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300205

May 2019

B.Tech. (CE/CSE/IT) 2nd Semester

MATHS-II

(Probability and Statistics)

(BSC106E)

Time : 3 Hours] [Max. Marks : 75

Instructions :

(i) It is compulsory to answer all the questions (1.5 marks each) of Part-A in short.

(ii) Answer any four questions from Part-B in detail.

(iii) Different sub-parts of a question are to be attempted adjacent to each other.

PART–A

1. (a) A die is tossed thrice. Getting '5' or '6' on the die in a toss is taken as success. Find the mean of number of success. (1.5)

(b) Define Chebyshev's Inequality. (1.5)

(c) Write formula for mode and median of Normal Distribution. (1.5)

(d) A speaks truth 4 out of 5 times. A die is tossed. He reports that there is a six. What is the chance that actually there was six? (1.5)

(e) Find variance of Gamma Disribution. (1.5)

(f) Prove that (X,Y) possesses a bivariate normal distribution if every linear combination of X, Y is a normal variate. (1.5)

(g) Explain briefly Karl-Pearson's coefficient of correlation. (1.5)

(h) The mean weekly sales of soap bars in departmental stores was 146.3 bars per store. After an advertising campaign the mean weekly sales in 22 stores for a typical week increased to 153.7 and showed a standard deviation of 17.2. Was the advertising campaign successful ? (1.5)

(i) Define covariance of two random variables. (1.5)

(j) Define Null hypothesis and Confidence Limits. (1.5)

PART–B

2. (a) A random variable X has the following probability function :

Values of X	0	1	2	3	4	5	6	7
P(X)	0	k	2k	2k	3k	k^2	$2k^2$	$7k^2+k$

(i) Find k, (ii) Evaluate $P(X < 6)$, $P(X \geq 6)$, and $P(0 < X < 5)$ (iii) If $P(X \leq a) > \frac{1}{2}$, find the minimum value of a, and (iv) Determine the distribution function of X. (8)

(b) Ten percent of the tools in a certain manufacturing process turn out to be defective . Find the probability that in a sample of 10 tools chosen at a random, exactly two will be defective by using the binomial distribution. (7)

3. (a) Let X be a continuous random variable with p.d.f.:

$$f(x) = \begin{cases} ax, & 0 \leq x \leq 1 \\ a, & 1 \leq x \leq 2 \\ -ax + 3a, & 2 \leq x \leq 3 \\ 0, & \text{elsewhere} \end{cases}$$

(i) Determine the constant a (ii) Compute $P(X \leq 1.5)$. (8)

(b) X be a normal variate with mean 30 and S.D. 5. Find the probabilities that

(i) $26 \leq X \leq 40$, (ii) $X \geq 45$. (iii) $|X - 30| > 5$. (7)

4. (a) Show that if X_1 and X_2 are standard normal variates with correlation coefficient ρ between them, then the correlation coefficient between X_1^2 and X_2^2 is given by ρ^2. (8)

(b) A and B are two weak students of statistics and their chances of solving a problem in statistics correctly are $\frac{1}{6}$ and $\frac{1}{8}$ respectively. If the probability of their making a common error is $\frac{1}{525}$ and they obtain the same answer, find the probability that their answer is correct. (8)

5. (a) For a distribution, the mean is 10, variance is 16, γ_1 is +1 and β_2 is 4. Obtain the first four moments about the origin, i.e., zero. Comment upon the nature of distribution. (8)

(b) Let (X, Y) have the joint p.d.f. given by :

$$f(x, y) = \begin{cases} 1, & \text{if } |y| < x, 0 < x < 1 \\ 0, & \text{otherwise} \end{cases}$$

Show that the regression of Y on X is linear but regression of X on Y is not linear. (7)

6. (a) Find the least squares approximation of second degree for the discrete data :

X	–2	–1	0	1	2
Y	15	1	1	3	10

(8)

(b) The heights of six randomly chosen sailors are (in inches) : 63, 65, 68, 69, 71 and 72. Those of 10 randomly chosen soldiers are 61, 62, 65, 66, 69, 69, 70, 71, 72 and 73. Discuss the light that these data throw on the suggestion that sailors are on the average taller than soldiers. (7)

7. (a) A set of five similar coins is tossed 320 times and the result is

No. of heads :	0	1	2	3	4	5
Frequency :	6	27	72	112	71	32

Test the hypothesis (Chi-square test) that the data follow a binomial distribution. (8)

(b) A random sample of size 16 values from a normal population showed a mean of 53 and a sum of squares of deviation from the mean equals to 150. Can this sample be regarded as taken from the population having 56 as mean ? Obtain 95% and 99% confidence limits of the mean of the population. (7)
