

Name:			
Enrolment No:			
UPES End Semester Examination, December 2025 Course: Probability and Statistics Program: B.Sc. (H) Mathematics/B.Sc. (H) Mathematics by Research, B.Sc. (H) Physics/B.Sc. (H) Physics by Research, B.Sc. (H) Geology Course Code: MATH 3061 Semester: V Time : 03 hrs. Max. Marks: 100			
Instructions: All questions are compulsory. There is an internal choice in Q7 and Q11.			
SECTION A (5Qx4M=20Marks)			
S. No.		Marks	CO
Q 1	If A and B are any two events, then show that $P(A \cup B) = P(A) + P(B) - P(A \cap B).$	4	CO1
Q 2	Calculate the probability of getting exactly 3 heads in 5 flips of a fair coin?	4	CO2
Q 3	The number of traffic accidents per week in a small city has a Poisson distribution with mean equal to 3. Find the probability of exactly 2 accidents occur in 2 weeks.	4	CO2
Q 4	For what value of the constant k the function given by $f(x,y) = \begin{cases} kxy & \text{if } x = 1, 2, 3; y = 1, 2, 3 \\ 0 & \text{otherwise} \end{cases}$ is a joint probability mass function (p.m.f.) of some random variables X and Y .	4	CO3
Q 5	If $\text{Var}(X + Y) = 3$, $\text{Var}(X - Y) = 1$, $E[X] = 1$ and $E[Y] = 2$, then evaluate $E[XY]$?	4	CO4
SECTION B (4Qx10M= 40 Marks)			
Q 6	If the probability density function of the random variable is $f(x) = \begin{cases} 1 - x & \text{for } x < 1 \\ 0 & \text{otherwise} \end{cases}$ Then determine the mean and variance of X ?	10	CO1
Q 7	Suppose 30 percent of all electrical fuses manufactured by a certain company fail to meet municipal building standards. Find the probability that in a random sample of 10 fuses, exactly 3 will fail to meet municipal building standards?	10	CO2
OR			

	A lot of 8 TV sets include 3 that are defective. If 4 of the sets are chosen at random for shipment to a hostel, how many defective sets can they expect?																								
Q 8	Joint p.m.f. for the random variables X and Y is given by : <table border="1"><tr><td>$X \backslash Y$</td><td>1</td><td>2</td></tr><tr><td>1</td><td>0.1</td><td>0.3</td></tr><tr><td>2</td><td>0.2</td><td>0.4</td></tr></table> Find the marginal distributions of X and Y . Check whether X and Y are independent.	$X \backslash Y$	1	2	1	0.1	0.3	2	0.2	0.4	10	CO3													
$X \backslash Y$	1	2																							
1	0.1	0.3																							
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Q 9	If the joint moment generating function of the random variables X and Y is $M(s, t) = e^{(2s+4t+8st)}$ Calculate $E[X]$, $E[Y]$, $\text{Cov}(X, Y)$.	10	CO4																						
SECTION-C (2Qx20M=40 Marks)																									
Q 10	Random variables X and Y have joint continuous distribution with probability density function $f(x, y) = \begin{cases} c(2x + y) & \text{for } 0 < x < 1, 0 < y < 2 \\ 0 & \text{elsewhere} \end{cases}$ (a) Find the value of c . (b) Compute $E[X]$ and $E[Y]$. (c) Formulate $E[X Y = y]$. (d) Check X and Y are independent or not?	20	CO3																						
Q 11	The data on heights of fathers and sons are given in the following table, where X is height of fathers and Y is height of son. <table border="1"><tr><td>X</td><td>65</td><td>63</td><td>67</td><td>64</td><td>68</td><td>62</td><td>70</td><td>66</td><td>68</td><td>67</td></tr><tr><td>Y</td><td>68</td><td>66</td><td>68</td><td>65</td><td>69</td><td>66</td><td>68</td><td>65</td><td>71</td><td>67</td></tr></table> Evaluate the coefficient of correlation for the following data by making a table. Also construct a regression line and consequently predict the son's height for father with height 72 inches. OR In a partially destroyed laboratory on record of an analysis of correlation data, the following results only are legible: $\text{Var}(X) = 9$ Regression equations: $8x - 10y + 66 = 0$, $40x - 18y = 214$. Find: (a) The mean value of X and Y . (b) The standard deviation of Y . (c) The coefficient of correlation between X and Y .	X	65	63	67	64	68	62	70	66	68	67	Y	68	66	68	65	69	66	68	65	71	67	20	CO4
X	65	63	67	64	68	62	70	66	68	67															
Y	68	66	68	65	69	66	68	65	71	67															