

2025

## COMMERCE

Paper : CC-103

(Statistics for Business Decisions)

Full Marks : 40

*The figures in the margin indicate full marks.**Candidates are required to give their answers in their own words as far as practicable.*

## Module - I

Answer *any two* questions.

1. (a) An electronic device is made up of 3 components A, B and C. The probability of failure of component A is 0.05, that of B is 0.02 and that of C is 0.03 in some fixed period of time. Find the probability that the device will work satisfactorily during the time, assuming that the three components work independently.
- (b) If  $x_1, x_2, \dots, x_n$  be a random sample of size  $n$  from an infinite population with mean  $\mu$  and variance  $\sigma^2$ , then show that

$$s^2 = \frac{1}{n-1} \sum_{i=1}^n (x_i - \bar{x})^2 \text{ is an unbiased estimator } \sigma^2. \quad 5+5$$

2. (a) If  $(X, Y)$  be a pair of discrete random variable with the joint distribution as follows :

Y X \	1	3	5
2	6/30	4/30	2/30
4	1/30	3/30	3/30
6	3/30	4/30	4/30

Compute correlation coefficient between X and Y. Are X and Y independent?

- (b) An insurance company insures the lives of 5,000 persons of age 30. If it is known that a person of age 30 will die in a given year is 0.0002, find the probability that the company will have to pay at least 3 claims during a given year. 6+4

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3. (a) A wholesale distributor of a product finds that the annual demand for a product is normally distributed with mean of 120 and the standard deviation of 16. If he orders only once a year, what quantity should be ordered to ensure that there is only a 5 percent chance of running short?
- (b) The probability density function of a random variable X

$$f(x) = k(x - 1)(2 - x) \text{ for } 1 \leq x \leq 2$$

Determine

- (i) The value of the constant k
- (ii)  $P[X \leq 1.5]$
- (iii)  $P\left[\frac{5}{4} \leq X \leq \frac{3}{2}\right]$ . 5+(1+2+2)

4. (a) The following data gives the score out of 50 marks in statistics of 30 students in M Com Sem-1 Examination - 2024.

37, 24, 26, 31, 23, 45, 35, 34, 27, 25, 43, 27, 21, 39, 32,  
24, 42, 36, 48, 23, 31, 46, 41, 28, 34, 26, 38, 40, 35, 26

Draw random sample of size 6 without replacement from the given scores by suitable method. Give an estimate of mean score and its estimated standard error. You may use the following random numbers.

1346 5471 5274 4865 3283 1164 9247 5754

- (b) Compute the variance of a Binomial distribution. 6+4

### Module - II

Answer *any two* questions.

5. (a) In order to study how women respond to lipstick brands, a marketing research company surveyed a group of professionals and collected the following information :

**Lipstick Brands**

	<i>Smartbox</i>	<i>Bobbi Crown</i>	<i>Hooda Beauty</i>	<i>Marc Cosmetics</i>
<b>Professionals</b> <i>Professional Accountants</i>	12	14	20	25
<i>Fashion Designers</i>	10	15	12	8
<i>Architects</i>	8	12	21	25

At 5% level of significance, test whether the lipstick brand preference of a women depends on her occupation.

(3)

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(b) You are given the following information :

$$r_{12} = -0.369, r_{13} = 0.918, r_{23} = -0.245$$

Compute adjusted coefficient of multiple determination  $\bar{R}_{1,23}^2$  when the size of the sample is 10.

6+4

6. (a) Quantity demanded (Y) of a product is a function of price ( $X_1$ ) and disposable income ( $X_2$ ) of the consumer. A researcher collected the following data in order to estimate the demand function :

Y (units)	$X_1$ (₹ in thousand)	$X_2$ (₹ in thousand)
10	4	6
12	6	8
10	2	4
12	2	6
16	6	10

Develop a multiple regression equation that best describes the data and forecast demand when  $X_1 = 3$  and  $X_2 = 5$ .

(b) The demand for an item in the last 6 years is given below :

<u>Year</u>	<u>Demand</u>
1	109
2	112
3	103
4	108
5	106
6	123

Calculate the Exponentially Smoothed forecasts using  $\alpha = 0.3$

6+4

7. (a) A financial analyst gathered the current ratios of twelve companies from four distinct industries. These companies also vary in sizes based on their market capitalisation (₹ in million). The relevant current ratios are shown below :

Company Sizes (₹ in crores)	Industries			
	Oil	FMCG	Steel	Banking
Large-Cap	4.4	5.8	4.8	4.6
Mid-Cap	4.6	5.2	5.9	4.3
Small-Cap	4.5	4.9	4.9	2.9

Do these results indicate a significant variation either between the industries and between the sizes? Test at 5% level of significance.

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- (b) Given  $r_{12} = 0.97$ ,  $r_{13} = 0.99$ ,  $r_{23} = 0.97$ . Compute the value of coefficient of multiple correlation treating the second variable as dependent variable, first and third variables are independent variables. Compute the partial correlation between first and second variable eliminating the effect of third variable. 6+(2+2)
8. (a) A group of 5 patients treated with medicine 'A' weight 42, 39, 48, 60, 41 kg; a second group of 7 patients from the same hospital treated with medicine 'B' weight 38, 42, 56, 64, 68, 62 kg. Do you agree with the claim that medicine 'B' increase with weight significantly?
- (b) The Income Tax Department is interested to compare the number of companies that claim deduction under section 80JJAA of the Income Tax Act, 1961 at its two regional offices. Independent random samples of company assesses drawn from the jurisdiction of two regional offices provide the following information :

<i>Particulars</i>	<i>North West Region</i>	<i>Mumbai Region</i>
Sample Size	500	600
No. of companies claimed deduction u/s 80JJAA through e-filing of Return of Income	70	54

Do these data reveal a significant difference in the proportion of companies claiming deduction u/s 80JJAA between the regional offices of the Income Tax Department? Test at 5% level of significance. 5+5

**: Table Values :**

[Given that,  $\Phi(1.5) = 0.9331$ ,  $\Phi(1.0) = 0.8413$ ,  $\Phi(2.0) = 0.9772$ ,  $\Phi(1.645) = 0.95$ ,  $z_{0.025} = 1.960$ ,  $z_{0.05} = 1.645$ ,  $\chi^2_{0.05, 3} = 7.815$ ,  $\chi^2_{0.05, 4} = 9.488$ ,  $\chi^2_{0.05, 6} = 12.592$ ,  $\chi^2_{0.05, 7} = 14.067$ ,  $t_{0.01, 25} = 2.485$ ,  $t_{0.05, 10} = 1.812$ ,  $t_{0.01, 10} = 2.764$ ,  $t_{0.005, 19} = 2.861$ ,  $t_{0.005, 20} = 2.845$ ,  $F_{0.05, 3, 6} = 4.757$ ,  $F_{0.05, 2, 6} = 5.143$ ,  $F_{0.05, 3, 2} = 19.164$ ,  $F_{0.05, 3, 7} = 4.35$ ,  $e = 2.7183$ ]