VIT
CHENNAI
Vellore Institute of Technology

Reg. Number: 22BCE1351

Continuous Assessment Test (CAT) - II – April 2024					
Programme	:	B.Tech	Semester	:	Win Semester 2023-2024
Course	:	Probability and Statistics	Code	:	BMAT202L
Faculty	:	Dr. Prabhakar V Dr. Harshavarthini Shanmugam	Class No.	:	CH2023240500894 CH2023240500895
Slot	:	C1+TC1	Duration	:	90 Minutes
Max. Mark	:	50			

General Instructions:

- Write only your registration number in the question paper and do not write other information.
- Only non-programmable calculator without storage is permitted.

Answer All Questions

Q.No.	Description	Marks
1.	Find the correlation coefficient between the age of cars in years (X) and annual maintenance cost in rupees (Y) and comment on the nature of the relationship. X: 2, 4, 6, 7, 8, 10, 12 Y: 1600, 1500, 1800, 1900, 1700, 2100, 2000	10
2.	**(a)** In a trivariate distribution of three random variables X_1, X_2 and X_3 with zero means, the standard deviations and correlation coefficients are given: $\sigma_1 = 4.42, \sigma_2 = 1.10, \sigma_3 = 85, \rho_{12} = 0.8, \rho_{13} = -0.40, \rho_{23} = -0.56$. Determine the following: (i) partial correlation $\rho_{12.3}$ (ii) regression line of X_1 on X_2. **(b)** On average, 3 traffic accidents per month occur at a certain intersection. What is the probability that in any given month at this intersection i.) exactly 5 accidents will occur? ii.) fewer than 3 accidents will occur? iii.) at least 2 accidents will occur.	5+5
3.	**(a)** A boiler containing eight welds is manufactured in a small shop. When the boiler is completed, each weld is checked by an inspector. If more than one weld is defective on a single boiler, the person who made that boiler is reported to the foreman. i.) If 9% of all welds made by Joe Smith are defective, what percentage of all boilers madeby him will have more than one defective weld? ii.) Over a long period of time how many times will Joe Smith be reported to the foreman foreach 15 boilers he makes? **(b)** The elongation of a steel bar under a particular load has been established to be normally	5+5

	distributed with a mean of 0.05 inch and $\sigma = 0.01$ inch. Find the probability that the elongation is (i) below 0.04 inch (ii) between 0.025 and 0.065 inch	
4.	**(a)** Suppose that the service life, in years, of a hearing aid battery is a random variable having a Weibull distribution with $\alpha = 1/2$ and $\beta = 2$. i.) How long can such a battery be expected to last? ii.) What is the probability that such a battery will be operating after 2 years? **(b)** Scientists have recently become concerned about the safety of Teflon cookware and various food containers because perfluorooctanoic acid (PFOA) is used in the manufacturing process. An article reported that of 600 children tested, 96% had PFOA in their blood. According to the FDA, 90% of all Americans have PFOA in their blood. Does the data on PFOA incidence among children suggest that the percentage of all children who have PFOA in their blood exceeds the FDA percentage for all Americans? Carry out an appropriate test of hypothesis at 5% level of significance.	5+5
5.	From research on comparing business environment cultures across between USA and Canada we have the following summary data:	10

Country	Sample Size	Sample Mean	Population SD
USA	174	5.8	6.0
Canada	353	5.1.	4.6

(i) Does it appear that true average time per week that USA managers spend thinking about new ideas differs from that for Canadian managers at 5% level of significance?

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