	11	8	8
w_i	6	5	3	2	17	12	10

Note that the collection of objects is the same in each case, but that the order is different.

(a) For each case, find all optimal solutions of this problem which are identified by the algorithm given in Section 4.3 of the course notes and Section 5.7 of the textbook. For each i, $1 \leq i \leq 5$, give both the value of S_i and the set of elements which were merged, purged, or rejected computing S_i from S_{i-1}. Do not compute S_7. Rather, use the TraceBack technique described in the notes and text to compute the final solutions. You must show how your tracebacks proceed to obtain full credit. (Note that multiple tracebacks may be necessary to find all such solutions.)
Note: Do not change the order in which the objects are processed. Use exactly the order given in the tables above.

(b) For each case, identify those additional optimal solutions which are not found by the process identified in step (a). (A feasible solution is optimal if has at least as much profit as any other feasible solution. The weight of the solution, as long as it is feasible, does not enter into the definition of optimality.)

(c) Show how to modify the algorithm so that it finds all optimal solutions. Your modification should add the minimum amount of overhead possible. (Thus, simply to eliminate purging all suboptimal pairs is not an adequate answer.) Illustrate the operation of your algorithm on both instances by showing how it finds all solutions.

You are strongly advised to show all work. If you do not show your work, and any part of your solution is wrong, you will lose full credit for that part, even if you just made a simple copying error.