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

Math 131 (Term 153)

Final Exam – CODE 001

(Duration: 150 minutes. Number of Exercises: 25)

Student Name____________________________________ **Student ID:** ____________________

Exercise 1
A person invested 20,000 SR, part at an interest rate of 6% annually and the remainder at 7% annually. The total interest at the end of 1 year was equivalent to an annual 6.75 % rate on the entire 20,000 SR. Then, the amount invested at 6% is:

(a) 3,000 SR (b) 5,000 SR (c) 7,000 SR (d) 10,000 SR (e) 15,000 SR

Exercise 2
The demand function for a product is p = 200 – 5q, where p is the price (in SR) per unit when q units are demanded (per day). Then, the maximum revenue that the manufacturer can receive is

(a) 1,000 SR (b) 2,000 SR (c) 3,000 SR (d) 4,000 SR (e) 5,000 SR

Exercise 3
The system $\begin{cases} x = \frac{y^2}{y-1} + 1 \\ x\,(y-1) = 1 \end{cases}$ has

(a) infinitely many solutions (b) four solutions (c) two solutions (d) one solution (e) no solution

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Exercise 4
The supply and demand equations of a product are q – 1000p + 3000 = 0 and 2q + 1000p – 6000 = 0. If a tax of 0.6 SR per unit is imposed on the supplier, then the equilibrium price is:

(a) 4.0 SR (b) 4.1 SR (c) 4.2 SR (d) 4.3 SR (e) 4.4 SR

Exercise 5
Consider the function $Z = 10x + 2y$ subject to $x + 2y \geq 4, x - 2y \geq 0, x, y \geq 0$. Then Z has:

(a) no maximum value
(b) a maximum value at (4,0)
(c) a minimum value at (0,2)
(d) a maximum value at (2,1)
(e) a maximum value at (3,5)

Exercise 6

A diet is to contain at least 18 units of carbohydrates and at most 20 units of protein. Food A contains 2 units of carbohydrates and 4 units of protein; food B contains 2 units of carbohydrates and 2 unit of protein. Food A costs 12 SR per unit and food B costs 8 SR per unit. Let x = # of units of food A and y = # of units of food B. The linear programming problem to minimize Cost Z is:

(a) Minimize $Z = 12x + 8y$ subject to $2x + 2y \geq 18$; $4x + 2y \geq 20$.
(b) Minimize $Z = 16x + 20y$ subject to $2x + 2y \geq 12$; $4x + 2y \geq 8$.
(c) Minimize $Z = 12x + 8y$ subject to $2x + 4y \geq 18$; $2x + y \leq 20$.
(d) Minimize $Z = 12x + 8y$ subject to $x + y \geq 9$; $2x + y \leq 10$.
(e) Minimize $Z = 8x + 12y$ subject to $2x + 2y \geq 18$; $4x + 2y \leq 20$.

Exercise 7

If $= \begin{pmatrix} 1 & 2 & 4 & 6 \\ 0 & 1 & 2 & 3 \\ 1 & 1 & 2 & 1 \end{pmatrix}$, then the reduced form for the matrix A is:

(a) $\begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 2 \\ 0 & 0 & 0 \end{pmatrix}$ (b) $\begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \end{pmatrix}$ (c) $\begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 2 & 3 \\ 0 & 0 & 0 & 1 \end{pmatrix}$ (d) $\begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 2 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}$ (e) $\begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 2 & 0 \\ 0 & 0 & 0 & 0 \end{pmatrix}$

Exercise 8

We use the simplex method to solve the following linear programming problem:

Maximize $W = -x + 5y + 4z - 3t$ subject to $\begin{cases} -x + z + t \leq 2 \\ x + y + z \leq 5 \\ x + y + z - t \leq 3 \\ x, y, z, t \geq 0 \end{cases}$

The maximum is

(a) 17 (b) 18 (c) 19 (d) 20 (e) 21

Exercise 9

The number of years it would take for money to double at an effective rate of 9% is

(a) 8 years (b) 9 years (c) 10 years (d) 11 years (e) 12 years

Exercise 10

A debt of 600 SR due in three years and 800 SR due in four years is to be repaid by a single payment two years from now. If the interest rate is 8% compounded semiannually, the single payment will be:

(a) 1238.58 SR (b) 1332.80 SR (c) 1400 SR (d) 1490.62 SR (e) 1584.85 SR

Exercise 11

A trust fund is being set up by a single payment so that at the end of 30 years there will be 50,000 SR in the fund. If interest is compounded continuously at an annual rate of 6%, how much money should be paid into the fund initially? The answer is:

(a) 302482.37 SR (b) 287174.56 SR (c) 50000 SR (d) 8705.51 SR (e) 8264.94 SR

Exercise 12
A machine is purchased for 10,000 SR down payment along with payments of 1000 SR at the end of every six months for six years. If interest is at 8% compounded semiannually, the corresponding cash price of the machine is :

(a) 9385.07 SR (b) 19385.07 SR (c) 19760.48 SR (d) 25025.81 SR (e) 25626.84 SR

[From Appendix A: $a_{10|0.04} = 8.110896$; $a_{11|0.04} = 8.760477$; $a_{12|0.04} = 9.385074$
$s_{11|0.04}$ =13.486351 ; $s_{12|0.04} = 15.025805$; $s_{13|0.04} = 16.626838$]

Exercise 13
Suppose that insurance proceeds of 30,000 SR are used to purchase an annuity of equal payments at the beginning of each quarter for 3 years. If interest is at the rate of 16% compounded quarterly, the amount of each payment is:

(a) 1919.77 SR (b) 1996.57 SR (c) 2500.00 SR (d) 3073.62 SR (e) 3196.57 SR

[From Appendix A: $a_{10|0.04} = 8.110896$; $a_{11|0.04} = 8.760477$; $a_{12|0.04} = 9.385074$
$s_{11|0.04}$ =13.486351 ; $s_{12|0.04} = 15.025805$; $s_{13|0.04} = 16.626838$]

Exercise 14
Suppose an organization is named by three Greek letters. (There are **24** letters in the Greek alphabet.) How many names are possible if no letter can be used more than one time? The answer is:

(a) 3^{24} (b) 24^{3} (c) 72 (d) ${}_{24}C_3$ (e) ${}_{24}P_3$

Exercise 15
A committee has 4 male and 4 female members. In how many ways can a subcommittee of four be selected if at most two females are to serve on it?

(a) 16 (b) 36 (c) 53 (d) 144 (e) 241

Exercise 16
On an examination, 10% of the students received an **A**, 25% a **B**, 35% a **C**, 25% a D, and 5% an **F**. If a student is selected at random, the probability that he received neither a D nor an F is:

(a) 0.2 (b) 0.25 (c) 0.3 (d) 0.7 (e) 0.8

Exercise 17
Urn I contains 1 White and 1 Blue marbles and Urn II contains 1 Blue and 2 Red marbles. An urn is selected at random. Then a marble is randomly drawn from it and placed in the other urn from which we randomly draw a marble. The probability that the second draw yields a white marble is

(a) $\frac{13}{48}$ (b) $\frac{11}{48}$ (c) $\frac{1}{16}$ (d) $\frac{1}{18}$ (e) $\frac{2}{18}$

Exercise 18
A first card is drawn from a deck of 52 cards. Then a second card is drawn.
Let E = {Second card is a Spade}, F = {First card is a Spade}, and G = {First card is a Club}. Then:

(a) E and F are independent **(b)** E and G are independent **(c)** P(E | F) = $\frac{12}{52}$ **(d)** P(E | G) = $\frac{12}{51}$ **(e)** P(F) + P(G) = 2P(E)

Exercise 19
The scores of a quiz in a math class of six students are 5, 6, 10, 11, 12, 15. How many standard deviations from the mean is the highest score? The answer is:

(a) 0 (b) 1 (c) 2 (d) 3 (e) 4

Exercise 20
We have two investment possibilities **A** and **B**. For **A**, there is 40% chance to lose 10,000 SR, 20% to breakeven, and 40% to make 80,000 SR. For **B**, there is 30% chance to lose 200,000 SR, 20% to breakeven, and 50% to make 64,000 SR. Let E_1 and E_2 denote the expected values of profits for **A** and **B**, respectively. Then, $E_1 + E_2 =$

(a) – 62,000 (b) – 56,000 (c) 0 (d) 56,000 (e) 62,000

Exercise 21
A bag contains three red and two white marbles. Two marbles are randomly selected. If X is the number of red marbles withdrawn, then E(X) =

(a) $\frac{2}{5}$ (b) $\frac{3}{5}$ (c) $\frac{4}{5}$ (d) $\frac{6}{5}$ (e) $\frac{7}{5}$

Exercise 22
Consider the following game. You are to toss three fair coins. If three heads or three tails turn up, you win 10 SR. If one head or two heads turn up, you lose 6 SR. Your expected winnings (per game) are:

(a) – 2 SR (b) – 1 SR (c) 0 SR (d) 1 SR (e) 2 SR

Exercise 23
A biased coin is tossed three times in succession. The probability of heads on any toss is $\frac{4}{5}$. The probability that two or three tails occur is:

(a) 0.008 (b) 0.096 (c) 0.104 (d) 0.896 (e) 0.904

Exercise 24
From a deck of 52 cards, 7 cards are randomly drawn <u>in succession with replacement</u>. The probability that there are exactly four hearts is:

(a) $({}_{13}C_4)/({}_{52}C_7)$ (b) $({}_{13}C_4\ {}_{39}C_3)/({}_{52}C_7)$ (c) 0.058 (d) $({}_{7}C_4\ {}_{7}C_3)/({}_{52}C_7)$ (e) 0.942

Exercise 25
In a production process, the probability of a defective unit is $\frac{1}{4}$. Suppose a sample of 8 units is selected at random and let X be the number of defectives. Then $P(X = 2) =$

(a) $1 - P(X \leq 1)$ (b) $\frac{(3^2)(7)}{4^7}$ (c) $\frac{(3^2)(14)}{4^7}$ (d) $\frac{(3^6)(7)}{4^7}$ (e) $\frac{(3^6)(14)}{4^7}$

---------------------------------- *Good Luck* --