

	Reg. No.:	
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SUPPLEMENTARY EXAMINATION – November 2023

Programme	: B.Tech.	Semester	: Fall 2023-24 / Fall 2023-24 (Fast Track)
Course Title	: Probability, Statistics & Reliability	Course Code	: MAT3003
Faculty Name	: Dr. Jyoti Badge	Slot / Class No	: NA
Time	: 1½ hours	Max. Marks	: 50

Answer ALL the Questions

Q. No.	Question Description	Marks
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PART - A (30 Marks)

1	(a)	(i) Find the probability of getting a red ace when a card is drawn at random from an ordinary deck of cards. (ii) A single card is drawn at random from an ordinary deck of cards. Find the probability that it is either an ace or a black card. (iii) At a university in western Pennsylvania, there were 5 burglaries reported in 2003, 16 in 2004, and 32 in 2005. If a researcher wishes to select at random two burglaries to further investigate, find the probability that both will have occurred in 2004 (iv) A coin is tossed 5 times. Find the probability of getting at least 1 tail	10																													
	OR																															
	(b)	Given the following table: <table><tr><td>x</td><td>-3</td><td>-2</td><td>-1</td><td>0</td><td>1</td><td>2</td><td>3</td></tr><tr><td>$p(x)$</td><td>0.05</td><td>0.10</td><td>0.30</td><td>0</td><td>0.30</td><td>0.15</td><td>0.10</td></tr></table> Compute: (i) $E(X)$, (ii) $E(2X - 3)$, (iii) $E(4X + 5)$, (iv) $V(X)$ and (v) $V(2X + 3)$	x	-3	-2	-1	0	1	2	3	$p(x)$	0.05	0.10	0.30	0	0.30	0.15	0.10	10													
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$p(x)$	0.05	0.10	0.30	0	0.30	0.15	0.10																									
2	(a)	For 50 students of a class the regression equation of marks in Statistics (X) on marks in Accountancy (Y) is $3Y - 5X + 108 = 0$. The mean marks of Accountancy (Y) is 44 and the variance of marks in Statistics is 9/16 of the variance of marks in Accountancy. Find: (a) mean marks of Statistics (X), (b) regression coefficient of X on Y and (c) the coefficient of correlation between marks in two subjects.	10																													
	OR																															
	(b)	Memory capacity of 9 students were tested before and after training. State whether the training was effective or not from the following scores: <table><tr><td>Students</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td></tr><tr><td>Before</td><td>10</td><td>15</td><td>9</td><td>3</td><td>7</td><td>12</td><td>16</td><td>17</td><td>14</td></tr><tr><td>After</td><td>17</td><td>17</td><td>8</td><td>5</td><td>6</td><td>11</td><td>18</td><td>20</td><td>3</td></tr></table> Test at 5% level of significance. The critical value of t at 5% level of significant and for 8 d.f. is 2.306.	Students	1	2	3	4	5	6	7	8	9	Before	10	15	9	3	7	12	16	17	14	After	17	17	8	5	6	11	18	20	3
Students	1	2	3	4	5	6	7	8	9																							
Before	10	15	9	3	7	12	16	17	14																							
After	17	17	8	5	6	11	18	20	3																							

3	(a)	In an industry, 200 workers, employed for a specific job, were classified according to the performance and training not received to test independence of the specific training and performance. The data is summarized as follows: <table><tr><td></td><td colspan="2">Performance</td><td rowspan="2">Total</td></tr><tr><td></td><td>Good</td><td>Not good</td></tr><tr><td>Trained</td><td>100</td><td>50</td><td>150</td></tr><tr><td>Untrained</td><td>20</td><td>30</td><td>50</td></tr><tr><td>Total</td><td>120</td><td>80</td><td>200</td></tr></table> Use χ^2 test of independence at 5% level of significance. Critical value of χ^2 at 5% level of significance and 1 d.f., i. e. 3.84		Performance		Total		Good	Not good	Trained	100	50	150	Untrained	20	30	50	Total	120	80	200	10
	Performance		Total																			
	Good	Not good																				
Trained	100	50	150																			
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OR																						
	(b)	A medical researcher wants to determine whether there is a difference in the mean lengths of time it takes three types of pain relievers to provide relief from headache pain. Several headache sufferers are randomly selected and given one of the three medications. Each headache sufferer records the time (in minutes) it takes the medication to begin working. The results are shown in the table. At $\alpha = 0.01$, can you conclude that at least one mean time is different from the others? Assume that each population of relief times is normally distributed and that the population variances are equal. <table><tr><td>Medication 1</td><td>Medication 2</td><td>Medication 3</td></tr><tr><td>12</td><td>16</td><td>14</td></tr><tr><td>15</td><td>14</td><td>17</td></tr><tr><td>17</td><td>21</td><td>20</td></tr><tr><td>12</td><td>15</td><td>15</td></tr><tr><td></td><td>19</td><td></td></tr></table> The critical value of F at 1% level of significance is 7.56	Medication 1	Medication 2	Medication 3	12	16	14	15	14	17	17	21	20	12	15	15		19		10	
Medication 1	Medication 2	Medication 3																				
12	16	14																				
15	14	17																				
17	21	20																				
12	15	15																				
	19																					
PART - B (20 Marks)																						
4	(i)	Determine which events are mutually exclusive and which are not, when a single die is rolled. (a) Getting an odd number and getting an even number. (b) Getting a 3 and getting an odd number.	10																			
	(ii)	The joint probability distribution of a pair of random variables is given by the following table: - <table><tr><td>Y \ X</td><td>1</td><td>2</td><td>3</td></tr><tr><td>1</td><td>0.1</td><td>0.1</td><td>0.2</td></tr><tr><td>2</td><td>0.2</td><td>0.3</td><td>0.1</td></tr></table> Find (c) The marginal distributions (d) The conditional distribution of X given Y = 1 (e) $P\{(X + Y) < 4\}$		Y \ X	1	2	3	1	0.1	0.1	0.2	2	0.2	0.3	0.1							
Y \ X	1	2	3																			
1	0.1	0.1	0.2																			
2	0.2	0.3	0.1																			
5	(a)	A system consists of four components in series with two components having reliability of 0.9 and two others having reliability of 0.8 at the end of one year. What is the system reliability at the end of one year? (b) For a 2-out-of-3 system, each component has reliability of 0.9. What is the reliability of the system?	10																			

