Econ 172A, Fall 2010: Quiz IV Answers

I am responsible for several mistakes on the quiz. It was not possible to answer Questions 4, 7, and 8 in Forms 1 and 3 and Question 8 of Form 2. I gave full credit to any answer on the impossible questions. Here are the answers that received points:

Form 1: d, d, a, ANY, a, a, ANY, ANY.

Form 2: b, a, c, b, a, b, d, ANY.

Form 3: d, c, d, ANY, a, a, ANY, ANY.

Scores from Form 2 were systematically lower than the scores from other forms, presumably because there were fewer "free" points on Quiz 2. I adjusted Quiz 2 scores upward. If you took Quiz 2, there will be two scores on the front of the exam; the lower number is your raw score, the higher number is the official score. The official score will count towards your final grade. If your raw score was less than 15, your official score is 15. If your raw score was 15 or more, your official score is 20% higher (but no more than 40). (For Forms 1 and 3 there was no adjustment.)

Median (Adjusted Scores): 32.

More detailed answers below. These are the complete answers to the questions on the quiz you took. I also attach complete answers to the questions that I intended to ask.

Table 1: Knapsack Data

Value	16	16	10	7	1
Weight	10	8	6	3	1
Value/Weight	1.6	2	1.67	2.33	1

Quiz 4: Detailed Answers, Form 1

Consider a knapsack problem in which there are 5 items. Assume that the knapsack has capacity 21 and the numbers above describe the values and weights of the objects.

For each question below select the best answer. (Only one answer per question.)

1. The solution to the relaxed problem (ignoring integer constraints) yields an upper bound for the true problem equal to:

   a. 37 b. 40 c. 50 d. other

   Fill knapsack in decreasing order of value/weight ratio, until filled to capacity. This means item 4 (weight 3, value 7), item 2 (weight 8, value 16); item 3 (weight 6, value 10); and .4 item 1 (weight 10, value 6.4). Relaxed problem has value 39.4. Upper bound for integer problem, 39. So "other" must be the correct choice.

   Branch on the first item (the one with weight 10 and value 16). This creates two subproblems, one in which you bring the item (call this Subprogram I) and one in which you do not (call this Subproblem II).

2. The solution to the relaxed Subproblem I (ignoring integer constraints) yields an upper bound for the true Subproblem I equal to:

   a. 34 b. 37 c. 40 d. other

   Must carry item 1. Continue: Item 4, Item 2. This fills knapsack and gives value 16 + 7 + 16. Value is 39. Weight is 21. Other is the answer.

3. The solution to the relaxed Subproblem II (ignoring integer constraints) yields an upper bound for the true Subproblem II equal to:

   a. 34 b. 37 c. 40 d. other

   Cannot carry item 1. The other items fit. Value 34. a is the answer.

4. Based on the information from solving relaxed versions of the original problem, Subproblem I and Subproblem II, the lower bound for the problem is:

   a. $-\infty$ b. 34 c. 35 d. 37

   Subproblem II is solved in integers, creating lower bound of 34. Subproblem I is solved in integers, creating lower bound of 39. It is a better lower bound. So 39 is the correct answer (even though it is not one of the choices).

5. Subproblem I has been fathomed.

   a. True b. False.

   True. Solved in integers.

6. Subproblem II has been fathomed.

   a. True b. False.

   True. We have solution in integers.

7. Based only on the upper and lower bounds obtained from the computations above, the value to the true problem is:

   a. 34 b. 35 c. 37 d. Not enough information.

   The value is 39. No answer above is correct.

8. Which of the following changes might decrease the value of the problem:

   (a) Increasing the weight of an item.

   (b) Decreasing the value of an item.

   (c) Increasing the value to weight ratio of an item.

   (d) None of the above.

   Increasing the weight might decrease value (by making it infeasible to carry something). Decreasing the value obviously might decrease the value of the problem. Increasing the value to weight ratio of an item may decrease the value. (An example is a problem with one object. Suppose originally, the weight, value, and capacity are all one. Now double the weight, triple the value, and leave capacity unchanged. Value of problem goes from 1 to 0.) Hence all of the first three choices might be right. So there is not a unique correct answer.

Quiz 4: Detailed Answers, Forms 2-3

Form 2 was like Form 1 except for two changes. First, the capacity was 20. Second, Subproblem I was the one without Item 1 and Subproblem II was the one with item 2. With these changes,

1. Relaxed solution: Items 4, 2, 3, and 30% of item 1. Value 37.8, upper bound 37. (b) is correct.
2. Bring all items except the first one. Value 34. (a) answer.
3. Bring items 1, 4, and 7/8 of item 2. Value 37. (c) answer.
4. Lower bound 34 (from part 3). Answer (b).
5. (a)
6. (b) (solution not integer, still feasible, upper bound greater than lower bound).
7. (d) (but, in fact 34 is the answer for form 2 and 68 is the answer for form 3).
8. ANY

Form 3 was like Form 1 except: I doubled all values, weights, and the capacity. As in Form 2, I switched the two subproblems. I also changed the order of the choices in several parts.

1. 78.8 value, upper bound 78, (d). Take items 4, 2, 3, and 40% of 1.
2. Bring all but item 1. Value 68. Answer (c).
3. Bring item 1, 4, 2. Value: 78. Answer (d).
4. ANY (lower bound 78)
5. (a)
6. (a)
7. ANY (value is 78)
8. ANY

True Quiz 4 - Form 3 – Answers

This is the quiz that I meant to give. I underlined the changes (in table and in Question 8).

Consider a knapsack problem in which there are 5 items. Assume that the knapsack has capacity 42 and the numbers above describe the values and weights of the objects.

Value	32	32	20	8	2
Weight	20	16	12	6	2
Value/Weight	1.6	2	1.67	1.33	1

For each question below select the best answer. (Only one answer per question.)

1. The solution to the relaxed problem (ignoring integer constraints) yields an upper bound for the true problem equal to:

   a. 100 b. 80 c. 74 d. other

   Take items 2, 3 and .7 item 1 value 72.4, rounded down to 74. Answer (c).

   Branch on the first item (the one with weight 20 and value 32). This creates two subproblems, one in which you do not bring the item (call this subprogram I) and one in which you do (call this subproblem II).

2. The solution to the relaxed Subproblem I (ignoring integer constraints) yields an upper bound for the true Subproblem I equal to:

   a. 80 b. 74 c. 62 d. other

   Bring all but the first item, value 62.

3. The solution to the relaxed Subproblem II (ignoring integer constraints) yields an upper bound for the true Subproblem II equal to:

   a. 80 b. 74 c. 62 d. other

   Bring the first item, the second item, and half of the third item. Value 74. Answer (b).

4. Based on the information from solving relaxed versions of the original problem, Subproblem I and Subproblem II, the lower bound for the problem is:

   a. 80 b. 70 c. 62 d. $-\infty$

   (c) from the second part.

5. Subproblem I has been fathomed.

   a. True b. False.

   true.

6. Subproblem II has been fathomed.

   a. True b. False.

   false.

7. Based only on the upper and lower bounds obtained from the computations above, the value to the true problem is:

   a. 62 b. 70 c. 74 d. Not enough information.

   a.

8. Which of the following changes might increase the value of the problem?:

   (a) Increasing the weight of an item.
   (b) Decreasing the value of an item.
   (c) Increasing the value to weight ratio of an item.
   (d) None of the above.

   Only the third. Answer (c).