

DECEMBER 2015

P/ID 17508/PCASH

Time : Three hours

Maximum : 100 marks

PART A — ($6 \times 5 = 30$ marks)

Answer any SIX questions.

1. Prove that probability of the impossible event is zero.
2. If $A \cap B = \phi$, then show that $P(A) \leq P(\bar{B})$.
3. Ten coins are thrown simultaneously then find the probability of getting at least seven heads.
4. A manufacturer of cotter pins knows that 5% of his product is defective. If he sells cotter pins in boxes of 100 and guarantees that not more than 10 pins will be defective, what is the approximate probability that a box will fail to meet the guaranteed quality?
5. Define correlation and explain the types of correlation with the help of scatter diagram.
6. Define null hypothesis and alternative hypothesis.
7. A machinist is making engine parts with axle diameters of 0.700 inch. A random sample of 10 parts shows a mean diameter of 0.742 inch with a standard deviation of 0.040 inch. Compute the statistic you would use to test whether the work is meeting the specifications.

8. Calculate 5 yearly moving average of number of students studying in a commerce college as shown by the following figures :

Year	No. of students	Year	No. of students
1987	332	1992	405
1988	311	1993	410
1989	357	1994	427
1990	392	1995	405
1991	402	1996	438

PART B — (7 × 10 = 70 marks)

Answer any SEVEN questions.

9. Use chebychev's inequality to determine how many times a fair coin must be tossed in order that the probability will be atleast 0.90 that the ratio of the observed number of heads to the number of tosses will lie between 0.4 and 0.6.
10. Two unbiased dice are thrown. If X is the sum of the numbers showing up, prove that $P(|x - 7| \geq 3) \leq \frac{35}{54}$ then compute this with the actual probability.
11. Show that for the bivariate normal distribution :

$$dp = \text{const.} \exp\left[-\frac{1}{2(1-e^2)}(x^2 - 2exy + y^2)\right] dx dy.$$

(a) M.G.F is $M(t_1, t_2) = \exp\left[\frac{1}{2}(t_1^2 + 2et_1t_2 + t_2^2)\right]$

(b) Moments obey the recurrence relation

$$\mu_{rs} = (r + s - 1)e\mu_{r-1, s-1} + (r - 1)(s - 1)(1 - e^2)\mu_{r-2, s-2}.$$

12. A manufacturer, who produces medicine bottles, finds that 0.1% of the bottles are defective. The bottles are packed in boxes containing 500 bottles. A drug manufacturer buys 100 boxes from the producer of bottles. Using Poisson distribution, find how many boxes will contain :

- (a) no defective and
- (b) atleast two defectives.

13. Ten competitors in a musical test were ranked by the three judges A, B and C in the following order :

Ranks of A : 1 6 5 10 3 2 4 9 7 8

Ranks of B : 3 5 8 4 7 10 2 1 6 9

Ranks of C : 6 4 9 8 1 2 3 10 5 7

Using rank correlation method, discuss which pairs of judges has the nearest approach to common linkings in music.

14. For 10 randomly selected observations, the following data were recorded :

Observation No : 1 2 3 4 5 6 7 8 9 10

Overtime hrs (X) : 1 1 2 2 3 3 4 5 6 7

Additional units (Y) : 2 7 7 10 8 12 10 14 11 14

Determine the co-efficient of regression and regression equation using the non-linear form $Y = a + b_1x + b_2x^2$.

15. It is believed that the precision of an instrument is no more than 0.16. Write down the null and alternative hypothesis for testing this belief carry out the test at 1% level given 11 measurements of the same subject on the instrument.
2.5, 2.3, 2.4, 2.3, 2.5, 2.7, 2.5, 2.6, 2.6, 2.7, 2.5.
16. A random sample of 10 boys had the following I.Q's : 70, 120, 110, 101, 88, 83, 95, 107, 100. Do these data support the assumption of a population mean I.Q's of 100? Find a reasonable range in which most of the mean I.Q values of samples of 10 boys lie.
17. Write down the solving procedure of one way classification with table.
18. To assess the significance of possible variation in performance in a certain test between the grammar schools of a city, a common test was given to a number of students taken at random from the senior 5th Class of each of the four schools concerned. The results are given below. Make an analysis of variance of data.

	Schools			
	A	B	C	D
	8	12	18	13
	10	11	12	9
	12	9	16	12
	8	14	6	16
	7	4	8	15