

Reg. No.:

Name :



# VIT

Vellore Institute of Technology  
(Chartered as an Institution under section 3 of AICTE Act, 1987)

## Continuous Assessment Test (CAT)-II – March 2023

Programme	: B.Tech	Semester	: Winter Semester 2023
Course Code	: BMAT202L	Class	: CH2022235002615,17,19,
Course Title	: Probability and Statistics	Nbr(s)	: 21,23,35,32,30,28,25,37
Faculty(s)	: Dr. Kaliyappan M, Dr. Revathi G K, Dr. Jaganathan B, Dr. Hannah Grace G, Dr. Sudip Debnath, Dr. Mythili G. Y, Dr. K. Sethu Kumarasamy, Dr. Sushmitha P, Dr. Kamalesh Acharya, Dr. Ashish Kumar Nandi, Dr. Sandip Daluil	Slot	: E1+TE1
Time	: 90 Minutes	Max. Marks	: 50

Answer all the Questions

(5 X 10 = 50 Marks)

Q. No.	Sub-division	Question Text	Marks																
1.	(a)	<p>An experiment was carried out to investigate variation of solubility of chemical X in water. The quantities in kg that dissolved in 1 litre at various temperatures are shown in the table.</p> <table><tr><td>Temp °C (y)</td><td>15</td><td>20</td><td>25</td><td>30</td><td>35</td><td>50</td><td>70</td></tr><tr><td>Mass of X (x)</td><td>2.1</td><td>2.6</td><td>2.9</td><td>3.3</td><td>4.0</td><td>5.1</td><td>7.0</td></tr></table> <p>(i) Calculate the equation of regression line y on x . (ii) Discuss any two properties using the above data in terms of regression coefficients.</p>	Temp °C (y)	15	20	25	30	35	50	70	Mass of X (x)	2.1	2.6	2.9	3.3	4.0	5.1	7.0	5+5
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Mass of X (x)	2.1	2.6	2.9	3.3	4.0	5.1	7.0												
	(b)	<p>From the heights (<math>X_1</math>), weights(<math>X_2</math>) and ages (<math>X_3</math>) of a group of students the following correlation coefficients were obtained: <math>r_{12} = 0.75</math>, <math>r_{23} = 0.54</math>, and <math>r_{31} = 0.43</math> obtained the partial correlation coefficient between <math>X_1</math> and <math>X_2</math> by controlling the effect of <math>X_3</math>. Also find multiple correlation coefficient <math>R_{1.23}</math>. What percentage of variability of <math>X_1</math> is caused by its relationship to <math>X_2</math>.</p>																	
2.	(a)	<p>The incidence of occupational disease in an industry is such that the workers of 20% chance of suffering from it.</p> <p>(i) What is the probability that out of 6 workers 4 or more will catch the disease? (ii) Find the expected number of workers will catch the disease.</p>	5+5																

	(b)	The local authorities of a city installed 2000 electric lamps in the street of the city. If the lamps have an average life of 1000 burning hours with a S.D. of 200 hours. Assume that the lives of the lamps follows a Gaussian distribution. (i) What number of the lamps might be expected to fail in the first 700 burning hours? (ii) After what period of burning hours would we expect that 10% of the lamps would have failed?																					
3.	(a)	The life of a recirculating pump follows a distribution with scale and shape parameters 2 and 700 hours respectively. (a) Determine the mean life of a pump. (b) What is the probability that a pump will last longer than its mean?	5+5																				
	(b)	A manufacturer claims that the average tensile strength of thread A exceeds the average tensile strength of thread B by at least 10 kilograms. To test this claim, 50 pieces of each type of thread were tested under similar conditions. Type A thread had an average tensile strength of 85.7 kilograms with a standard deviation of 6.28 kilograms, while type B thread had an average tensile strength of 77.8 kilograms with a standard deviation of 5.61 kilograms. Test the manufacturer's claim using a 0.05 level of significance.																					
4.	(a)	At a certain college, it is estimated that at most 25% of the students ride bicycles to class. Does this seem to be a valid estimate if, in a random sample of 90 college students, 28 are found to ride bicycles to class? Use a 0.05 level of significance.	5+5																				
	(b)	A survey was done with the hope of comparing salaries of chemical plant managers employed in two areas of the country, the northern and west central regions. An independent random sample of 300 plant managers was selected from each of the two regions. These managers were asked their annual salaries. The results are as follows <table border="1"><thead><tr><th>North</th><th>West Central</th></tr></thead><tbody><tr><td><math>\bar{x}_1 = 102300</math></td><td><math>\bar{x}_2 = 98500</math></td></tr><tr><td><math>s_1 = 5700</math></td><td><math>s_1 = 3800</math></td></tr></tbody></table> Construct a 99% confidence interval for $\mu_1 - \mu_2$ , the difference in the mean salaries.	North	West Central	$\bar{x}_1 = 102300$	$\bar{x}_2 = 98500$	$s_1 = 5700$	$s_1 = 3800$															
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5	(a)	A random sample of 16 values from a normal population showed a mean of 41.5 inches and the sum of squares of deviations from this mean equal to 135 square inches. Show that the assumption of a mean of 43.5 inches for the population is not reasonable.	5+5																				
	(b)	Two random samples of sizes 9 and 7 had the following values of the variables. <table border="1"><tbody><tr><td>Sample A</td><td>9</td><td>10</td><td>11</td><td>12</td><td>10</td><td>14</td><td>9</td><td>11</td><td>16</td></tr><tr><td>Sample B</td><td>11</td><td>10</td><td>12</td><td>13</td><td>8</td><td>9</td><td>12</td><td>-</td><td>-</td></tr></tbody></table> Do the estimates of population variance differ significantly?	Sample A	9	10	11	12	10	14	9	11	16	Sample B	11	10	12	13	8	9	12	-	-	
Sample A	9	10	11	12	10	14	9	11	16														
Sample B	11	10	12	13	8	9	12	-	-														