

Roll No.

Total Pages : 06

753206

May 2026

M. Sc. (Mathematics) (Second Semester)

Mathematical Statistics (MATH21-751)

Time : 3 Hours]

[Maximum Marks : 75

Note : It is compulsory to answer all the questions (1.5 marks each) of Part A in short. Answer any four questions from Part B in detail. Different sub-parts of a question are to be attempted adjacent to each other. Students can use calculator. Specific tabular values are mentioned in the question paper, no more tables are required.

Part A

1. (a) Define equally likely events, Give example. 1.5
- (b) For a continuous random variable $X \geq 0$, if $E(X) = 2$, find $E(2 - 3X)$. 1.5

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P.T.O.

7. (a) A random sample of size 10 from a normal population has mean 42 and s.d. 5. Test whether this sample can be considered from the population with mean 45 ? (Tabulated value of t for 19 degrees of freedom at 5% level is 2.09). 7

(b) A die is thrown 276 times with the following results :

Face	1	2	3	4	5	6
Frequency	40	32	29	59	57	59

Test at 5% level of significance if the die is biased or not, assuming that χ^2 for 5 d.f. is 11.07. 8



(c) What is the probability that a card drawn at random from a pack of well-shuffled pack of cards, is a club ? 1.5

(d) If $P(A) = \frac{6}{11}$, $P(B) = \frac{5}{11}$, $P(A \cup B)$, then find $P\left(\frac{B}{A}\right)$. 1.5

(e) Find the mean of a random variable X with the probability distribution :

$$f(x) = \frac{1}{n}, x = 1, 2, 3, \dots, n. \quad 1.5$$

(f) Write any *two* basic assumptions of Student's t -test. 1.5

(g) In hypothesis testing, write the test statistic for the test of significance for difference of proportions. 1.5

(h) In left-tailed test, what is the critical value at 1% level of significance ? 1.5

(i) Find the mode of a random variable X if it follows Poisson distribution $X \sim P(4.3)$. 1.5

(j) Define standard error. 1.5

Part B

2. (a) A random variable X has the following probability distribution : 7

X	$P(X = x)$
0	a
1	$4a$
2	$3a$
3	$7a$
4	$8a$
5	$10a$
6	$6a$
7	$9a$

(i) Determine a

(ii) Find $P(X < 3)$, $P(X \geq 4)$,

$$P(0 < X < 5)$$

(iii) Find the smallest value of m for which $P(X = m) = 0.6$.

(b) A fair coin is tossed until head or five tails occur. Find expected number of tosses of the coins. 8

3. (a) A continuous random variable X has the probability function $f(x) = \frac{1}{2}(x+1)$, $-1 < x < 1$. Find the standard deviation of X . 7

(b) Find k so that $f(x, y) = kxy$, $1 \leq x \leq y \leq 2$ will be a joint probability density function. 8

4. (a) Suppose 10% of probability for a certain population following a normal distribution $N(\mu, \sigma^2)$ is below 35 and 5% is above 90. Find the values of μ and σ . [Given $P(Z \leq 1.28) = 0.1$, $P(Z \geq 1.645) = 0.05$]. 7

(b) A dice is thrown 7 times. If "getting an odd number" is a "success", what is the probability of (i) exactly 5 successes, (ii) at most 5 successes? 8

5. (a) If X follows Poisson distribution with parameter λ and μ_r , denotes its r th order moment with respect to mean, then prove the recurrence relation :

$$\mu_{r+1} = r\lambda\mu_{r-1} + \lambda \frac{d\mu_r}{d\lambda}. \quad 7$$

(b) A random variable X has the density function $e^{-x}(0 \leq x < \infty)$. Use Chebyshev's inequality to obtain a lower bound to the probability of the inequality $P(-1 \leq X \leq 3)$ and compare it with the actual value. 8

6. (a) If 57 out of 150 patients suffering from malaria are cured by allopathy and 33 out of 100 patients with same disease are cured by homeopathy, is there reason to believe that allopathy is better than homeopathy at 5% level of significance? 7

(b) The average marks in Statistics of a sample of 100 students is 51 with a s.d. of 6 marks. Could this be a random sample from a population with average marks 50? 8