[This question paper contains 4 printed pages.]

4704 *Your Roll No.* ....

B.Sc. (G)/I **AS**

MATHEMATICAL SCIENCES (Statistics)

Paper I – Statistical Methods – I

Time : 3 Hours *Maximum Marks : 38*

(Write your Roll No. on the top immediately on receipt of this question paper.)

Attempt **Six** *questions in all, selecting at least* **two** *questions from each Section.*
Question No. **1** *is compulsory.*

1. (a) Mean of 100 observations is 50 and S.D. is 5. What will be the new mean and SD if 5 is subtracted from each observation and then it is divided by 4 ?

   (b) If $M_X(t) = (0.3 + 0.7e^t)^5$, find the distribution of X and its mean.

   (c) If $b_{XY} = -0.4$, $b_{YX} = -0.9$, find
   (i) $\rho(X, Y)$ (ii) $\rho(2X + 3, -3Y + 2)$.

   (d) Given that $(AB) = 15$, $(A\beta) = 23$, $(\alpha B) = 26$, $(\alpha\beta) = 34$, find the other frequencies. Symbols have their usual meanings. (2,2,2,2)

P.T.O.

SECTION A

2. (a) Show that, for any discrete distribution, the sum of squares of deviations is minimum when taken about mean.

   (b) Show that if the variable takes the values 0, 1, 2, ---, n with frequencies proportional to the binomial coefficients $^nC_0$, $^nC_1$, $^nC_2$, --- ^nC_n respectively, then mean of the distribution is n/2 and variance is n/4. (3,3)

3. (a) Define Bowley's coefficient of skewness and establish its limits. If $\mu_3 \geq 0$, comment on the symmetry of the distribution.

   (b) What is association of attributes ? How is it measured ? Also define complete association and dissociation of two attributes. (3,3)

4. (a) Define Spearman's rank correlation coefficient (ρ) and show that

$$\rho = 1 - \frac{\sigma \sum di^2}{n(n^2 - 1)},$$ where di is the difference between the ranks of the ith individual, i = 1, 2, ---, n.

   (b) Explain the method of fitting an exponential curve $Y = ae^{bX}$ to a set of n points (X_i, Y_i), i = 1, 2, ---, n by the method of least squares. (3,3)

SECTION B

5. (a) Prove, for $X \sim P(\lambda)$, that

$$\mu_{r+1} = \lambda\left(r\,\mu_{r-1} + \frac{d\mu_r}{d\lambda}\right) \text{ where}$$

μ_r is the rth moment about mean. Hence find variance.

(b) Obtain moment generating function of $X \sim B(n, p)$. Also, comment on additive property of binomial distribution. (3,3)

6. (a) Define geometric distribution and show that it 'Lacks Memory'.

(b) If X has uniform distribution in [0, 1] find the mean deviation about mean. (3,3)

7. (a) Obtain m.g.f. of a gamma variate with parameter λ. Hence find the limiting form of standard gamma variate as $\lambda \to \infty$. Also interpret the result.

(b) Show that, for normal distribution with mean μ and variance σ^2, the central moments satisfy the relation

$$\mu_{2n} = (2n-1)\,\mu_{2n-2}\,\sigma^2 \;;\; \mu_{2n+1} = 0. \qquad (3,3)$$

8. (a) Define coefficient of partial correlation $r_{12.3}$ and show that

$$r_{12.3} = \frac{r_{12} - r_{13} r_{23}}{\sqrt{\left(1 - r_{13}^2\right)\left(1 - r_{23}^2\right)}}$$

(b) Define Bivariate normal distribution. If $(X, Y) \sim BVN(\mu_1, \mu_2, \sigma_1^2, \sigma_2^2, \rho)$, find marginal p.d.f. of X and write its mean and variance.

(3,3)