

PRINCE SULTAN UNIVERSITY

Finite Mathematics MATH 101

Second Major Exam

NAME _____ ID _____

- Q1. Use the **geometric approach** to find the maximum and minimum values of the objective function $z = 5x + 7y$, subject to the following constraints:

$$\begin{cases} x + y \geq 2 \\ 2x + 3y \leq 6 \\ x \geq 0 \\ y \geq 0 \end{cases}.$$

- Q2. Check to see if the following problem is in standard form, Find the dual problem, then introduce slack variables and set up the initial simplex tableaux.

Do not attempt to solve it.

$$\text{Minimize } C = 4x_1 + 2x_2 + 6x_3$$

subject to the constraints

$$5x_1 + 3x_2 + 3x_3 \geq 20$$

$$3x_1 + x_2 + 2x_3 \geq 9$$

$$2x_1 + 6x_2 + 5x_3 \geq 30$$

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

Q3. Use mixed-constraints method to solve the maximum problem

$$\text{Maximize } P = 3x_1 + 2x_2 - x_3$$

Subject to

$$\begin{cases} x_1 + 3x_2 + x_3 \leq 9 \\ 2x_1 + 3x_2 - x_3 \geq 2 \\ 3x_1 - 2x_2 + x_3 \geq 5 \\ x_1 \geq 0, x_2 \geq 0, x_3 \geq 0 \end{cases} .$$

Q4. Given the letters A, B, C, D, E, F, G .

- a) How many permutations of the seven letters?
- b) How many permutations of the seven letters have E in the first position?
- c) How many permutations of the seven letters have E in one of the first two positions?

Q5. Suppose you have 30 books (15 novels, 10 history books, and 5 math books). Assume that all 30 books are different.

- a) In how many ways can you put the 30 books in a row on a shelf?
- b) In how many ways can you get a bunch of four books to give to a friend?
- c) In how many ways can you get a bunch of three history books and seven novels to give to a friend?

Q6. A class consists of 7 PYP students and 15 freshmen. The class needs to form a committee of size **five**.

- a) How many committees are possible?
- b) How many committees are possible if the committee must have three PYP students and two freshmen?
- c) How many committees are possible if the committee must have at least three PYP students?

Q7. A survey of MATH 101 students at Prince Sultan University showed the following Mobiles use:

6 use Nokia and Motorola	11 use Nokia
7 use SonyEricson and Motorola	12 use Motorola
5 use Nokia and SonyEricson	17 use SonyEricson
2 use all three of the above	2 use none of the above

Sketch the diagram and use it to answer the following questions:

- a) How many students were surveyed?
- b) How many of the Casio users do NOT use TI?
- c) How many of the Motorola users do NOT use Nokia?
- d) How many students use at least one Mobile besides Nokia?
- e) How many students use at most two of the mobiles?