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Total No. of Questions : 11 ]

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# **AFMA-272**

**M.A./M.Sc. (Final) Examination, 2023**

**MATHEMATICS**

Paper - Opt.-VII

**(Mathematical Theory of Statistics)**

*Time : 3 Hours ]*

*[ Maximum Marks : 100*

**Section-A**

**(Marks : 2 × 10 = 20)**

*Note :-* Answer all *ten* questions (Answer limit **50** words). Each question carries **2** marks.

**Section-B**

**(Marks : 4 × 5 = 20)**

*Note :-* Answer all *five* questions. Each question has internal choice (Answer limit **200** words). Each question carries **4** marks.

**Section-C**

**(Marks : 20 × 3 = 60)**

*Note :-* Answer any *three* questions out of five (Answer limit **500** words). Each question carries **20** marks.

**Section-A**

1. (i) Two unbiased dice are thrown. Find the probability that the total of the numbers on the dice is greater than 8.
- (ii) Write Chebyshev inequality.
- (iii) Obtain MGF of a negative binomial distribution.

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- (iv) Define probable error of correlation coefficient.
- (v) Define index number and write Fisher's Ideal formula.
- (vi) Define Fiducial limits.
- (vii) Define test of significance for difference of two means.
- (viii) Write aim of analysis of variance.
- (ix) Define point estimation and write one example.
- (x) State Rao-Cramer inequality.

### Section-B

2. Each coefficient in the equation  $ax^2 + bx + c = 0$  is determined by throwing ordinary die. Find the probability that the equation will have real roots.

*Or*

For a distribution mean  $\bar{X} = 10$ , variance  $\mu_2 = 16$ ,  $y_1 = 1$  and  $\beta_2 = 4$ . Obtain the first *four* moments about origin. Also explain the nature of distribution.

3. Derive that Poisson distribution as a limiting case of the negative binomial distribution.

*Or*

In a normal distribution 31% of the items are under 45 and 8% are 64. Find the parameters of the distribution. [ $\phi(0.5) = 0.19$ ,  $\phi(1.4) = 0.42$ ]

4. Explain test of index numbers.

*Or*

- (i) Write definition of  $\chi^2$  distribution
- (ii) Write conditions of validity of  $\chi^2$ -test

5. Sample of sizes 10 and 12 taken from two normal population given  $s_1 = 12$  and  $s_2 = 18$ . Test the hypothesis  $\sigma_1 = \sigma_2$ .

*Or*

Draw the analysis of variance table for :

- (i) One criterion classification
- (ii) Two criterion classification
6. Show that in a normal distribution  $\bar{x}$  is a minimum variance estimator of  $\mu$ .

*Or*

Show that in a random sampling from a normal population sample mean is a consistent estimator of population mean.

### Section-C

7. Let the random variable X assume the value  $r$  with the probability law

$$P(X = r) = q^{r-1} P \quad r = 1, 2, 3, \dots$$

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

8. Fit a second degree parabola to the following data :

$x$	0	1	2	3	4
$y$	1	5	10	22	38

9. State and prove central limit theorem.

10. The following table gives the results of experiments on four varieties of a crop in 5 blocks of plots :

Variety	Block				
	1	2	3	4	5
A	32	34	33	35	37
B	34	33	36	37	35
C	31	34	35	32	36
D	29	26	30	28	29

11. Show that the sampling variance is a consistent estimator for the population variance of a normal distribution.