Econ 172A, Fall 2012: Quiz I

IMPORTANT

1. The quiz has 3 forms. You should answer the questions from only one form.
   - If the third number in your student identification number is 1, 4, 7 answer the questions from Form 1.
   - If the third number of your student identification number is 2, 5, 8, 0 answer the questions from Form 2.
   - If the third number of your student identification number is 3, 6, 9, or if you have no student identification number, answer the questions from Form 3.
   - Just to make sure: If your student identification number is A12345678, then the third number of your student identification number is 3.
2. You may not use calculators, books, or notes during this quiz.
3. If you do not know how to interpret a question, then ask me.
4. Please remain in your seat until the exam is over.
5. You will not receive credit unless you put your answers in the spaces below.
6. I will collect the quizzes at 4:50.

RECORD ANSWERS

- NAME:
- STUDENT IDENTIFICATION NUMBER:
- I read the instructions and I am answering the questions corresponding to the appropriate form, which is FORM:

Question 1. Circle the correct choice or choices: a. b. c.

Question 1d. The number of corners is:

Question 2. Circle the correct choice or choices: a. b. c. d. e.

Form I

This is Form 1. Use this form if the third number in your student ID is 1, 4, 7. Otherwise use another form.

1. Consider the Linear Programming Problem:

$$\begin{array}{lrcrcl} \max & c \cdot x & & & & \\ \text{subject to} & x_1 & + & x_2 & \leq & 2 \\ & -x_1 & + & 2x_2 & \leq & 1 \\ & & & x_2 & \geq & 0 \end{array}$$

.

Call the feasible set S, so that the problem is $\max x_0$ subject to $x \in S$, where $x_0 = c \cdot x$ for $c = (c_1, c_2)$. Suppose that x^* is a solution to the problem.

For parts (a)-(c) Indicate on the front page which of the choices below are always true. For part (d) indicate the number of corners on the first page.

I recommend that you solve the problem by graphing the feasible set, but you need not show your work. (More than one statement may be true.)

(a) The solution to the linear programming $\max 10x_0$ subject to $x \in S$ is x^*.

(b) There exists objective function coefficients $c = (c_1, c_2)$ such that $x^* = (x_1, x_2) = (0, .5)$ is the unique solution to the linear programming problem.

(c) There exists objective function coefficients $c = (c_1, c_2)$ such that $x^* = (x_1, x_2) = (0, .5)$ is a solution to the linear programming problem.

(d) How many corners does the feasible set have?

2. A juice company sells three varieties of drink. The last straw (L) contains 4 ounces of apples (a), 2 ounces of blueberries (b) , and 6 ounces of strawberry (s). The blue group (B) contains 2 ounces of apples, 6 ounces of blueberries, and 4 ounces of raspberries (r). The uniform (U) contains 3 ounces each of apples, blueberries, strawberries, and raspberries. The store can sell a 12 ounce serving of L for \$6.00; a 12 ounce serving of B for \$ 5.00; and a 12 ounce serving of U for \$4.00. Let x_i represent the number of 12 ounce servings of juice i sold for $i = L, B, U$. Let x_0 denote the objective function (the revenue generated from the sale of x_i servings of juice i at given prices). Let y_j equal the number of ounces of fruit j used in the production for $j = a, b, s, r$. The juice seller wants to find x_L, x_B, and x_U to maximize the revenue assuming that the available supply of apples is S_a ounces, the available supply of blueberries is S_b ounces, the available supply of strawberries is S_s ounces, and the available supply of raspberries is S_r ounces. Which of the constraints below is consistent with this information? Indicate our answer on the first page.

(a) $y_r \leq S_r$

(b) $x_0 = 6x_L + 5x_B + 4x_U$

(c) $x_L + x_B + x_U = y_a + y_b + y_s + y_r$

(d) $x_L = 4y_a + 2y_b + 6y_s$

(e) $y_s = 6x_L + 3x_U$

Form 2

This is Form 2. Use this form if the third number in your student ID is 2, 5, 8, 0. Otherwise use another form.

1.

$$\begin{array}{lrcrcl} \text{max} & c \cdot x & & & & \\ \text{subject to} & x_1 & + & x_2 & \leq & 2 \\ & -x_1 & + & 2x_2 & \leq & 1 \\ & & & x & \geq & 0 \end{array}$$

.

Call the feasible set S, so that the problem is $\max x_0$ subject to $x \in S$, where $x_0 = c \cdot x$ for $c = (c_1, c_2)$. Suppose that x^* is a solution to the problem.

For parts (a)-(c) Indicate on the front page which of the choices below are always true. For part (d) indicate the number of corners on the first page.

I recommend that you solve the problem by graphing the feasible set, but you need not show your work. (More than one statement may be true.)

(a) The solution to the linear programming $\max 10x_0$ subject to $x \in S$ is x^*.

(b) There exists objective function coefficients $c = (c_1, c_2)$ such that $x^* = (x_1, x_2) = (0, .5)$ is the unique solution to the linear programming problem.

(c) There exists objective function coefficients $c = (c_1, c_2)$ such that $x^* = (x_1, x_2) = (0, .5)$ is a solution to the linear programming problem.

(d) How many corners does the feasible set have?

2. A juice company sells three varieties of drink. The last straw (L) contains 4 ounces of apples (a), 2 ounces of blueberries (b) , and 6 ounces of strawberry (s). The blue group (B) contains 2 ounces of apples, 6 ounces of blueberries, and 4 ounces of raspberries (r). The uniform (U) contains 3 ounces each of apples, blueberries, strawberries, and raspberries. The store can sell a 12 ounce serving of L for \$4.00; a 12 ounce serving of B for \$ 5.00; and a 12 ounce serving of U for \$6.00. Let x_i represent the number of 12 ounce servings of juice i sold for $i = L, B, U$. Let x_0 denote the objective function (the revenue generated from the sale of x_i servings of juice i at given prices). Let y_j equal the number of ounces of fruit j used in the production for $j = a, b, s, r$. The juice seller wants to find x_L, x_B, and x_U to maximize the revenue assuming that the available supply of apples is S_a ounces, the available supply of blueberries is S_b ounces, the available supply of strawberries is S_s ounces, and the available supply of raspberries is S_r ounces. Which of the constraints below is consistent with this information? Indicate our answer on the first page.

(a) $x_0 = 4x_L + 5x_B + 6x_U$

(b) $y_a + y_b + y_s + y_r = x_L + x_B + x_U$

(c) $x_L = 4y_a + 2y_b + 6y_s$

(d) $y_s = 6x_L + 3x_U$

(e) $S_b \geq y_b$

Form 3

This is Form 3. Use this form if the third number in your student ID is 3, 6, 9, or if you have no student identification number. Otherwise use another form.

1.

$$\begin{array}{lrcrcr} \max & c \cdot x & & & & \\ \text{subject to} & x_1 & + & x_2 & \leq & 2 \\ & x_1 & - & 2x_2 & \leq & -1 \\ & & & x & \geq & 0 \end{array}$$

.

Call the feasible set S, so that the problem is $\max x_0$ subject to $x \in S$, where $x_0 = c \cdot x$ for $c = (c_1, c_2)$. Suppose that x^* is a solution to the problem.

For parts (a)-(c) Indicate on the front page which of the choices below are always true. For part (d) indicate the number of corners on the first page.

I recommend that you solve the problem by graphing the feasible set, but you need not show your work. (More than one statement may be true.)

(a) The solution to the linear programming $\max -10x_0$ subject to $x \in S$ is x^*.

(b) There exists objective function coefficients $c = (c_1, c_2)$ such that $x^* = (x_1, x_2) = (0, .5)$ is the unique solution to the linear programming problem.

(c) There exists objective function coefficients $c = (c_1, c_2)$ such that $x^* = (x_1, x_2) = (0, .5)$ is a solution to the linear programming problem.

(d) How many corners does the feasible set have?

2. A juice company sells three varieties of drink. The last straw (L) contains 2 ounces of apples (a), 4 ounces of blueberries (b) , and 6 ounces of strawberry (s). The blue group (B) contains 2 ounces of apples, 6 ounces of blueberries, and 4 ounces of raspberries (r). The uniform (U) contains 3 ounces each of apples, blueberries, strawberries, and raspberries. The store can sell a 12 ounce serving of L for \$4.00; a 12 ounce serving of B for \$ 5.00; and a 12 ounce serving of U for \$6.00. Let x_i represent the number of 12 ounce servings of juice i sold for $i = L, B, U$. Let x_0 denote the objective function (the revenue generated from the sale of x_i servings of juice i at given prices). Let y_j equal the number of ounces of fruit j used in the production for $j = a, b, s, r$. The juice seller wants to find x_L, x_B, and x_U to maximize the revenue assuming that the available supply of apples is S_a ounces, the available supply of blueberries is S_b ounces, the available supply of strawberries is S_s ounces, and the available supply of raspberries is S_r ounces. Which of the constraints below is consistent with this information? Indicate our answer on the first page.

(a) $x_0 = 4x_L + 5x_B + 6x_U$

(b) $S_a = y_a$

(c) $y_a + y_b + y_s + y_r = x_L + x_B + x_U$

(d) $x_L = 4y_a + 2y_b + 6y_s$

(e) $y_b = 4x_L + 6x_B + 3x_U$