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

Math 131 (Term 163)

Exam 1 (Duration: 90 minutes)

Student Name_____ Student ID: _____

Question	Score
1	\10
2	\10
3	\10
4	\10
5	\14
6	\10
7	\16
8	\20
Total Score	\100

Exercise 1 (10 points)

A real-estate firm owns 96 apartments. At 550 SR per month, every apartment can be rented. For each 25 SR per month increase, there will be three vacancies with no possibility of filling them. The firm wants to receive 54,600 SR per month from rents. What rent should be charged for each apartment?

Exercise 2 (10 points)

Suppose a company offers you a sales position with your choice of two -methods of determining your yearly salary. One method pays 35,000 SR plus a bonus of 3% of your yearly sales. The other method pays a straight 5% commission on your sales. For what yearly sales amount is it better to choose the second method?

Exercise 3 (10 points)

The demand function for an electronics company's laptop computer line is $p = 2400 - 6q$, where p is the price (in SR) per unit when q units are demanded (per week) by consumers. Find the level of production that will maximize the manufacturer's total revenue and find the maximum revenue.

Exercise 4 (10 points)

The Bigfoot Co. manufactures sandals for which the material cost is 0.85 SR per pair and the labor cost is 0.96 SR per pair. Additional variable costs amount to 0.32 SR per pair. Fixed costs are 70,500 SR. If each pair sells for 2.63 SR, how many pairs must be sold for the company to break even?

Exercise 5 (14 points)

A manufacturer produces three products: A, B, and C. The profits for each unit of A, B, and C sold are 1 SR, 2 SR, and 3 SR, respectively. Fixed costs are 17,000 SR per year, and the costs of producing each unit of A, B, and C are 4 SR, 5 SR, and 7 SR, respectively. Next year, a total of 11,000 units of all three products is to be produced and sold, and a total profit of 25,000 SR is to be realized. If total cost is to be 80,000 SR, how many units of each of the products should be produced next year? Use **matrix reduction** method ONLY.

Define your variables:

Augmented matrix:

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

System:

Solution:

Exercise 6 (10 points)

An oil company has two refineries and needs at least 30,000 of low-grade oil and at most 20,000 and 10,000 barrels of medium- and high-grade oil, respectively. Each day, Refinery I produces 3000 barrels of low-, 2000 barrels of medium, and 1000 barrels of high-grade oil, whereas Refinery II produces 4000 barrels each of low- and medium- and 1500 barrels of high-grade oil. If it costs 25,000 SR per day to operate Refinery I and 15,000 SR per day to operate Refinery II, how many days should each refinery be operated to satisfy the production requirements at minimum cost? Formulate the problem (**Do NOT solve it**).

Exercise 7 (16 points)

Use the geometric approach to **minimize** $Z = x - y$ subject to $\begin{cases} x \geq 6 \\ x + 3y \geq 6 \\ x - 3y \geq -6 \\ y \geq 0 \end{cases}$
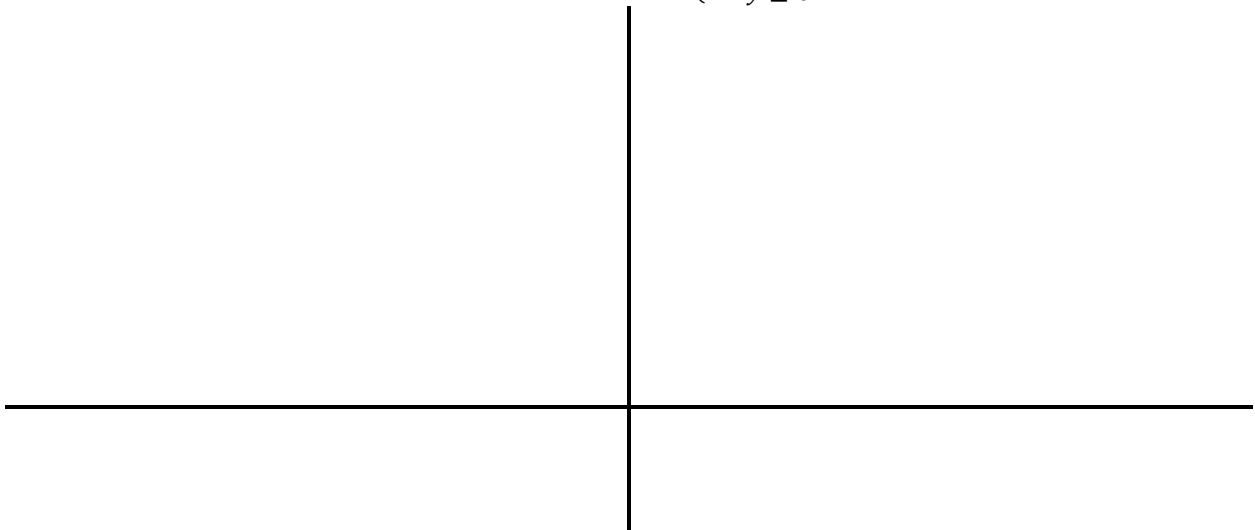
Corner Points	Value at $Z = x - y$

Exercise 8 (20 points)

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

Minimize $Z = 4x_1 + 5x_2 + 30x_3$ subject to $\begin{cases} x_1 + x_2 + 2x_3 \geq 7 \\ x_1 + 2x_2 + 3x_3 \geq 8 \\ x_1 + 2x_2 + 5x_3 \geq 9 \end{cases}$

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: