



Final Assessment Test – November 2024

Course: TMAT201L - Probability and Statistics

Class NBR(s): 4161 / 4570 / 8065

Time: Three Hours

Slot: G1+TG1

Max. Marks: 100

- 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 may be permitted

Answer ALL Questions

(10 X 10 = 100 Marks)

1. (i) Box A contains 5 red and 3 white marbles, and box B contains 2 red and 6 white marbles. If a marble is drawn from each box, what is the probability that they are both of the same colour? [5]

- (ii) A speaks truth 60% of the time and B speaks truth 70% of the time. Find the probability that they will say the same thing while describing a single event. [5]

2. The probabilities of X, Y and Z becoming managers are $\frac{4}{9}$, $\frac{2}{9}$ and $\frac{1}{3}$, respectively. [10]
The probabilities that the Bonus Scheme will be introduced if X, Y and Z become managers are $\frac{3}{10}$, $\frac{1}{2}$ and $\frac{4}{5}$, respectively.

- (i) What is the probability that Bonus Scheme will be introduced?
(ii) If the Bonus Scheme has been introduced, what is the probability that the manager appointed was X?

3. A random variable X has the following probability distribution function: [10]

x	1	2	3	4	5	6	7
f(x)	k	2k	2k	3k	k ²	2k ²	7k ² + k

Find the value of "k". Using this value of "k", find its mean $E(X)$. Determine the cumulative distribution function of X.

4. The joint probability density function of two random variables X and Y is given by: $f(x, y) = 6(1 - x - y)$; $x > 0, y > 0, x + y < 1$. Find the marginal distributions of X and Y. Hence examine if X and Y are independent. [10]

5. Marks obtained by eight students in the college test (y) and the university test (x) are as follows: [10]

x	65	66	67	67	68	69	70	72
y	67	68	65	68	72	72	69	71

Estimate the mark of a student could have obtained in the university test if he/she obtained 100 in the college test but was ill at the time of the university test? Find the regression lines.

- 6.a) (i) Assuming that the typing mistakes per page committed by a typist follow a Binomial distribution, find the theoretical frequencies for the following distribution of typing mistakes. [10]

No. of mistakes Per page	0	1	2	3	4	5	6
No. of pages	13	25	52	38	32	16	4

- (ii) Average number of accidents on any day on a national highway is 1.8. Assuming Poisson distribution, determine the probability that the number of accidents is (a) at least one, and (b) at most one.

OR

- 6.b) In a normal distribution, 31% of the items are under 45 and 8% of the items are over 64. Find the mean and standard deviation of the distribution. Also, find the proportion of items which are under 40. [10]
7. Samples of two types of electric bulbs were tested for length of life and the following data were obtained. [10]

	Size	Mean	S.D
Type-I	8	1234 hours	36 hours
Type-II	7	1036 hours	40 hours

Is the difference in the means sufficient to warrant that type-I bulbs are superior to type-II bulbs?

8. In an experiment on pea-breeding, Mendel obtained the following frequencies of seeds: 315 round and yellow, 101 wrinkled and yellow, 108 round and green, 32 wrinkled and green. According to his theory of heredity, the numbers should be in proportion 9:3:3:1. Is there any evidence to doubt his theory at 5% level of significance? [10]
- 9.a) In order to determine whether there is significant difference in the durability of 3 makes of computers, samples of size 5 are selected from each make and the frequency of repair during the first year of purchase is observed. The results are as follows: [10]

	A	5	6	8	9	7
Makes	B	8	10	11	12	4
	C	7	3	5	4	1

In view of the above data, what conclusion can you draw?

OR

- 9.b) The following data represent the number of units of production per day turned out by five different workers using four different types of machines: [10]

		Machine Types			
		A	B	C	D
Workers	1	44	38	47	36
	2	46	40	52	43
	3	34	36	44	32
	4	43	38	46	33
	5	38	42	49	39

Test whether the mean productivity is the same for the four different machine types.

10. The time to failure in operating hours of a critical solid-state power unit has the hazard rate function $\lambda(t) = 0.003 \left(\frac{t}{500}\right)^{0.5}$, for $t \geq 0$. What is the reliability if the power unit must operate continuously for 50 hours? Determine the design life if a reliability of 0.90 is desired. [10]

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