


VIT

Vellore Institute of Technology

Final Assessment Test – November 2024

Course: PMAT501L - Probability and Statistics

Class NBR(s): 4867 / 4869 / 7600

Slot: E2+TE2

Max. Marks: 100

Time: Three Hours

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

General Instruction:

Statistical Tables are permitted

Answer ALL Questions

(10 X 10 = 100 Marks)

1. An urn contains 10 white and 3 black balls. Another urn contains 3 white and 5 black balls. Two balls are drawn at random from the first urn and placed in the second urn, and then 1 ball is taken at random from the later. What is the probability that it is a white ball? [10]
2. Find the value of a , $P(X < 3)$, cumulative distribution function, mean, variance and standard deviation of the discrete random variable (X) with the following probability distribution. [10]

$X=x:$	0	1	2	3	4	5	6	7	8
$P(X=x):$	a	$3a$	$5a$	$7a$	$9a$	$11a$	$13a$	$15a$	$17a$

3. The joint probability density function of the continuous random variable (X, Y) is given by $f(x, y) = kxye^{-(x^2+y^2)}$; $x > 0, y > 0$. Find the value of k and prove also that X and Y are independent. [10]
4. If X represents the outcome, when a fair die is tossed, then find the moment generating function of X and hence find $E(X)$ and $Var(X)$. [10]
5. Construct the equations of the regression lines from the following data: [10]

X	22	26	29	30	31	31	34	35
Y	20	20	21	29	27	24	27	31

6. In a certain factory producing razor blades, there is a small chance 0.30 for any blade to be defective. The blades are supplied in packets of 30. Use Poisson distribution to calculate the approximate number of packets containing (i) exactly 3 defective blades, (ii) at least 3 defective blades, and (iii) at most 3 defective blades in a consignment of 3,000 packets. [10]
7. A radar unit is used to measure speeds of cars on a motorway. The speeds are normally distributed with a mean of 1000 km/hr and a standard deviation of 100 km/hr. Find the probability that a car picked at random is traveling with the speed (i) not exceeding 950 km/hr, (ii) in between 700 km/hr and 1100 km/hr, and (iii) exceeding 1150 km/hr. [10]

8. A sample of 700 bulbs of brand A gave a mean lifetime of 850 hours with a standard deviation of 150 hours, while another sample of 500 bulbs of brand B gave a mean lifetime of 600 hours with a standard deviation of 120 hours. Do the data indicate that the brand A bulbs are superior to the brand B bulbs at 1% level of significance? [10]

- 9.a) Two independent samples of eight and seven items respectively had the following values of the variable. [10]

Sample I:	9	11	13	11	15	9	12	14
Sample II:	10	12	10	14	9	8	10	

Do the two estimates of population variance differ significantly at 5 % level of significance?

OR

- 9.b) A certain drug is claimed to be effective in curing cold. In an experiment on 500 persons with cold, half of them were given the drug and half of them were given the sugar pills. The patients' reactions to the treatment are recorded in the following table. [10]

	Helped	Harmed	No Effect
Drug	150	30	70
Sugar Pills	130	40	80

On the basis of this data, can it be concluded that the drug and sugar pills differ significantly in curing cold at 1 % level of significance?

- 10.a) The nicotine content of two brands (A & B) of cigarettes, measured in milligrams, was found to be as follows: [10]

A	2.1	4.0	6.3	5.4	4.8	3.7	6.1	3.3		
B	4.1	0.6	3.1	2.5	4.0	6.2	1.6	2.2	1.9	5.4

Test the hypothesis, at 0.05 level of significance, that the median nicotine contents of the two brands are equal against the alternative that they are unequal.

OR

- 10.b) In an experiment to determine which of three different missile systems is preferable, the propellant burning rate is measured. The data, after coding, are given below: [10]

Propellant Burning Rates

Missile System								
1			2			3		
24.0	16.7	22.8	23.2	19.8	18.1	18.4	19.1	17.3
19.8	18.9		17.6	20.2	17.8	17.3	19.7	18.9
						18.8	19.3	

Use the Kruskal-Wallis test and a significance level of 0.005, test the hypothesis that the propellant burning rates are the same for the three missile systems.

⇔⇔⇔F/L/TX⇔⇔⇔