

Code No: 153AJ

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**B. Tech II Year I Semester Examinations, December - 2024/ January -2025****COMPUTER ORIENTED STATISTICAL METHODS****(Common to CSE, IT, CE(SE), CSE(IOT), CSE(N))****Time: 3 Hours****Max. Marks: 75**

- Note:** i) Question paper consists of Part A, Part B.
ii) Part A is compulsory, which carries 25 marks. In Part A, answer all questions.
iii) In Part B, Answer any one question from each unit. Each question carries 10 marks and may have a, b as sub questions.

PART – A**(25 Marks)**

- 1.a) Explain the concept of conditional probability and statistical independence. [2]
- b) A student A can solve 80 percent of the problems in a question paper and student B can solve 60 percent. What is the probability that the problem will be solved if both of them try independently? [3]
- c) State Chebyshev's theorem. [2]
- d) The mean and standard deviation of a binomial distribution are 20 and 4, respectively. Find n, p, q and the moment generating function. [3]
- e) Find the mean of exponential distribution. [2]
- f) If X is normally distributed with mean 8 and variance 16, find $P(5 \leq X \leq 10)$. [3]
- g) Define the terms (i) maximum likelihood estimate (ii) standard error. [2]
- h) Out of 20000 customers' ledger accounts, a sample of 600 was given to test the accuracy of posting and balancing and 45 mistakes were found. Assign limits which the number of mistakes can be expected at 95% level of confidence. [3]
- i) Define stochastic process. Give examples. [2]
- j) Explain about steady state of a Markov chain. When does a Markov chain is said to be ergodic? [3]

PART - B**(50 Marks)**

- 2.a) Data on the readership of a certain magazine show that the proportion of "male readers under 35" is 0.40 and over 35 is 0.20. If the proportion of readers under 35 is 0.70, find the proportion of subscribers that are "female over 35 years". Also calculate the probability that a randomly selected male subscriber is "under 35 years" of age.
- b) State Baye's theorem. In a class of 75 students, 20 students were considered to be very intelligent, 40 as medium and the rest below average. The probability that a very intelligent student fails in a semester examination is 0.015; the medium student failing has a probability 0.04; and the corresponding probability for a below average student is 0.19. If a student is known to have passed the examination, what is the probability that he is below average? [5+5]

OR

3.a) A random variable X has the density function:

$$f(x) = k \cdot \frac{1}{1+x^2}, \text{ for } -\infty < x < \infty,$$

Find the constant k , the expectation of X .

b) An urn contains 6 red and 4 white balls. Three balls are drawn at random. Obtain the probability distribution of the number of white balls drawn. [5+5]

4.a) A Company produces component parts for an engine. Parts specification suggests that 95% of items meet specifications. The parts are shipped to customers in lots of 100.

(i) What is the probability that more than 2 items will be defective in a given lot.
(ii) What is the probability that more than 10 items will be defective in a lot?

b) A random variable X takes the values $-1, 1, 3, 5$ with associated probabilities $\frac{1}{6}, \frac{1}{6}, \frac{1}{6}$ and $\frac{1}{2}$. Find by direct computation $P(|X - 3| \geq 1)$. Find the upper bound to this probability by applying Chebyshev's theorem. [5+5]

OR

5.a) Suppose that X is a random variable for which $E(X) = 10$ and $Var(X) = 25$. Find the positive values of a and b such that $Y = aX - b$ has the expectation 0 and variance 1.

b) The probability that a bulb will fail before 100 hrs. of its use is 0.2. Bulbs fail independently, if 15 bulbs are tested for life lengths, what is the probability that the number of failures before 100 hrs. does not exceed 3? Also explain the distribution that you assume. [5+5]

6.a) In a normal distribution, 31% of the items are under 45 and 8% are over 64. Find the mean and variance of the distribution. What can you say about the median and mode of this distribution?

b) A random sample of 220 students in a college were asked to give opinion in terms of Yes or No about the winning of their college team in a tournament. The following data is collected:

	Class in College		
	I year	II year	III year
Yes	43	20	37
No	23	57	40

Test whether there is any association between opinion and class in college using 5% level of significance? [5+5]

OR

7.a) A random sample of size 16 taken from a normal population showed a mean of 41.5 inches and the sum of the squares of the deviations from the mean is 135 sq. inches. Find the maximum error with 95% confidence.

b) A stenographer claims that she can take dictation at the rate of 120 words per minute. Can we reject her claim on the basis of 100 trials in which she demonstrates a mean of 116 words with a standard deviation of 15 words? Use 5% level of significance. [5+5]

8.a) In a random sample of 1000 persons from city A, 400 are found to be consumers of wheat. In another sample of 800 from city B, 400 are found to be consumers of wheat. Do these data reveal a significant difference between the two cities, so far as the proportion of wheat consumers is concerned?

b) Explain the following (i) Parameter and statistic (ii) Null and alternative hypothesis and (iii) F-distribution. [5+5]

OR

9.a) In a sample of 400 people from a village, 230 are found to be vegetarians and the rest are non-vegetarians. Can we assume that both vegetarian and non-vegetarian foods are equally popular?

b) Two random samples gave the following results:

Sample no.	Size	Sum of the values	Sum of the squares of the values
1	10	150	2340
2	12	168	2460

Test whether the samples have been drawn from the same normal population at 5% level of significance. [5+5]

10.a) Explain the classification of the states of the Markov process.

b) Suppose there are two market products of brand A and B, respectively. Let each of these two brands have exactly 50% the total market in same period and let the market be of a fixed size. The transition matrix is given below. If the initial market share breakdown is 50% for each brand, then determine their market shares in the steady state. [5+5]

		To	
		A	B
From	A	0.9	0.1
	B	0.5	0.5

OR

11.a) Test the following transition matrix to see if the Markov chain is regular and ergodic, where x is some positive p_{ij} value.

$$P = \begin{bmatrix} 1 & 2 & 3 & 4 \\ 0 & x & x & 0 \\ x & 0 & 0 & x \\ x & 0 & 0 & x \\ 0 & x & x & 0 \end{bmatrix}$$

b) A Salesman territory consists of cities A, B and C. He never sells in the same city on successive days. If he sells in city A, then the next day he sells in city B. However, if he sells in either B or C, then the next day, he is twice as likely to sell in city A as in the other cities. In the long run, how often does he sell in each of the cities? [5+5]