King Fahd University of Petroleum and Minerals
Department of Mathematics and Statistics

Math 131 (Term 143)

Exam 1 (Duration: 90 minutes)

Student Name______________________________________ **Student ID:** ____________________

Question	Score
1	\16
2	\16
3	\16
4	\16
5	\16
6	\20
Total Score	\100

Exercise 1 (16 points)

A small business predicts its revenue growth by a straight-line method with a slope of **10,000 SR** per year. In its tenth year, it had revenues of **110,000 SR**. Find an equation that describes the relationship between the revenue $\boldsymbol{R}$ and the number of years $\boldsymbol{T}$ since it opened for business.

Exercise 2 (16 points)

A marketing firm estimates that $\boldsymbol{n}$ months after the introduction of a client's new product, $\boldsymbol{f(n)}$ thousand households will use it, where

$$f(n) = \frac{6}{5}n(10 - n),\ 0 \leq n \leq 10.$$

Estimate the maximum number of households that will use the product.

Exercise 3 (16 points)

Supply and demand equations for a certain product are, respectively, $\mathbf{3q - 200p + 1800 = 0}$ and $\mathbf{q + 100p - 1800 = 0}$. Where p represents the price per unit in Riyals and q represents the number of units sold per time period. Find the equilibrium price when a tax of **0.27 SR** per unit is imposed on the supplier.

Exercise 4 (16 points)

A produce grower is purchasing fertilizer containing three nutrients: **A**, **B**, and **C**. The minimum monthly requirements are **320** units of **A** and **400** of **B**; and the maximum monthly requirements are **800** units of **C**. There are two popular blends of fertilizer on the market. Blend **I,** costing **10 SR** a bag, contains **2** units of **A** and **1** unit of **B**. Blend **II**, costing **20 SR** a bag, contains **2** units of **B** and **20** units of **C**. How many bags of each blend should the grower buy each month to minimize the cost of meeting the nutrient requirements? Formulate the problem (Do not solve it).

Exercise 5 (16 points)

A firm produces three products **A**, **B**, and **C** that require processing by three machines **I**, **II**, and **III**. The time in hours required for processing one unit of each product is given by the following table:

	A	B	C
Machine I	4	2	1
Machine II	2	1	1
Machine III	3	1	3

Machine **I** is available for **380** hours, Machine **II** is available **210** hours, and Machine **III** is available for **350** hours. Use matrix reduction method, to find how many units of each product should be produced to make use of all the available time on the machines.

Let

x =

y =

z =

System of Equations:

Augmented Matrix:

Reduced Matrix: (Show your work on the back of this page)

Solution:

x =

y =

z =

Exercise 6 (20 points)

Use the dual and simplex method to solve the following problem:

Minimize $\boldsymbol{Z = 2x_1 + 5x_2 + 3x_3}$ subject to $\begin{cases} \boldsymbol{x_2 + x_3 \geq 5} \\ \boldsymbol{x_1 + x_2 + x_3 \geq 4} \\ \boldsymbol{x_1 - x_2 - x_3 \leq 1} \\ \boldsymbol{-x_1 + x_3 \leq 3} \end{cases}$

Dual Problem:

Final Tableau (Show your work on the back of this page)

Initial Tableau:

Solution of the Dual Problem:

Solution of the Initial Problem: