

COSC 480 - Midterm #1, Fall 2012

Instructions: Complete each question to the best of your ability. Partial credit will be given for partially correct answers. Be sure to put your name on this test and any extra sheets of paper that you use. Please answer the questions on extra sheets of paper, not on this test. This exam has two questions and is out of 100 points (each question is worth 50 points). SHOW ALL WORK. In both questions, you may use CPLEX or Excel to verify answers only. The exam is to be turned in at the start of class Monday, October 29th in hard copy. No email submissions will be accepted. You may not use slip-days for this exam.

1.) A cargo plane has three compartments for storing cargo: front, center, and back. These compartments have capacity limits on both weight and space, as summarized below:

Compartment	Weight Capacity (tons)	Space Capacity (cubic ft.)
Front	12	7000
Center	18	9000
Back	10	5000

Furthermore, the weight of the cargo in the respective compartments must be the same proportion of that compartment's weight capacity to maintain the balance of the airplane.

The following four cargoes have been offered for shipment on an upcoming flight as space is available:

Cargo	Weight (tons)	Volume (cubic feet/ton)	Profit (\$/ton)
1	20	500	320
2	16	700	400
3	25	600	360
4	13	400	290

Any portion of these cargoes can be accepted. The objective is to determine how much (if any) of each cargo should be accepted and how to distribute each among the compartments to maximize the total profit for the flight.

- a.) Formulate the LP for this problem. Show the augmented and non-augmented versions.
- b.) Solve via simplex. List at the bottom your solution for your variables and objective function. Please circle your solution. NOTE: There are multiple optimal solutions, find only one.

2.) Consider the following problem:

$$\text{Minimize } Z = 3x_1 + 2x_2 + 7x_3$$

Subject to:

$$-x_1 + x_2 = 10$$

$$2x_1 - x_2 + x_3 \geq 10$$

With:

$$x_1, x_2, x_3 \geq 0$$

- a.) Convert and write out the augmented form of the problem.
- b.) Solve via Big M simplex. List at the bottom your solution for x_1, x_2, x_3 , and Z . Please circle your solution.
- c.) Are there any shadow prices present for either constraint? If so, list them.