Prince Sultan University
MATH 101
Final Exam
First Semester 2009/2010, Term 091
Saturday, February 6, 2010

Time Allowed: 150 minutes

Name: **ID Number:**

Section Number: **Instructor Name:**

Important Instructions:

- You may use CASIO scientific calculator that does not have programming or graphing capabilities.
- You may **NOT borrow** a calculator from anyone.
- There should be **NO talking** during the examination.
- Your exam will be taken **immediately** without any warning if your mobile is seen or heard.
- You must show all your work beside the problem. Be organized.
- You may use the back of the pages for extra space, but be sure to indicate that on the page with the problem.
- This examination has **18** problems, some with several parts. Make sure that your paper has all these problems.

Problems	Max points	Student's Points
1,2,3	14	
4,5	12	
6,7	11	
8	11	
9,10,11	16	
12,13,14,15	22	
16,17,18	14	
Total	100	

Q.1 (5 points) When the price of an item is \$4, the demand is 12 millions. When the price is \$6, the demand is 9 millions.

a) Find a linear demand equation for this item.

b) What is the demand when the price is \$5?

Q.2 (4 points) Find t so that $tx - 4y = -3$ is parallel to the line $2x + 2y = 5$.

Q.3 (5 points) Find x and y such that $\begin{bmatrix} 3 & -2 & 2 \\ 1 & 0 & -1 \end{bmatrix} + \begin{bmatrix} x-y & 2 & -2 \\ 4 & x & 6 \end{bmatrix} = \begin{bmatrix} 6 & 0 & 0 \\ 5 & 2x+y & 5 \end{bmatrix}$.

Q.4 (5 points) Let $A = \begin{bmatrix} -3 & 2 \\ -1 & 1 \end{bmatrix}$. Find X such that $AX = \begin{bmatrix} 2 & 0 & -1 \\ 3 & 1 & -2 \end{bmatrix}$.

Q.5 (7 points) Solve the system of equations $\begin{cases} x - y - z = 1 \\ -x + 2y - 3z = -4 \\ 3x - 2y - 7z = 0 \end{cases}$.

Q.6 (6 points) Graph the following system $\begin{cases} x + 2y \geq 2 \\ x + y \leq 4 \\ 3x + y \leq 3 \\ x \geq 0, y \geq 0 \end{cases}$. List the corner points **and** determine whether the graph is bounded or unbounded.

Q.7 (5 points) If a five year $5,000 savings certificate earning 6% with quarterly compounding is bought, what is the amount of the investment at the end of five years?

Q.8 (3 points) Find the coefficient of x^6 in the expansion of $(2x+3)^{15}$.

Q.9 (8 points) Use **simplex method** to minimize $C = 3x + 2y$ subject to the constraints $\begin{cases} 2x + y \geq 4 \\ x - y \leq 2 \\ x + y \leq 6 \\ x \geq 0, y \geq 0 \end{cases}$.

Q.10 (7 points) At the end of each three months Michael puts $300 into an account which pays 7.5% interest compounded quarterly. After 10 years he stops the payments but leaves the total amount in the account to collect interest for 2 more years at interest rate 5% compounded semiannually. Determine the balance in the account at the end of 12 years.

Q.11 (5 points) Driving plates consists of 3 digits followed by 3 letters. Suppose that the letters are to be selected from the set $\{A, B, C, D, E, F, G, H\}$. If VIP plates are those that have the same digit in each position. How many possible VIP plates are there?

Q.12 (4 points) A jean manufacturer makes three types of jeans, each of which goes through three manufacturing phases—cutting, sewing and finishing. The number of minutes each type of product requires in each of three phases is given below:

Jean	Cutting	Sewing	Finishing
I	8	12	4
II	12	18	8
III	18	24	12

There are 5200 minutes of cutting time, 6000 minutes of sewing time and 2200 minutes of finishing time each day. The company can sell all the jeans it makes and makes a profit of $4 on each Jean I, $4.5 on each Jean II, and $6 on each Jean III. What number of jeans in each category should be made each day to maximize profit?
Formulate a linear programming problem that models the problem given above. Be sure to identify all variables used. **Do not solve.**

Q.13 (4 points) 5 spoons, 4 forks and 4 knifes are to be arranged in order on the table. In how many ways can this be done?

Q.14 (8 points) A box contains 10 blue balls, 8 white balls and 3 red balls. Two balls are to be selected randomly without replacing the other.

a) In how many ways can this be done?

b) What is the probability that one blue and one red will be selected?

c) What is the probability that at least one red ball will be selected?

d) What is the probability that no red ball will be selected?

Q.15 (4 points) What is the probability that a seven-digit telephone number has one or more repeated digits?

Q.16 (6 points) Suppose that E and F are **independent events** such that $P(E) = 0.4$ and $P(E \cap F) = 0.2$. Find $P(E \cup F)$?

Q.17 (6 points) Let *A, B, C, E* and *F* be events in a sample space *S*. Use the following table of probabilities to obtain the probability for the following events:

	A	*B*	*C*
E	0.2	0.15	0.25
F	0.05	0.3	0.05

a) $P(E)$ =

b) $P(E \cap B)$ =

c) $P(F \mid B)$ =

d) $P(\overline{F} \mid C)$ =

Q.18 (8 points) By examining the past driving records of 840 randomly selected drivers over the period of 1 year, the following data were obtained:

	Under 25 (*U*)	Over 25 ($\overline{U}$)	Totals
Accident (*A*)	40	5	45
No Accident ($\overline{A}$)	285	510	795
Totals	325	515	840

a) What is the probability of a driver having an accident, given that the person is under 25?

b) What is the probability of a driver having an accident or is over 25?

c) Are the events *U* and *A* independent? (Explain)

d) Are the events $\overline{U}$ and $\overline{A}$ mutually exclusive? (Explain)