

**ITEC451 Midterm Exam**  
**Spring 2023**  
**(Total 50 Points)**

Name: \_\_\_\_\_

1. (5 points = 1 points each \* 5 answers) Fill in the blank by selecting one of the following, (a)~(e).

- a) Select a Suitable Alternative
- b) Formulate a Mathematical Model of the Problem
- c) Define the problem.
- d) Observe the System
- e) Verify the Model and Use the Model for Prediction

**When an organization's problem is solved, the following seven-step model-building procedure would be good to be followed:**

- Formulate the Problem
  - (1)\_\_\_\_\_.
  - Specify objectives.
  - Determine parts of the organization to be studied.
- (2)\_\_\_\_\_.
- Determine parameters affecting the problem.
- Collect data to estimate values of the parameters.
- (3)\_\_\_\_\_.
- (4)\_\_\_\_\_.
- Does the model yield results for values of decision variables not used to develop the model?
- What eventualities might cause the model to become invalid?
- (5)\_\_\_\_\_.
- Given a model and a set of alternative solutions, determine which solution best meets the organizations objectives.
- Present the Results and Conclusion(s) of the Study to the Organization
- Implement and Evaluate Recommendations

2. (15 points) Solve the following questions using the Gauss-Jordan method. You must show all the intermediate matrices of the Gauss-Jordan method.

$$2x_2 + 2x_3 = 4$$

$$x_1 + 2x_2 + x_3 = 4$$

$$x_2 - x_3 = 0$$

3. **(15 points) [Linear Programming]** Extremely-Fast corp. is an internet service provider which must determine how many OC-768 communication cables need to be leased to TYPE-A clients and TYPE-B clients, respectively. (The OC-768 is a fiber optic network cable with transmission speeds of up to 39,813.12 Mbits/s.)
- One OC-768 can provide a network service to 18 TYPE-A clients and requires 9 hours of maintenance and customer services per week.
  - One OC-768 cable can support 11 TYPE-B clients and requires 5 hours of maintenance and customer services.
  - Each client can lease a Type-A channel at \$200 per week.
  - Each client can lease a Type-B channel at \$300 per week.
  - Seven OC-768 cables and 52 hours per week of labor for maintenance and customer services are available.
  - The company regulations require that at least 30 TYPE-B clients be supported during any weeks.

Let

$x_1$  = number of the cables with TYPE-A clients, and  
 $x_2$  = number of cables with TYPE-B clients.

Using these decision variables, formulate LP whose solution will tell Extremely-Fast corp. how to maximize the total profit from TYPE-A and TYPE-B clients.

**4. (15 points) [Linear Programming] A Diet Problem**

- My diet requires that all the food I get come from one of the four “basic food groups”.
- At present, the following four foods are available for consumption: brownies, chocolate ice cream, cola and pineapple cheesecake.
- Each brownie costs 70¢, each scoop of ice cream costs 30¢, each bottle of cola costs 20¢, and each piece of pineapple cheesecake costs 65¢.
- Each day, I must ingest at least 600 calories, 7 oz of chocolate, 11oz of sugar, and 7 oz of fat.
- The nutritional content per unit of each food is given.

Type of Food	Calories	Chocolate (Ounces)	Sugar (Ounces)	Fat (Ounce)
Brownie	300	2	1	3
Chocolate ice cream (1 scoop)	150	2	2	3
Cola (1 bottle)	200	1	0	2
Pineapple cheesecake (1 piece)	300	0	3	4

- Formulate a linear programming model that can be used to satisfy my daily nutritional requirements at minimum cost.