

(6 pages)

MAY 2015

**P/ID 17456/RCF/
PCAB**

Time : Three hours

Maximum : 75 marks

PART A — (5 × 5 = 25 marks)

Answer ALL questions.

1. (a) If $P(A \cup B) = 4/5$, $P(A \cap B) = 1/5$ and $P(\bar{A}) = 1/4$, find $P(A)$ and $P(B)$. Also, examine the independence of A and B .

Or

- (b) What is probability density function? Find the value of k so that the following function becomes the probability density function a random variable.

$$f(x) = \begin{cases} kx^2 e^{-x}, & \text{if } 0 < x < \infty \\ 0, & \text{otherwise.} \end{cases}$$

2. (a) Obtain the moment generating function of Geometric (1/3) distribution. Using the function, obtain mean of the distribution.

Or

- (b) If the probability density function of a random variable X is given by

$$f(x) = \begin{cases} \theta e^{-\theta x}, & \text{if, } 0 < x < \infty \\ 0 & \text{, otherwise,} \end{cases}$$

find the cumulative distribution function of X and using which determine the cumulative distribution function of X^3 .

3. (a) Calculate the coefficient of correlation to the following data using Spearman's formula :
- X : 68 64 75 50 64 80 75
Y : 62 58 68 45 81 60 68

Or

- (b) Describe the method of fitting the equation $y = ax^b$.

4. (a) What is sampling? Mention the advantages of sampling.

Or

- (b) Among a randomly chosen 1000 persons, 856 of them expressed that they will cast their votes in the next election. Using this information, obtain 90% confidence limits to the proportion of population of voters who will cast their votes in the next election.

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5. (a) What is meant by local control? Explain its significance in scientific experiments.

Or

- (b) Describe random fluctuations with a suitable example.

PART B — (5 × 10 = 50 marks)

Answer any FIVE questions.

6. A company has four production sections, viz., A, B, C and D, which contribute 30%, 20%, 28% and 22% respectively to the total output of the company. It was observed that these sections produced respectively 1%, 2%, 3% and 4% defective units. If an unit selected randomly from the total output is defective, what is the probability that it was produced by (a) B (b) D?
7. The probability density function of a random variable is given by

$$f(x) = \begin{cases} ax, & \text{if } 0 < x < 1 \\ 0, & \text{otherwise.} \end{cases}$$

Find the value of 'a'. Also, obtain the coefficient of variation of the respective distribution.

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8. The probability density function of the joint probability distribution of the random variables X and Y is given by

$$f(x,y) = \begin{cases} 2(x+y-3xy^2), & \text{if } 0 < x < 1, 0 < y < 1 \\ 0, & \text{otherwise} \end{cases}$$

Find the marginal distributions of X and Y . Also, compute the covariance between X and Y .

9. Find the moment generating function of the normal distribution using which examine the kurtosis property of the distribution.
10. The expected remaining life of an electronic part is assumed to depend on the age of the part. The age of 10 of these parts were recorded. When each part is burnt out, the elapsed time was recorded. The observations are :

Age of part

(in hours) : 40 65 90 5 30 10 80 85 70 25

Remaining life

(in hours) : 30 20 10 80 40 65 15 15 20 50

Determine the relationship between the age of parts and the remaining life of the parts assuming the non-linear form $y = ab^x$.

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11. Drug A and Drug B were proposed to reduce weight. The drugs were tested with some patients and decrease in the weight of those patients are

Drug A : 11 13 9 10 11 12

Drug B : 12 8 7 10 11 13 9

Using this information, test whether the average decrease in the weight due to both the drugs is same at 5% level of significance.

12. One hundred randomly selected adults were asked whether TV shows as a whole are primarily entertaining, educational, non-informative. Each respondent chose only one answer and the respondents were categorized according to their gender and their response. Examine whether gender and opinion are associated at 5% level of significance.

| Gender | Opinion | | | Total |
|--------|--------------|-------------|-----------------|-------|
| | Entertaining | Educational | Non-informative | |
| Female | 25 | 13 | 15 | 53 |
| Male | 24 | 12 | 11 | 47 |
| Total | 49 | 25 | 26 | 100 |

13. Applying the technique of two-way analysis of variance to the following data, test the significant difference among (a) average yield of three varieties of crops (b) average yield from the four blocks of land. Set the level of significance at 5%.

| Variety | Block | | | |
|---------|-------|----|-----|----|
| | I | II | III | IV |
| A | 4 | 8 | 6 | 8 |
| B | 5 | 5 | 7 | 8 |
| C | 6 | 7 | 9 | 5 |