

This question paper contains 4+2 printed pages]

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S. No. of Question Paper : 77

Unique Paper Code : 237151

E

Name of the Paper : **Basic Statistics and Probability**

Name of the Course : **B.A. (Programme) Statistics**

Semester : I

Duration : **3 Hours**

Maximum Marks : **75**

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

Question No. 1 is compulsory.

Attempt *six* questions in all.

Simple calculator can be used.

1. (a) Fill in the blanks :

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(i) For a symmetrical distribution $\beta_1 = \dots\dots\dots$

(ii) Probability of impossible event = $\dots\dots\dots$

(iii) If A and B are mutually exclusive events, then $P(A \cup B) = \dots\dots\dots$

P.T.O.

(iv) Mean deviation is least when taken about

(v) If one of the regression coefficients is greater than unity, then other must be

(b) A random variable X has the following probability function :

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X	P(X)
0	0
1	k
2	$2k$
3	$2k$
4	$3k$
5	k^2
6	$2k^2$
7	$7k^2 + k$

(i) Find k

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

(c) The two regression equations are given to be :

$$8X - 10Y + 66 = 0, 40X - 18Y = 214$$

with variance of $X = 9$. Find :

(i) Mean values of X and Y .

(ii) The correlation coefficient between X and Y .

(iii) Standard Deviation of Y .

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2. (a) Calculate the mean and standard deviation for the following table, giving the age distribution of 542 members :

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Age (in Years)	No. of Members
20—30	3
30—40	61
40—50	132
50—60	153
60—70	140
70—80	51
80—90	2

- (b) In a series of measurements, we obtain m_1 values of magnitude x_1 , m_2 values of magnitude x_2 and so on. If \bar{X} is the mean value of all the measurements, prove that the standard deviation is :

$$\sqrt{\frac{\sum m_r (k - x_r)^2}{\sum m_r} - \delta^2}$$

where $\bar{X} = k + \delta$ and k is any constant.

3. (a) Let r be the range and s be the standard deviation of a set of observations $x_1, x_2, x_3, \dots, x_n$, then prove that $s \leq r$.
- (b) What do you mean by Skewness and Kurtosis ? Prove that Kurtosis is greater than unity.
4. (a) Show that for n events A_1, A_2, \dots, A_n :

$$(i) \quad P\left(\bigcap_{i=1}^n A_i\right) \geq \sum_{i=1}^n P(A_i) - (n-1)$$

$$(ii) \quad P\left(\bigcup_{i=1}^n A_i\right) \leq \sum_{i=1}^n P(A_i)$$

- (b) A problem in statistics is given to three students A, B and C whose chances of solving it are $\frac{1}{2}$, $\frac{3}{4}$ and $\frac{1}{4}$ respectively. What is the probability that the problem will be solved if all of them try independently ? 6

5. (a) Prove that for any two events A and B : 6

$$P(A \cap B) \leq P(A) \leq P(A \cup B) \leq P(A) + P(B).$$

- (b) State and prove Bayes' theorem. 6

6. (a) Define Karl Pearsonian Correlation Coefficient and show that it is independent of change of origin and scale. 6

- (b) X and Y are two random variables with variances σ_x^2 and σ_y^2 and r is the coefficient of correlation between them. If

$$U = X + KY \text{ and } V = X + \frac{\sigma_x}{\sigma_y} Y,$$

- find the value of K so that U and V are uncorrelated. 6

7. (a) Given that

$$X = 4Y + 5 \text{ and } Y = KX + 4,$$

are the two lines of regression of X on Y and Y on X, respectively, show that $0 < 4K < 1$. If $K = 1/16$, find the means of the two variables and coefficient of correlation between them. 6

(b) In the usual notation, prove that : 6

$$R_{1.23}^2 = (r_{12}^2 + r_{13}^2 - 2r_{12}r_{23}r_{31}) / (1 - r_{23}^2).$$