

Satyug Darshan Institute of Engineering & Technology, Faridabad

Department of Applied Science and Humanities

Academic year 2025-26

Programme: B.Tech. CSE/CE	Year & Semester: 1 st & 2 nd
Course Name: Probability and Statistics	Course Code: MTU-142-V
Prepared by: Dr. Ashok Kumar	

Unit I

Short answer questions

Q.N.	Question	KL
1	A speaks truth in 75% cases and B in 80% cases. In what percentages of cases are they likely to contradict each other in stating the same fact?	3
2	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 expectation 0 and variance 1.	2
3	Suppose that X has a Poisson distribution. If $P(X=2)=(2/3) P(X=1)$ find, (i) $P(X=0)$ (ii) $P(X=3)$.	2
4	If A and B are two events such that $P(A) = \frac{1}{4}$, $P(B) = \frac{1}{3}$ and $P(A \cup B) = \frac{1}{2}$ Show that A and B are independent events.	2
5	Prove that total area under the normal curve is unity.	2

Long answer questions

Q.N.	Question						KL
1	Fit a Poisson distribution on the following						2
	x	0	1	2	3	4	
	f	192	100	24	3	1	
2	State and Prove Chebyshev's Inequality						3
3	If $X_1, X_2, \dots, X_k$ are k independent Poisson Variate with parameters $\lambda_1, \lambda_2, \dots, \lambda_k$ respectively, prove that the conditional distribution $P(X_1 \cap X_2 \cap \dots \cap X_K / X)$ where $X = x_1 + x_2 + \dots + x_k$ is fixed, is multinomial.						3
4	Show that the exponential distribution 'lacks memory' i.e. If X has an exponential distribution, then for every constant $a \geq 0$ one has $P(Y \leq x / X \geq a) = P(X \leq x)$ for all x, where $Y=X-a$.						3
5	If $P(A)=1/3, P(B)=1/4, P(A \cup B)=1/2$. Determine (i) $P(B/A)$ (ii) $P(A/B)$						2

Satyug Darshan Institute of Engineering & Technology, Faridabad

Unit II

Short answer questions

Q.N.	Question	KL
1	Prove that the area under the normal curve is unity.	2
2	Define Gamma distribution.	1
3	If X is a random variable and c is constant Then prove that $M_{cx}(t) = M_x(ct)$	2
4	Find variance of Gamma distribution.	2
5	Find the Moment Generating Function for Normal distribution.	2

Long answer questions

Q.N.	Question	KL
1	If the probability density function $f(x) = \begin{cases} kx^3 & \text{if } 0 \leq x \leq 3 \\ 0 & \text{elsewhere} \end{cases}$ find the value of k and find the probability between $x=1/2$ and $x=3/2$.	2
2	In a Normal distribution, 31% of the items are under 45 and 8% are over 64. Find the mean and standard deviation of the distribution.	3
3	Find the Mean deviation from mean for the Normal Distribution	
4	The Probability density P(x) of a continuous random variable Is given by $P(x) = y_0 e^{- x }$, $-\infty < x < \infty$ Prove that $y_0 = \frac{1}{2}$ also find mean.	3
5	Q.No.1 If $f(x) = \begin{cases} \frac{1}{2}(x+1), & -1 < x < 1 \\ 0 & \text{Otherwise} \end{cases}$ represent the density of a random variable X. Find E[X] & Var[x]	3
6	A sample of 100 dry battery cells tested to find the length of the life produced the following results: mean=12 hours, S.D.=3 hours Assuming the data to be normally distributed, what percentage of battery cells are expected to have life; (a) more than 15 hours (b) less than 6 hours (c) between 10 and 14 hours.	3

Unit III

Short answer questions

Q.N.	Question	KL
1	Find K so that $f(x, y) = kxy$, $1 \leq x \leq y \leq 2$ will be a joint probability density function.	3
2	Define Baye's theorem.	1
3	If $p(x) = \begin{cases} \frac{x}{15} & , \quad x = 1, 2, 3, 4, 5 \\ 0 & , \text{otherwise} \end{cases}$ find $P\left(\frac{1}{2} < X < \frac{5}{2} / X > 1\right)$	2
4	If X and Y are two mutually independent events, then find Cov(X,Y)	3
5	Define Two-dimensional distribution function.	1

Satyug Darshan Institute of Engineering & Technology, Faridabad

Long answer questions

Q.N.	Question	KL																																			
1	A and B are two weak students of statistics and their chance 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.	3																																			
2	There are three bags: First contain 1 white, 2 red and 3 green balls, second contain 2 white, 3 red and 1green balls and third contain 3 white, 1red and 2 green balls. Two balls are drawn from a bag chosen at random. They are found to be 1 red and 1 white. Find the probability that balls so drawn came from the second bag.	3																																			
3	For the following bivariate probability distribution of X and Y find (i) $P(X \leq 2, Y = 3)$ (ii) $P(X \leq 1)$ (iii) $P(Y = 4)$ (iv) $P(Y \leq 5)$ (v) $P(X<2,Y\leq3)$ <table><tr><td>Y</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td></tr><tr><td>X</td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>0</td><td>0</td><td>0</td><td>1/32</td><td>2/32</td><td>2/32</td><td>3/32</td></tr><tr><td>1</td><td>1/16</td><td>1/16</td><td>1/8</td><td>1/8</td><td>1/8</td><td>1/8</td></tr><tr><td>2</td><td>1/32</td><td>1/32</td><td>1/64</td><td>1/64</td><td>0</td><td>2/64</td></tr></table>	Y	1	2	3	4	5	6	X							0	0	0	1/32	2/32	2/32	3/32	1	1/16	1/16	1/8	1/8	1/8	1/8	2	1/32	1/32	1/64	1/64	0	2/64	3
Y	1	2	3	4	5	6																															
X																																					
0	0	0	1/32	2/32	2/32	3/32																															
1	1/16	1/16	1/8	1/8	1/8	1/8																															
2	1/32	1/32	1/64	1/64	0	2/64																															
4	X and Y are two random variables having joint density function $=\frac{1}{27}(2x + y)$, where x and y can assume only integer value 0,1 and 2. Find Conditional distribution of Y for X=x.	3																																			
5	A Man is known to speak truth 3 out of 4 times. He throws a die and reports that it is six, find the probability that it is actually a six.	3																																			
6	State and prove Baye's Theorem.	3																																			
7	Two random variable X and Y have the joint density $f(x,y) = 2 - x - y, 0 < x < 1, 0 < y < 1$ Find the marginal and conditional density function of X and Y, and show that $\rho[X,Y] = \frac{-1}{11}$; Find E[X/y]	3																																			

Unit IV

Short answer questions

Q.N.	Question	KL
1	Calculate the coefficient of variation for the following data 5, 7, 8, 12, 18.	2
2	Calculate the geometric mean from the following items: 133, 141, 125, 173, 182.	2
3	The first four moments of a distribution about $x=4$ are 1, 4, 10 and 45. Determine the value of the mean, variance, μ_3 and μ_4	3
4	For a certain distribution, the first moment about 10 is 40 and the fourth moment about 50 is 48. Find the arithmetic mean and standard deviation of the distribution.	3
5	The coefficient of rank correlation between the debenture price and share price of a company was 0.8. If the sum of squares of the difference in ranks was 33, find the value of n.	3

Satyug Darshan Institute of Engineering & Technology, Faridabad

Long answer questions

Q.N.	Question	KL
1	Calculate Mean, Median and Mode for the following data obtaining to marks in Mathematics out of 140 marks for 80 students in the class. Marks More than: 0 20 40 60 80 100 120 No of students: 80 76 50 28 18 9 3	2
2	The Median and Mode of the following marks are known to be 33.5 and 34 respectively. However, three frequencies are missing. Determine their values. Marks: 0-10 10-20 20-30 30-40 40-50 50-60 60-70 Total No. of students: 4 16 ? ? ? 6 4 230	3
3	The annual rate of growth of output of a factory in 5 years are 5.0, 7.5, 2.5, 5.0 and 10.0 respectively. What is the compound rate of growth of output per Annam for the period?	2
4	Calculate Q_1 , Q_2 , Q_3 from the following data Profit: 20-30 30-40 40-50 50-60 60-70 70-80 80-90 90-100 Frequency : 4 8 18 30 15 10 8 7	3
5	If the median of the following data is 32. Find x and y. Marks : 0-10 10-20 20-30 30-40 40-50 50-60 Total Frequency: 10 x 25 30 y 10 100	3

Unit V

Short answer questions

Q.N.	Question	KL
1	Define error in sampling.	1
2	A normal population has a mean of 0.1 and standard deviation of 2.1. Find the probability that mean of a sample of size 900 will be negative.	2
3	A normal population has mean of 6.8 and standard deviation of 1.5. A sample of 400 members gave a mean of 6.75. Is the difference significant?	2
4	Define Null hypothesis and confidence Limits.	1
5	During a testing of 300 chips 10 have been found to be defective, Can the manufacturer claim that 2% of the chips are defective may be accepted?	2

Long answer questions

Q.N.	Question	KL												
1	Fit a straight line to the following data x: 0 1 2 3 4 y: 1.0 1.8 3.3 4.5 6.3 Hence find the difference between the actual value and the obtained value of y when x=3.	3												
2	Find the least square approximation of second degree for the discrete data: <table><tr><td>X</td><td>-2</td><td>-1</td><td>0</td><td>1</td><td>2</td></tr><tr><td>Y</td><td>15</td><td>1</td><td>1</td><td>3</td><td>10</td></tr></table>	X	-2	-1	0	1	2	Y	15	1	1	3	10	2
X	-2	-1	0	1	2									
Y	15	1	1	3	10									

Satyug Darshan Institute of Engineering & Technology, Faridabad

3	A machine produced 16 defective articles in a batch of 500. After overhauling it produced 3 defectives in a batch of 100. Has the machine improved?	3
4	In a hospital 475 female and 525 male babies were born in a week. Do these figures confirm the hypothesis that males and females are born in equal number?	3
5	A cubical die is thrown 9000 times and a throw of 3 or 4 is observed 3240 times. Show that the die cannot be regarded as an unbiased one and find the extreme limits between which the probability of a throw of 3 or 4 lies.	3
6	The means of simple samples of sizes 1000 and 2000 are 67.5 and 68.0cm respectively. Can the sample be regarded as drawn from the same population of S.D, 2.5cm?	2

Unit VI

Short answer questions

Q.N.	Question						KL														
1	Define degree of freedom for chi-square test.						1														
2	What are the expected frequencies of 2x2 contingency table given below <table><tr><td>2</td><td>10</td></tr><tr><td>6</td><td>6</td></tr></table>						2	10	6	6	2										
2	10																				
6	6																				
3	A random sample of size 16 has 53 as a mean. The sum of squares of the deviation from the mean is 135. Can this sample be regarded as taken from the population having 56 as mean?						2														
4	Find the student's t for the following variable values in a sample of eight: -4, -2, -2, 0, 2, 2, 3, 3 taking the mean of the universe to be zero.						3														
5	What are the conditions for applying Chi-Square test?						1														
6	The following table gives the number of accidents that took place in an industry during various days of the week. Test if accidents are uniformly distributed over the week. <table><tr><td>Day</td><td>Mon</td><td>Tue</td><td>Wed</td><td>Thu</td><td>Fri</td><td>Sat</td></tr><tr><td>No. of accidents</td><td>14</td><td>18</td><td>12</td><td>11</td><td>15</td><td>14</td></tr></table>						Day	Mon	Tue	Wed	Thu	Fri	Sat	No. of accidents	14	18	12	11	15	14	2
Day	Mon	Tue	Wed	Thu	Fri	Sat															
No. of accidents	14	18	12	11	15	14															

Long answer questions

Q.N.	Question	KL
1	A filling machine is expected to fill 5 kg of powder into a bags. A random sample of 10 bags gave the following weights 4.7, 4.9, 5.0, 5.1, 5.4, 5.2, 4.6, 5.1, 4.6 and 4.7. Test whether the machine is working properly.	3
2	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 that the data follow binomial distribution.	2
3	If a random sample of size 20 from a normal population with standard deviation 5.2 shows a mean of 16.9, test at 5% level of significance that the sample is drawn from a population with mean 15.5. Also calculate 99% confidence limit for mean.	3

Satyug Darshan Institute of Engineering & Technology, Faridabad

4	A sample of 20 items has mean 42 units and S.D. 5 units. Test the hypothesis that it is a random sample from a normal population with mean 45 units.	3																						
5	A sample of 6 persons in an office revealed an average daily smoking of 10, 12, 8, 9, 16, 5 cigarettes. The average level of smoking in the whole office has to be estimated at 90% level of confidence. $t=2.015$ for 5 degree of freedom.	3																						
6	A group of 10 rats fed on diet A and another group of 8 rats fed on a different diet B recorded the following increase in weight(gm) <table><tr><td>Diet A</td><td>5</td><td>6</td><td>8</td><td>1</td><td>12</td><td>4</td><td>3</td><td>9</td><td>6</td><td>10</td></tr><tr><td>Diet B</td><td>2</td><td>3</td><td>6</td><td>8</td><td>10</td><td>1</td><td>2</td><td>8</td><td></td><td></td></tr></table> Does it show the superiority of diet A over the diet B?	Diet A	5	6	8	1	12	4	3	9	6	10	Diet B	2	3	6	8	10	1	2	8			3
Diet A	5	6	8	1	12	4	3	9	6	10														
Diet B	2	3	6	8	10	1	2	8																