

Enrolment No: \_\_\_\_\_ Name of Student: \_\_\_\_\_  
 Department/ School: \_\_\_\_\_

**END-TERM EXAMINATION, ODD SEMESTER DECEMBER 2024**

**MAX. DURATION:** 2 HRS

**COURSE CODE:** CSET240

**COURSE NAME:** Probability and Statistics

**PROGRAM:** B.Tech

**TOTAL MARKS:** 40

Mapping of Questions to Course and Program Outcomes								
Q.No.	A1	A2	A3	A4	B1	B2	B3	B4
CO	2	1	1	1	1	2	2	2
PO	1, 2, 4, 5	1, 2, 4, 5	1, 2, 4, 5	1, 2, 4, 5	1, 2, 4, 5	1, 2, 4, 5	1, 2, 4, 5	1, 2, 4, 5
BTL	1	1	2	2	3	4	3	3

**GENERAL INSTRUCTIONS:-**

- Do not write anything on the question paper except name, enrolment number and department/school.
- Carrying mobile phones, smartwatches and any other non-permissible materials in the examination hall is an act of UFM.

**COURSE INSTRUCTIONS:**

- a) All the sections and questions are compulsory. Calculators are allowed.

**SECTION A**

**[4Q × 4 Marks = 16 Marks]**

A1) In a study, researchers found the mean sodium intake in men and women 60 years or older to be 2940 mg with a standard deviation of 1476 mg. Use these values for the mean and standard deviation of the U.S. population and find the probability that a random sample of 75 people from the population will have a mean less than 2450 mg. Use the following data in your calculations:  $P[Z \leq -2.875] = 0.002$ . [4 Marks]

A2) Suppose  $X$  is a non-negative integral valued random variable. Show that the distribution of  $X$  is geometric if it lacks memory, that is, if for each  $k \geq 0$  and  $Y = X - k$ , one has  $P(Y = t | X \geq k) = P(X = t)$ , for  $t \geq 0$ . [4 Marks]

A3) The joint probability distribution of two random variables  $X$  and  $Y$  is given by,  $P(X=0, Y=1) = 1/3$ ;  $P(X=1, Y=-1) = 1/3$ ;  $P(X=1, Y=1) = 1/3$ .

- (a) Find the marginal distributions of  $X$  and  $Y$ .  
 (b) The conditional probability distribution of  $X$  given  $Y=1$ .

**[2 + 2 = 4 Marks]**

- A4) The amount of bread (in grams)  $x$  that a certain bakery is able to sell in a day is found to be a numeric valued random phenomenon, with a probability density function given as

$$f(x) = \begin{cases} kx, & \text{if } 0 \leq x < 5 \\ k(10 - x), & \text{if } 5 \leq x < 10 \\ 0, & \text{otherwise} \end{cases}$$

(a) Determine  $k$

(b) Let  $A$  be the event of selling the amount of breads more than 5 grams and  $B$  be the event of selling the amount of breads between 2.5 and 7.5 grams. Find  $P(A|B)$ .

[2 + 2 = 4 Marks]

#### SECTION B

[4Q x 6 Marks = 24 Marks]

- B1) If  $X$  and  $Y$  are two independent random variables following Poisson distribution such that,  $P(X = 1) = P(X = 2)$  and  $P(Y = 2) = P(Y = 3)$ . Find the variance of  $X - 2Y$ . [6 Marks]

- B2) The following are the head circumferences (centimeters) at birth of 5 infants: 33.38, 32.15, 33.99, 34.10, 33.97. From the data (obtained from a normally distributed population), can we conclude that the mean head circumferences for infants is not 34.5 centimeters? Use an appropriate hypothesis technique. Use the following information:  $t_{0.975, 4} = 2.7764$ .

[6 Marks]

- B3) For the sample data 24, 22, 26, 34, 35, 32, 33, 29, 19, 36, drawn from a population following a normal distribution construct a 95% confidence interval for the mean of the population. Use the following information:  $t_{0.975, 9} = 2.2622$ . [6 Marks]

- B4) Let us consider the following data.

X	5	8	6	9	7
Y	2	8	3	10	7

For the relation  $Y = aX + b$ , Use linear regression with least square technique, to find  $a$  and  $b$ . Suggest with logic a value of  $X$  and  $Y$  which can increase the correlation coefficient. [6 Marks]