National University
of Computer & Emerging Sciences Peshawar Campus

Student Name:_____
Program: BS (SE)
Semester: Fall-2021
Time Allowed: **03 hours**
Course: Probability & Statistics (MT2005/MT2009)

Roll No: _____
Examination: **FINAL**
Total Marks: 90, Weightage: **50**
Date: 19 / 01 / 2022
Instructor: Osama Sohrab

NOTE: ATTEMPT ALL PROBLEMS.

Problem # 01   **Marks = 4 + 4 = 08**

A certain town with a population of 100,000 has 3 newspapers: I, II, and III. The proportions of townspeople who read these papers are as follows:

I: 10 percent	I and II: 8 percent	I and II and III: 1 percent
II: 30 percent	I and III: 2 percent	
III: 5 percent	II and III: 4 percent	

Using venn diagram :

(a) Find the number of people who read only one newspaper.

(b) How many people read at least two newspapers?

Problem # 02   **Marks = 5 + 10 = 15**

(a) For any three events E, F and G show that

$$P(E \cup F \cup G) = P(E) + P(F) + P(G) - P(E \cap F) - P(E \cap G) - P(F \cap G) + P(E \cap F \cap G)$$

(b) All athletes at the Olympic games are tested for performance-enhancing steroid drug use. The imperfect test gives positive results (indicating drug use) for 90% of all steroidusers but also (and incorrectly) for 2% of those who do not use steroids. Suppose that 5% of all registered athletes use steroids. If an athlete is tested negative, what is the probability that he/she uses steroids?

Problem # 03   **Marks = 3 ∗ 3 = 9**

The joint PDF of X and Y is given by

$$f(x, y) = \begin{cases} x\, e^{-(x+y)} & x > 0, \ y > 0 \\ 0 & \text{otherwise} \end{cases}$$

(a) Compute the PDF of X.

(b) Compute the PDF of Y.

(c) Are X and Y independent?

Problem #04 Marks $= 6 + 12 = 18$

(a) Every day, a lecture may be canceled due to inclement weather with probability 0.05. Class cancelations on different days are independent. There are 15 classes left this semester. Compute the probability that at least 4 of them get canceled.

(b) A product is classified according to the number of defects it contains and the factory that produces it. Let X_1 and X_2 be the random variables that represent the number of defects per unit (taking on possible values of 0, 1, 2, or 3) and the factory number (taking on possible values 1 or 2), respectively. The entries in the table represent the joint possibility mass function of a randomly chosen product.

X_1 \ X_2	1	2
0	$\frac{1}{8}$	$\frac{1}{16}$
1	$\frac{1}{16}$	$\frac{1}{16}$
2	$\frac{3}{16}$	$\frac{1}{8}$
3	$\frac{1}{8}$	$\frac{1}{4}$

Find **E$[X_1]$, Var(X_2), and Cov(X_1, X_2)**.

Problem #05 Marks $= 10$

Find the **Interquartile range (IQR)** of the following data:

99	93	92	90	87	84
90	88	78	82	80	73
75	80	71	74	73	60
50	68	57	61	59	49

Problem #06 Marks $= 5 * 2 = 10$

In a certain industrial plant, accidents occur infrequently. It is known that the probability of an accident on any given day is 0.005 and accidents are independent of each other. **(a)** What is

the probability that in any given period of 400 days there will be an accident on one day? **(b)** What is the probability that there are at most three days with an accident?

Problem #07   **Marks = 10**

The monthly salary of employees in a university are approximately normally distributed with a mean of $50,000 and a standard deviation of $ 20,000.

(a) What percent of employees earn less than $ 30,000?

(b) What percent of employees earn between $ 40,000 and $ 75,000?

Problem #08   **Marks = 10**

The joint density function of X and Y is given by

$$f(x, y) = \begin{cases} 2e^{-x}e^{-2y} & 0 < x < \infty, 0 < y < \infty \\ 0 & \text{otherwise} \end{cases}$$

Compute (a) $P\{X > 1, Y < 1\}$ (b) $P\{X < Y\}$ (c) $P\{X < a\}$

THE END