

(6 pages)

OCTOBER 2013

P/ID 17406/RBG

Time : Three hours

Maximum : 75 marks

PART A — (5 × 5 = 25 marks)

Answer ALL questions.

1. (a) A box contains 6 red, 4 white and 5 black balls. A person draws 4 balls from the box at random. Find the probability that among the balls drawn there is at least one ball of each colour.

Or

- (b) List out the properties of distribution function.
2. (a) The joint probability density function of a two dimensional random variable (X, Y) is given by

$$f(x, y) = \begin{cases} 2; & 0 < x < 1, \quad 0 < y < x \\ 0, & \text{elsewhere} \end{cases}$$

- (i) Find the marginal density functions of X and Y .
- (ii) Find the conditional density function of Y given $X = x$ and conditional density function of X given $Y = y$.

Or

- (b) Find the probability that at most 5 defective fuses will be found in a box of 200 fuses if experience shows that 2 percent of such fuses are defective.

3. (a) Calculate the rank correlation coefficient for the following data.

X : 68 64 75 50 64 80 75 40 55 64

Y : 62 58 68 45 81 60 68 48 50 70

Or

- (b) Write short notes on method of least squares.

4. (a) The guaranteed average life of a certain type of electric light bulb is 1000 hours with a standard deviation of 125 hours. It is decided to sample the output so as to ensure that 90 percent of the bulbs do not fall short of the guaranteed average by more than 2.5 percent. What must be the minimum size of the sample?

Or

(b) The theory predicts the proportion of beans in the four groups A, B, C and D should be $9:3:3:1$. In an experiment among 1600 beans, the numbers in the four groups were 882, 313, 287 and 118. Does the experimental result support the theory at 5% level of significance.

5. (a) How do you measure the trend using moving average method?

Or

(b) What is randomized block design? State its applications.

PART B — ($5 \times 10 = 50$ marks)

Answer any FIVE questions.

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

7. A random variable X has the following probability function values of X .

$$x: \quad 0 \quad 1 \quad 2 \quad 3 \quad 4 \quad 5 \quad 6 \quad 7$$

$$f(x) : 0 \quad k \quad 2k \quad 2k \quad 3k \quad k^2 \quad 2k^2 \quad 7k^2 + k$$

- (a) Find k
- (b) Evaluate $P(X \leq 6)$, $P(X \geq 6)$ and $P(0 < X < 5)$
- (c) Determine the distribution function of X .
8. (a) A symmetric die is thrown 600 times. Find the lower bound for the probability of getting 80 to 120 sixes using Chebychev's inequality. (6)
- (b) List out the physical conditions for binomial distributions. (4)
9. Fit a Poisson distribution to the following data which gives the number of yeast cells per square for 400 squares.

No. of cells per square (x) : 0 1 2 3 4 5 6

No. of squares (y) : 103 143 98 42 8 4 2

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[P.T.O.]

10. X is a normal variate with mean 30 and standard deviation 5. Find the probabilities that
- (a) $26 \leq X \leq 40$
 - (b) $X \geq 45$
 - (c) $|X - 30| > 5$.
11. In a partially destroyed laboratory record of an analysis of correlation data, the following results are only eligible:
- Variance of $X = 9$
- Regression equation :
- $$8X - 10Y + 66 = 0,$$
- $$40X - 18Y = 214.$$
- What were
- (a) The mean values of X and Y
 - (b) The correlation coefficient between X and Y .
 - (c) The standard deviation of Y ?
12. The heights of six randomly chosen sailors are in inches : 63, 65, 68, 69, 71 and 72. Those of 10 randomly chosen sailors are 61, 62, 63, 66, 69, 69, 70, 71, 72 and 73. Discuss the height that these data throw on the suggestion that sailors are on the average taller than soldiers at 5% level of significance?

13. A manufacturing company has purchased three new machines of different makes and wishes to determine whether one of them is faster than the others in producing a certain output. Five hourly production figures are observed at random from each machine and the results are given in the following table. Use analysis of variance technique and determine whether the machines are significantly different in their mean speeds. Use $\alpha = 5\%$.

	Machine A ₁	Machine A ₂	Machine A ₃
	25	31	24
	30	39	30
Observations	36	38	28
	38	42	25
	31	35	28
