

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:

- 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, $P(X=0, Y=1) = 1/3$; $P(X=1, Y=-1) = 1/3$; $P(X=1, Y=1) = 1/3$.

- Find the marginal distributions of X and Y .
- 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 × 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]