132

2501   *Your Roll No.* ....

B.Sc. (G)/I   . A

MATHEMATICAL SCIENCES

Paper I – Essentials for Operational Research (Statistics)

Time : 3 Hours   *Maximum Marks : 55*

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

Answer any **Five** *questions.*

1. (a) Obtain Karl Pearson's measures of skewness for
       the following data :

Values :	5-10	10-15	15-20	20-25
Frequency :	6	8	17	21

Values :	25-30	30-35	35-40
Frequency :	15	11	2

(6)

   (b) Prove that for any discrete distribution standard
       deviation is not less than mean deviation from
       mean.   (5)

2. Define raw and central moments. Obtain the relation
    between the central moments of order r in terms of
    the raw moments. Using this relation, write the values
    of the first four central moments in terms of the raw
    moments.   (11)

                                            P.T.O.

3. (a) In a bolt factory, machines A, B and C manufacture, respectively, 25%, 35% and 40% of the total. Of their output 5, 4, 2 percents are defective bolts. A bolt is drawn at random from the product and if is found to be defective. What are the probabilities that was manufactured by machines A and B ? (6)

(b) If A, B, C are mutually independent events, then show that $A \cup B$ and C are also independent. (5)

4. (a) Prove that the recurrence relation for moments for the Binomial distribution with parameters n and p is :

$$\mu_{r+1} = pq \left[nr\mu_{r-1} + \frac{d}{dp}\mu_r \right]; \quad r = 1, 2, \text{ - - -}$$

Hence find β_1 and β_2. (6)

(b) If X and Y are independent Poisson variates with parameters λ and μ respectively such that

$$\rho(X = 1) = \rho(X = 2)$$

and $\rho(Y = 2) = \rho(Y = 3)$

Find the variance of $X - 2Y$. (5)

5. (a) Show that for a rectangular distribution with parameters a and b $(a < b)$, the mean deviation about mean is $\left(\dfrac{b-a}{4} \right)$. (5)

(b) If X has an exponential distribution, then for every constant a > 0, prove that

$$\rho(Y \le x \mid X \ge a) = \rho(X \le x), \ \forall \ x$$

where $Y = X - a$. (6)

6. (a) Find the m.g.f. about origin of an $N(\mu, \sigma^2)$ variate. (5)

(b) X is a normal variate with mean 30 and stand and deviation 5. Find the probability that

(i) $26 < X < 40$

(ii) $|X - 30| > 5$

(iii) $X \ge 45$ (6)

7. (a) Show that the co-efficient of correlation r is independent of change of scale and origin of the variables. (5)

(b) Out of the two lines of regression given by

$$X + 2Y - 5 = 0 \ \text{and} \ 2X + 3Y - 8 = 0.$$

Which one is the regression line of X on Y ?

Use the equations to find the mean of X and the mean of Y. If the variance of X is 12, calculate the variance of Y. (6)

8. (a) Write a short note on Simulation. (5)

(b) Define the following terms :

  (i) Stochastic Process

  (ii) Transition probability matrix

  (iii) Recurrent and Transient State (6)