U/E/TX

Reg. No: 22BCB0218

Vellore Institute of Technology

Final Assessment Test – May 2024

Course: **BMAT202L - Probability and Statistics**

Class NBR(s): **1666 / 1671 / 1687 / 1689 / 1691 / 1693 / 1695 / 1697 / 1700 / 1702 / 1704 / 1706 / 1708 / 1711 / 1714 / 1716 / 1720 / 1722 / 1724 / 1726 / 1729 / 1731 / 1734 / 4937**

Slot: **G1+TG1**

Time: **Three Hours**

Max. Marks: **100**

- KEEPING MOBILE PHONE/ELECTRONIC DEVICES EVEN IN 'OFF' POSITION IS TREATED AS EXAM MALPRACTICE
- DON'T WRITE ANYTHING ON THE QUESTION PAPER

General Instructions :

Statistical tables are permitted

Answer any TEN Questions

(10 X 10 = 100 Marks)

1. Compute the mean, median and mode for the following frequency distribution: **[10]**

Age Group (Months) :	200-250	250-300	300-350	350-400	400-450	450-500	500-550	550-600	600-650
No. of Persons :	300	1600	2100	3800	2450	1950	1100	700	400

2. The following data represents the marks obtained, out of 100, by two students A and B in 10 tests: **[10]**

Student *A* :	20	55	40	35	75	40	35	40	30	67
Student *B* :	20	90	70	30	85	45	92	50	38	70

Which student is more consistent in view of marks?

3. If the probability function of an infinite discrete distribution is given by $P(X = j) = \frac{1}{2^j}$ for $j = 1, 2, 3, \ldots \infty$ then find the mean and variance of the distribution. Find also $P(X \text{ is even}), P(X \leq 5)$ and $P(X \text{ is divisible by } 3)$. **[10]**

4. Let (X, Y) be a two-dimensional random variable with the joint probability density function given by **[10]**

$$f(x,y) = \begin{cases} cxye^{-10(x^2+y^2)}; & x \geq 0,\ y \geq 0 \\ 0 \quad\quad\quad\quad\quad\quad\ ; & otherwise \end{cases}$$

(i) Find the value of c,

(ii) Find the marginal density functions of X and Y,

(iii) Are the random variables X and Y independent?

5. In a partially destroyed laboratory record of an analysis of correlation data, the following results only are legible: Variance of $X = 9$, Regression equations: $8X - 10Y + 66 = 0,\ 40X - 18Y = 214$. What were **[10]**

(i) the mean values of X and Y,

(ii) the correlation coefficient between X and Y and,

(iii) the standard deviation of Y?

6. Out of 800 families with 4 children each, how many families would be expected to have (i) 2 boys and 2 girls, (ii) at least 1 boy, (iii) at most 2 girls and (iv) children of both sexes. Assume equal probabilities for boys and girls. **[10]**

7. A radar unit is used to measure speeds of cars on a motorway. The speeds are normally distributed with a mean of 90 km/hr and a standard deviation of 5 km/hr. Find the probability that a car picked at random is traveling with the speed (i) not exceeding 85 km/hr, (ii) in between 70 km/hr and 100 km/hr, and (iii) exceeding 105 km/hr. **[10]**

8. 15.5% of a random sample of 1600 undergraduates were smokers, whereas 20% of a random sample of 900 postgraduates were smokers in a state. Can we conclude that less number of undergraduates are smokers than the postgraduates? Use $\alpha = 5\%$. **[10]**

9. A sample of heights of 6400 English men has a mean of 170 cm and a SD of 6.4 cm, while another sample of heights of 1600 Americans has a mean of 172 cm and a SD of 6.3 cm. Do the data indicate that Americans are, on the average, taller than the Englishmen? Test the hypothesis at 5% level of significance. **[10]**

10. A survey of 320 families with 5 children revealed the following distribution: **[10]**

No. of boys:	0	1	2	3	4	5
No. of girls:	5	4	3	2	1	0
No. of families:	12	40	88	110	56	14

Is this result consistent with the hypothesis that male and female births are equally probable? Use $\alpha = 5\%$.

11. Four different drugs have been developed for a certain disease. These drugs are used in 3 different hospitals and the results are given below, as the number of cases of recovery from the disease per 100 people who have taken the drugs. **[10]**

	$D1$	$D2$	$D3$	$D4$
$H1$	19	8	23	8
$H2$	10	9	12	6
$H3$	11	13	13	10

What conclusion can you draw based on an analysis of variance?

12. The time to repair a power generator is described by its probability density function, **[10]**

$m(t) = \frac{4t^3}{9999}$; $1 \leq t \leq 10$ *Hours*.

(i) Find the probability that a repair will be completed in 7 hours,

(ii) Compute the Mean Time to Repair (MTTR),

(iii) Find the repair rate function $\mu(t)$.

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