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

Math 131 (Term 133)

Final – **CODE 001**

7:00 – 10:00 p.m. (Number of Exercises: 30)

Student Name_____ **Student ID:** _____

Exercise 1

An equation of the line passing through $(4, -5)$ and perpendicular to the line $3y = \frac{-2}{5}x + 3$ is

(a) $15y - 2x + 83 = 0$
(b) $2y - 15x + 70 = 0$
(c) $15y + 2x + 67 = 0$
(d) $2y - 15x - 50 = 0$
(e) $2y - 5x + 30 = 0$

Exercise 2

A company finds that if it produces and sells q units of a product, its total sales revenue in Saudi Riyals is $100\sqrt{q}$. If the variable cost per unit is SR 2 and the fixed cost is SR 1200, then the only values of q for which the company makes no profit ~~are~~: and no loss are :

(a) 144 and 2,500 (b) 400 (c) 400 and 900 (d) 900 (e) 2,500

Exercise 3

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

(a) 191 (b) 194 (c) 199 (d) 200 (e) 201

Exercise 4

A marketing firm estimates that n months after the introduction of a client's new product, $f(n)$ thousand households will use it where $f(n) = \frac{10}{9}n(12 - n); 0 \leq n \leq 12$. The maximum number of households that will use the product is

(a) 0 (b) 6,000 (c) 12,000 (d) 40,000 (e) 120,000

Exercise 5

Suppose a car dealer has showrooms in Dammam and Khobar and storehouses in Dhahran and Doha. The cost of delivering a car from Doha to Dammam is 35 SR, from Doha to Khobar is 50 SR, from Dhahran to Dammam is 45 SR, and from Dhahran to Khobar is 60 SR. The storehouse in Dhahran has 8 cars available and the storehouse in Doha has 6 cars. Suppose the showroom in Dammam orders 7 cars and the showroom in Khobar orders 4 cars. Let x = Number of cars delivered from Dhahran to Dammam and y = Number of cars delivered from Dhahran to Khobar. The linear programming problem to minimize cost Z is:

(a) Minimize $Z = 8x + 8y + 435$ subject to $x + y \leq 6;\ y \geq -x + 3$.
(b) Minimize $Z = 9x - 9y + 440$ subject to $x + y \leq 6;\ -x - y \leq -3$.
(c) Minimize $Z = 10x + 10y + 445$ subject to $x + y \leq 8;\ -x - y \leq -5$.
(d) Minimize $Z = 11x - 11y + 450$ subject to$x + y \leq 6;\ y \geq -x + 3$
(e) Minimize $Z = 12x + 12y + 455$ subject to $x + y \leq 8;\ y \geq -x + 5$

Exercise 6

We use the Simplex method to solve the following linear programming problem: Maximize $Z = 4x_1 + 5x_2 - 3x_3 - x_4$ subject to $\begin{cases} x_1 + x_3 - x_4 \leq 2 \\ x_1 + x_2 + x_4 \leq 5 \\ x_1 + x_2 - x_3 + x_4 \leq 3 \\ x_1, x_2, x_3, x_4 \geq 0 \end{cases}$

The maximum is

(a) 18 (b) 19 (c) 20 (d) 21 (e) 22

Exercise 7

A debt of SR 1,000 due in 3 years and SR 2,000 due in 4 years is to be repaid by a single payment 2 years from now. If the interest rate is 8% compounded semiannually, the single payment should be

(a) $1{,}000(1.04)^6 + 2{,}000(1.04)^8$
(b) $1{,}000(1.04)^{-6} + 2{,}000(1.04)^{-8}$
(c) $1{,}000(1.04)^3 + 2{,}000(1.04)^4$
(d) $1{,}000(1.04)^{-2} + 2{,}000(1.04)^{-4}$
(e) $1{,}000(1.04)^{-1} + 2{,}000(1.04)^{-2}$

Exercise 8

A student won a University prize. He will receive a check for 10,000 SR now and a similar one at the beginning of each year for the next 4 years. To provide all these payments, the University purchased an annuity at 8% compounded annually. The annuity cost the university (in SR)

(a) 35,061.12 (b) 35,770.97 (c) 43,121.27 (d) 48,666.01 (e) 49,927.10

[From Appendix A: $a_{3|0.08} = 2.577097$; $a_{4|0.08} = 3.312127$; $a_{5|0.08} = 3.992710$
$s_{4|0.08} = 4.506112$; $s_{5|0.08} = 5.866601$; $s_{6|0.08} = 7.335929$]

Exercise 9
In order to replace a machine in the future, a company is placing equal payments into a sinking fund at the end of each six months so that after 30 months the amount in the fund is 25,000 SR. The fund earns 16% compounded semi-annually. The amount of each payment (in SR) is

(a) 4,261.41 (b) 5,000 (c) 6,261.41 (d) 99,817.75 (e) 146,665.02

[From Appendix A: $a_{3|0.08} = 2.577097$; $a_{4|0.08} = 3.312127$; $a_{5|0.08} = 3.992710$
$s_{4|0.08} = 4.506112$; $s_{5|0.08} = 5.866601$; $s_{6|0.08} = 7.335929$]

Exercise 10
The number of all possible ways can five of seven books be arranged on a bookshelf is

(a) 120 (b) 21 (c) 5,040 (d) 3,125 (e) 2,520

Exercise 11
A basketball manager determines that, of his 9 team members, 4 are strong hitters and 5 are weak. If the manger wants the strong hitters to be the first 4 batters in a batting order, then the number of all possible batting orders is

(a) $(4^4)(5^5)$ (b) $({}_9P_4)({}_9P_5)$ (c) $({}_9C_4)({}_9C_5)$ (d) (4!)(5!) (e) $({}_9P_4)(5!)$

Exercise 12
In a mathematics class with 10 students, the instructor wants homework problems 2, 3, and 5 put on the board by three different students. The instructor can assign the problems in

(a) 720 ways (b) 1,000 ways (c) 120 ways (d) $10^2 10^3 10^5$ ways (e) $10^2+10^3+10^5$ ways

Exercise 13
A hand of 5 cards is dealt from a deck of 52 cards. The number of all possible hands with (exactly) 2 spades and (exactly) one diamond is

(a) 91 (b) 1,014 (c) 329,550 (d) 1,192,464 (e) 2,598,960

Exercise 14
A coin is tossed 6 times. The resulting sequence of heads and tails is recorded. Let A = Number of all possible sequences which have at most 3 heads and let B = Number of all possible sequences which have at least 3 heads. Then

(a) $A = 22$ (b) $A = 157$ (c) $A = B$ (d) $B = 41$ (e) $B = 1{,}800$

Exercise 15
A poker hand consists of 5 cards from a deck of 52 cards. The hand is a "full house" if there are 3 cards of one denomination and 2 cards of another denomination. For example, three 5's and two 10's form a full house. The number of all possible full-house hands is

(a) 3,744 (b) 4,512 (c) 22,464 (d) 103,776 (e) 211,926

Exercise 16
Suppose that $S = \{1,2,3,4,5,6,7,8,9,10\}$ is the sample space for an experiment with events:
$E = \{1,3,5\}$; $F = \{3,5,7,9\}$; $G = \{2,4,6,8\}$. Then $(E \cup G) \cap F' =$

(a) {1,2,3,4,5,6,7,8,9} (b) {1,2,3,4,5,6,8,10} (c) Empty Set (d) {3,5} (e) {1,2,4,6,8}

Exercise 17
For the sample space $\{a, b, c, d, e, f\}$, suppose that the probabilities of a, b, c, d are the same and that the probabilities of e, f are the same. Suppose also that $P\{a, e\} = \frac{5}{16}$. Then $P(a) =$

(a) $\frac{1}{16}$ (b) $\frac{2}{16}$ (c) $\frac{3}{16}$ (d) $\frac{4}{16}$ (e) $\frac{5}{16}$

Exercise 18
Urn I contains 1 Red and 1 Blue marbles and Urn II contains 1 Blue and 2 White 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 red marble is

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

Exercise 19
The probability that person A survives 15 more years is $\frac{2}{5}$ and the probability that person B survives 15 more years is $\frac{2}{3}$. If we assume independence, the probability that neither A nor B survives 15 more years is

(a) $\frac{1}{5}$ (b) $\frac{4}{15}$ (c) $\frac{16}{15}$ (d) $\frac{4}{5}$ (e) $\frac{8}{15}$

Exercise 20
A quiz consists of 5 multiple-choice problems. Each problem has 4 choices for the answer, but only one of them is correct. Suppose a student randomly guesses the answer to each problem. Assuming the guesses are independent, the probability that the student gets exactly 4 correct answers is

(a) 0.0039 (b) 0.0049 (c) 0.0146 (d) 0.0732 (e) 0.800

Exercise 21
Bill Gates lives in a town of 1,000 people. He is worth $10 billion and each one of the other 999 people is worth 0 $. In this town,

(a) the median personal wealth is not representative
(b) the mean for the personal wealth is equal to 1,000,000
(c) the mode for the personal wealth is representative and is equal to 1,000
(d) the mode for the personal wealth is equal to 0
(e) the median personal wealth is equal to 10,000,000

Exercise 22
The monthly salaries of the employees of a company are 300 SR, 500 SR, 1,200 SR, 1,500 SR, 3,000 SR, 10,000 SR with corresponding frequencies 8, 5, 3, 2, 1, 1, respectively. The number of employees who earn within one standard deviation of the mean is

(a) 20 (b) 19 (c) 18 (d) 17 (e) 16

Exercise 23
A landscaper earns 100 SR per day when working and loses 50 SR per day when not working. The probability of working on any day is $\frac{3}{4}$. The landscaper's expected daily earnings (in SR) are:

(a) $\frac{150}{4}$ (b) $\frac{200}{4}$ (c) $\frac{250}{4}$ (d) $\frac{300}{4}$ (e) $\frac{350}{4}$

Exercise 24
From a group of two women and three men, two persons are selected at random to form a committee. Let X be the number of men in the committee. Then $E(X) =$

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

Exercise 25
In a game, a coin is tossed 3 times. You gain 200 SR if 3 heads turn up and 100 if 2 heads turn up. You lose 150 SR in the other cases. Your expected gain in this game is

(a) 137.5 SR (b) 12.5 SR (c) 0 SR (d) -12.5 SR (e) -137.5 SR

Exercise 26

In a production process, the probability of a defective unit is $\frac{1}{2}$. Suppose a sample of 5 units is selected at random. Let X be the number of defectives. Then $P(X \geq 2) =$

(a) $\frac{3}{16}$ (b) $\frac{5}{16}$ (c) $\frac{11}{16}$ (d) $\frac{13}{16}$ (e) $\frac{15}{16}$

Exercise 27

Suppose X is a binomially distributed random variable with $\mu = 2$ and $\sigma^2 = \frac{3}{2}$. Then $P(X = 2) =$

(a) $\frac{(3^6)(7)}{2^{13}}$ (b) $\frac{(3^6)(7)}{2^{14}}$ (c) $\frac{(3^2)(7)}{2^{13}}$ (d) $\frac{(3^2)(7)}{2^{14}}$ (e) $1 - P(X \leq 1)$

Exercise 28

In a production process, the probability of a defective unit is 0.01. A sample of 1,000 units is selected at random. The probability that at least 999 units are NOT defective is

(a) 0.5 (b) 0.05 (c) 0.005 (d) 0.0005 (e) 0.00005

Exercise 29

The heights (in inches) of adults in a large group of population are normally distributed with $\mu = 64$ and $\sigma = 4$. The percentage of population under 72 inches tall is

(a) 97.72% (b) 95.44% (c) 47.72% (d) 7.44% (e) 2.28%

[From Appendix C: $A(1) = 0.3413$; $A(2) = 0.4772$; $A(3) = 0.4987$]

Exercise 30

The yearly income of a group of 10,000 employees is normally distributed with $\mu = 60{,}000\ SR$ and $\sigma = 5{,}000\ SR$. The number of employees who have yearly incomes less than $50{,}000\ SR$ is

(a) 9,772 (b) 9,544 (c) 4,772 (d) 744 (e) 228

[From Appendix C: $A(1) = 0.3413$; $A(2) = 0.4772$; $A(3) = 0.4987$]