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Total Pages : 07

003201

May 2025

B. Tech. (CE/IT/DS/CE) (Second Semester)

Mathematics-II (Probability and Statistics)

(MTU-142-V/BSC-106E)

Time : 3 Hours] *[Maximum Marks : 75*

Note : It is compulsory to answer all the questions (1.5 marks each) of Part A in short. Answer any *four* questions from Part B in detail. Different sub-parts of a question are to be attempted adjacent to each other.

Part A

1. (a) Write down the various measures of Skewness. **1.5**

(b) If X and Y are independent random variables then prove that $E(XY) = E(X)\,E(Y)$. **1.5**

(c) State and prove the recurrence relation for Binomial distribution. **1.5**

4. (a) The probabilities of A, B and C becoming managers of a company are 4/9, 2/9 and 1/3 respectively. The probabilities that the bonus scheme will be introduced if A, B and C become managers are 3/10, 1/2 and 4/5 respectively : 8

(i) What is the probability that Bonus scheme will be introduced ?

(ii) If the Bonus scheme has been introduced, what is the probability that manager appointed was A ?

(b) Find the most likely price in Mumbai corresponding to the price of Rs. 70 at Kolkata from the following :

	Kolkata	Mumbai
Average price	65	67
Standard deviation	2.5	3.5

Correlation coefficient between the prices of the commodities in the two cities is 0.8. 7

5. (a) The mean yield for one-acre plot is 662 kilos with standard deviation 32 kilos. Assuming normal distribution, how many one-acre plots in a batch of 1000 plots would you expect to have yield : 8

(i) over 700 kilos

(ii) below 650 kilos

(iii) What is the lowest yield of the best 100 plots ?

(b) Fit a exponential curve of the form $Y = ab^x$ to the following data : 7

X	1	2	3	4	5	6	7	8
Y	1	1.2	1.8	2.5	3.6	4.7	6.6	9.1

6. (a) Random samples drawn from two countries gave the ahead data relating to the heights of adult males : 8

(d) Prove that the ordinate is maximum at mean for the normal curve. 1.5

(e) Define Leptokurtik curve and write down the values of β_2 and γ_2 for this curve. 1.5

(f) Define Correlation. What are the conditions for a perfect correlation ? 1.5

(g) Write down the expression for the standard error of the difference of mean of two independent random samples of size n and m. 1.5

(h) What are the applications of Chi-square distribution ? 1.5

(i) Which distribution is known as generalization of Binomial distribution. Write down its probability function. 1.5

(j) Explain critical region and level of significance. 1.5

Part B

2. (a) What is the expectation of number of failures preceding the first success in an infinite series of independent trials with constant probability p of success in each trial ? 8

(b) State and prove Chebychev's inequality. 7

3. (a) The random variable X and Y are jointly normally distributed and U and V are defined by $U = X \cos\alpha + Y \sin\alpha$; $V = Y \cos\alpha - X \sin\alpha$. Show that U and V will be uncorrelated if $\tan 2\alpha = \frac{2r\sigma_x\sigma_y}{\sigma_x^2 - \sigma_y^2}$, where r = Correlation (X, Y), σ_x^2 = Variance (X), σ_y^2 Variance (Y). Are U and V then independent ? 8

(b) Is there any relation between Exponential and Gamma distributions ? Find out the mean and Variance of Exponential and gamma distributions. 7

	Country A	Country B
Mean height (in inches)	67.42	67.25
Standard deviation (In inches)	2.58	2.5
Number of Samples	1000	1200

Is the difference between the means significant ?

Is the difference between the standard deviations significant ?

(b) Random samples of 400 men and 600 women were asked whether they would like to have a flyover near their residence. 200 men and 350 women were in favour of the proposal. Test the hypothesis that proportions of men and women in favour of the proposal, are same against that they are not, at 5% level. 7

7. (a) When the first proof of 392 pages of a book of 1200 pages were read, the distribution of printing mistakes were found to be as follows :

No of mistakes in a page	0	1	2	3	4	5	6
No of pages	275	72	30	7	5	2	1

Fit a Poisson distribution to the above data and test the goodness of fit. 8

(b) A random sample of 10 boys had the following I.Q's :

70, 120, 110, 101, 88, 83, 95, 98, 107, 100.

Do these data support the assumption of a population mean I.Q. of 100 ? Find a reasonable range in which most of the mean I.Q. values of samples of 10 boys lie. 7

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