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Sl. No. : 1836 GC 3 Your roll No.....  
Unique Paper Code : 42371104  
Name of the Paper : Descriptive Statistics and Probability Theory.  
Name of the Course : B.Sc. (Prog.) Mathematical Sc. (CBCS).  
Semester : I  
Duration : 3 Hours  
Maximum Marks : 75 Marks

Instructions for Candidate:

- i) Attempt six questions in all.
- ii) Question No. 1 is compulsory.
- iii) Attempt any five from the remaining questions.

1. (a) Fill in the blanks.

- (i) The sum of absolute deviations is minimum from \_\_\_\_\_.
- (ii) Coefficient of variation of a distribution is 60 % and its standard deviation is 12 its mean is \_\_\_\_\_.
- (iii) If  $A, B$  and  $C$  are any three events then  $P(A \cup B/C) =$  \_\_\_\_\_.
- (iv) For a moderately asymmetrical distribution empirical relationship between mean, median and mode is \_\_\_\_\_.
- (v) The line of regression of  $Y$  on  $X$  passes through the point \_\_\_\_\_.

(1×5 = 5)

(b) If  $P(A \cup B) = \frac{5}{6}$ ,  $P(A \cap B) = \frac{1}{3}$ ,  $P(\bar{A}) = \frac{1}{2}$ , find  $P(A)$  and  $P(B)$ . Hence show that  $A$  and  $B$  are independent.

(c) Explain Yule's notation for partial regression coefficient.

(d) The mean of marks in statistics of 100 students in a class was 72. The mean of marks of boys was 75, while their number was 70. Find out the mean marks of girls in the class.

(e) For two observations  $a$  and  $b$ , show that standard deviation is half the distance between them.

(f) Prove that if one of the regression coefficients is greater than unity, the other must be less than unity. (2×5 = 10)

2. (a) Describe how you can represent a frequency distribution diagrammatically using cumulative frequencies. Explain graphically how the ogive can be used to find the median and first quartile.

(b) Define the terms

- i) Standard deviation.
- ii) Root mean square deviation and establish the relationship between the two.

(6, 6)

3. (a) State and prove addition theorem of probability for two events  $A$  and  $B$ . Also, for any three events  $A, B$  and  $C$  defined on a sample space  $S$  such that  $B \subset C$  and  $P(A) > 0$ , show that  $P(B|A) \leq P(C|A)$ .

(b) Let  $A$  and  $B$  be two events such that  $P(A) = \frac{3}{4}$  and  $P(B) = \frac{5}{8}$ , show that

i)  $P(A \cup B) \geq \frac{3}{4}$  and

ii)  $\frac{3}{8} \leq P(A \cap B) \leq \frac{5}{8}$ .

- (c) A five figure number is formed by the digits 0,1,2,3,4(without repetition). Find the probability that the number formed is divisible by 4. (6,3,3)
4. (a) Using the Principle of Least Squares fit the curve of the form  $y = ax^2 + bx + c$ .  
 (b) The variables  $X$  and  $Y$  are connected by the equation  $aX + bY + C = 0$ . What is the correlation between them if  
 (i) if the signs of  $a$  and  $b$  are alike  
 (ii) if the signs of  $a$  and  $b$  are different.  
 (c) Show that two uncorrelated variables may not be independent. (6, 3, 3)
5. (a) Out of the two lines of regression given by :  $4X - 5Y + 30 = 0$  and  $20X - 9Y - 107 = 0$ , which one is the regression line of  $X$  on  $Y$ ? Also compute the regression coefficient.  
 (b) Define kurtosis. Explain it with the help of figure. For a mesokurtic distribution the first moment about 7 is 23 and the second moment about origin is 1000. Find the coefficient of variation and the fourth moment about mean. (6, 6)
6. (a) A committee of 4 people is to be appointed from 3 officers of the production department, 4 officers from the purchase department, 2 officers of the sales department and one chartered accountant. Find the probability of forming the committee in the following manner:  
 i) There must be one from each category.  
 ii) It should have at least one from the purchase department.  
 iii) The chartered accountant must be in the committee.  
 (b) Prove that Spearman's rank correlation coefficient ( $\rho$ ) is given by:
- $$\rho = 1 - \frac{6 \sum d_i^2}{n(n^2-1)}, \text{ where } d_i \text{ denotes the difference between the ranks of } i\text{th individual.}$$
- (6, 6)
7. (a) Define skewness. Give various measures of skewness and find the limits for Bowley's coefficient of skewness.  
 (b) The chances that doctor A will diagnose a disease X correctly is 70%. The chances that a patient will die by his treatment after correct diagnosis is 30% and the chances of death by wrong diagnosis is 80%. A patient of doctor A, who had diseases X, died. What is the chance that his disease was diagnosed correctly? (6, 6)
8. (a) Prove that two mutually disjoint events with positive probabilities are always dependent. Is the converse true? Justify your answer.

(b) Explain the concepts of multiple and partial correlation coefficients. Explain the following notations:

i)  $R_{1.23}$

ii)  $r_{12.3}$

iii)  $r_{12}$

(6, 6)