VIT®
Vellore Institute of Technology

Final Assessment Test – November/December 2023

Course: **PMAT501L - Probability and Statistics**

Time: **Three Hours** Max. Marks: **100**

KEEPING MOBILE PHONE/SMART WATCH, EVEN IN 'OFF' POSITION, IS TREATED AS EXAM MALPRACTICE

General Instruction: Use of Statistical Tables are permitted

Answer any TEN Questions

(10 X 10 = 100 Marks)

1. The chances of X, Y and Z becoming managers of a certain company are $\frac{4}{9}, \frac{2}{9}, \frac{3}{9}$ respectively. The probabilities that bonus scheme will be introduced if X, Y and Z become managers are 0.3, 0.5 and 0.4 respectively. If the bonus scheme has been introduced, what is the probability that Z was appointed as the manager?

2. Suppose a pair of fair dice is rolled. Let X be the random variable representing the sum of the number of dots on the top faces of the dice.
   a) Construct a discrete probability distribution for the same.
   b) Find $P(X \geq 9)$
   c) Find the probability that X takes an even value.

3. A product is a mixture of two materials. Let the volume of material 1 used be represented as X, and the volume of material 2 used be represented as Y. The joint probability density function of the two random variables is $f(x,y) = c(2x+3y),\ 0 \leq x, y \leq 1$.
   a) What is c?
   b) Find the Marginal density functions of X and Y.
   c) What is the conditional probability the first material has a proportion less than or equal to 50%, given that the second material has a proportion equal to 30%?

4. The data on price and quantity purchased relating to a commodity for 10 months are given below: Calculate coefficient of correlation between price and quantity and interpret the results.

Price (in Rs.)	10	14	12	11	9	7	15	16	18	20
Quantity (in Kg)	25	20	30	32	35	40	19	16	12	10

5. Let X be a discrete random variable with probability mass function given by the following table

X	1	2	3	4	5
$P(X = x)$	0.15	0.20	0.40	0.15	0.10

Find the moment generating function of the random variable X and hence find its mean and variance.

6. A manufacturer produces light-bulbs that are packed into boxes of 100. Quality control studies indicate that 0.5% of the light-bulbs produced are defective.
   a) Using Poisson distribution determine what percentage of the boxes will contain:
      i. no defective bulbs ii. 2 or more defectives
   b) Verify the results using Binomial distribution also.

7. The life time of electric bulbs from certain company was found to be normally distributed with mean 2040 hours and S.D. of 60 hours. Estimate the number of bulbs likely to burn for i) more than 2150 hours ii) less than 1950 hours iii) between 1920 and 2100 hours.

8. Before hiking the price of tea, 800 persons out of a sample of 1000 persons were found to be tea drinkers. After a hike in price, 800 people were found to be tea drinkers out of a sample of 1200 people. Can we conclude that the consumption of tea has decreased among people due to its price hike?

9. The heights of two batch students were taken for inspection. The heights of six randomly chosen boys from the first batch were in inches 63, 65, 68, 69, 71 and 72. Those of ten randomly chosen students from the second batch were 61, 62, 65, 66, 69, 69, 70, 71, 72, and 73. Could you regard that both the samples were drawn from same population?

10. From the data given in the following table, find out whether there is any relationship between gender and the preference of colour.

Gender	Colour		
	Red	Blue	Green
Male	25	45	50
Female	45	25	10

11. Was the following data collected at random? Test at 5% LOS.

18, 36, 19, 22, 25, 44, 23, 27, 27, 35, 19, 43, 37, 32, 28, 43, 46, 19, 20, 22

12. The following data represent the number of hours that members of two different teams work to complete certain task.

Team A	5.5	5.6	6.3	4.6	5.3	5.0	6.2	5.8	5.1
Team B	3.8	4.8	4.3	4.2	4.0	4.9	4.5	5.2	4.5

Test whether team B outperforms than team A using Kruskal-Walli's test with $\alpha = 0.01$.

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