

R18

Code No: 153BN

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech II Year I Semester Examinations, February - 2024

PROBABILITY AND STATISTICS

(Civil Engineering)

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) Suppose that we have a fuse box containing 20 fuses, of which 5 are defective. If 2 fuses are selected at random and removed from the box in succession without replacing the first, what is the probability that both fuses are defective? [2]
- b) Define a Random variable and probability distribution. [3]
- c) If the probability of a defective bolt is $\frac{1}{8}$, find the mean for the distribution of defective bolts of a sample of 64, if the number defective bolts follow binomial distribution. [2]
- d) If a Poisson distribution is such that $3P(X = 1) = 2P(X = 3)$, find $P(X \geq 1)$. [3]
- e) Write the mean and variance of exponential distribution with parameters α and β . [2]
- f) Suppose that a system contains a certain type of component whose time, in years, to failure is given by T . The random variable T is modeled nicely by the exponential distribution with mean time to failure $\beta = 5$. If 5 of these components are installed in different systems, what is the probability that at least 2 are still functioning at the end of 8 years? [3]
- g) Write the regression equation of Y on X, regression equation of X on Y. [2]
- h) Fit a straight line $Y = a + bX$ for the given data of 7 data points
 $\sum X = 113$, $\sum Y = 182$, $\sum X^2 = 1938$, $\sum XY = 3186$ [3]
- i) Find $P(-t_{0.025} < T < t_{0.05})$. [2]
- j) Define Type-I & Type-II errors. [3]

PART - B

(50 Marks)

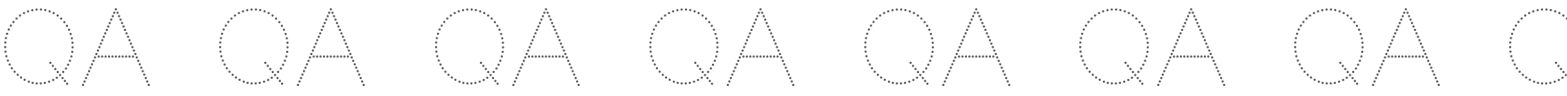
2.a) A random variable X has the following probability distribution

X	0	1	2	3	4	5	6	7
P(X)	0	K	2K	2K	3K	K ²	2K ²	7K ² +K

Find i) K, ii) Mean iii) Variance.

- b) A problem in statistics is given to the 3 students A, B, C whose chances of solving it are $\frac{1}{2}$, $\frac{3}{4}$ and $\frac{1}{4}$ respectively, find the probability that the problem is not solved? [5+5]

OR



3.a) Find the first four moments about mean from the following data

x	1	2	3	4	5
f	2	3	5	4	1

b) The probability density $f(x)$ of a continuous random variable is given by

$$f(x) = \begin{cases} cx(2-x), & \text{if } 0 \leq x \leq 2 \\ 0, & \text{otherwise} \end{cases}, \text{ find i) } c, \text{ ii) mean, iii) variance.} \quad [5+5]$$

4.a) Derive the mean of the Binomial distribution.

b) Determine the probability of getting the sum 6 exactly 3 times in 7 throws with a pair of fair dice. [5+5]

OR

5.a) Derive the mean of the Poisson distribution

b) If the probability that an individual suffers a bad reaction from a certain injection is 0.001, using Poisson distribution find the probability that out of 2000 individuals more than 2 individuals suffer a bad reaction. [5+5]

6. Show that for the normal distribution $mean = median = mode$. [10]

OR

7.a) Given the normally distributed variable X with mean 18 and standard deviation 2.5, find
i) $P(X < 15)$ ii) $P(17 < X < 21)$.

b) The heights of 1000 students are normally distributed with a mean of 174.5 centimeters and a standard deviation of 6.9 centimeters. Assuming that the heights are recorded to the nearest half-centimeter, how many of these students you would expect to have heights less than 160.0 centimeters? [5+5]

8. Compute the correlation coefficient for the following grades of 6 students selected at random: Mathematics grade: 70, 92, 80, 74, 65, 83. English grade: 74, 84, 63, 87, 78, 90. [10]

OR

9. Fit a second-degree polynomial to the following data by the method of least square.

[10]

X	2	4	6	8	10
Y	3.07	12.85	31.47	57.38	91.29

10. A random sample of 100-recorded deaths in the United States during the past year showed an average life span of 71.8 years. Assuming a population standard deviation of 8.9 years, does this seem to indicate that the mean life span today is greater than 70 years? Use a 0.05 level of significance. [10]

OR

11. Random sample of 400 men and 600 women were asked whether they would like to have a flyover near their residence. 200 men and 325 women were in favour of the proposal. Test the hypothesis that proportions of men and women in favour of the proposal are same, at 5% level. [10]

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