

[This question paper contains 24 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 3207

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Name of the Paper : Business Statistics

Name of the Course : B.Com (H) – DSC

Semester : IV

Duration : 3 Hours

Maximum Marks : 90

समय : 3 घण्टे

पूर्णांक : 90

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt all questions.
3. All parts of a question to be attempted together.
4. All questions carry equal marks.
5. Use of simple calculator is allowed.
6. Answers may be written either in English or Hindi; but the same medium should be used throughout the paper.

छात्रों के लिए निर्देश

1. इस प्रश्न-पत्र के मिलते ही ऊपर दिए गए निर्धारित स्थान पर अपना अनुक्रमांक लिखिए।
2. सभी प्रश्न कीजिए।
3. प्रश्न के भागों को एक साथ कीजिए।
4. सभी प्रश्नों के अंक समान हैं।
5. साधारण कैलकुलेटर उपयोग की अनुमति है।
6. इस प्रश्न-पत्र का उत्तर अंग्रेजी या हिंदी किसी एक भाषा में दीजिए, लेकिन सभी उत्तरों का माध्यम एक ही होना चाहिए।

P.T.O.

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1. (a) State, giving the reasons, the average to be used in the following situations:

(i) To determine the average size of the pair of shoes to be sold in the shop,

(ii) To determine the average wages in a company,

(iii) To find the average beauty among the participants in a fashion show,

(iv) To find out per capita income in different cities. (4)

(b) If the first four moments about the value 5 are -4, 22, -117 and 560, determine the corresponding moments about the mean. (5)

(c) Mr. Devavrat, a prospective corporate buyer, compared polyethene bags produced by two companies and tested bursting pressure of the bags and recorded results as follows:

Bursting Pressure (lb.)	Number of bags	
	Company A	Company B
0-10	4	18
10-20	18	22
20-30	58	36
30-40	108	64
40-50	22	54
50-60	10	26

You are required to find out :

(i) Average bursting pressure for each company,

(ii) Which company bags have more uniform pressure?

(iii) If the prices are the same, which company's bags would be preferred by the buyer? (9)

OR

(d) A leading retail chain is conducting a performance review of its outlets to identify variation in sales and to classify outlets into different performance segments. The management is particularly interested in understanding the distribution of sales among the lower-performing, average-performing, and top-performing outlets for better strategic decision-making. The following data shows the monthly sales (in ₹ lakh) across 100 outlets :

Monthly Sales (₹ lakh)	Number of Outlets
0-10	8
10-20	12
20-30	20
30-40	30
40-50	18
50-60	12
Total	100

You are required to :

(i) Determine the sales level below which 25% of the outlets fall.

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- (ii) Identify the sales level above which only the top-performing 25% outlets are placed.
- (iii) Briefly comment on whether the sales distribution is concentrated or widely spread among the middle-performing outlets. (9)
- (e) Calculate Karl Pearson's coefficient of skewness for the following distribution:

Profits (₹ lakh) (Less than)	20	40	60	80	100
Number of companies	16	40	100	128	140

(6)

- (f) Identify the suitable measure of dispersion for each of the following cases giving reasons thereof:

- (i) An investor is comparing two mutual funds that have different average returns and wants to assess which fund is more consistent relative to its returns.
- (ii) A logistics company analyses delivery times which vary slightly but consistently, with no major delays or extreme values.
- (iii) Two sales teams have different average sales figures. Management wants to compare which team is more consistent in performance.

(3)

2. (a) A well-established automobile components manufacturing company produces premium headlights for leading car brands using three automated production machines; Machine A, Machine B, and Machine C. These machines contribute

differently to the total production, where Machine A produces 40%, Machine B produces 35%, and Machine C produces the remaining 25% of the total output respectively. Due to differences in efficiency, calibration, and maintenance conditions of the machines, the quality of output also varies across these machines. Historical records indicate that Machine A produces 5% defective headlights, Machine B produces 4% defective headlights, and Machine C produces 3% defective headlights. In response to a recent increase in customer complaints, the quality control department conducts a random inspection of finished products. During this inspection, a headlight is randomly selected and is found to be defective. Based on this information, determine the probability that:

(i) the defective headlight was produced by Machine A,

(ii) the defective headlight was produced by either Machine B or Machine C. (6)

- (b) A manufacturing company specializing in automobile clutch plates supplies its products in standardized boxes of 200 units to various automobile assembly plants. Recently, some clients have raised concerns about product quality, prompting the company's quality assurance team to conduct a detailed inspection of randomly selected boxes from dispatched consignments. During one such inspection, it was observed that out of 200 clutch plates in a box, 20 units had a type A defect, 10 units had a type B defect, and 4 units had both types of defects. These defects may affect product performance and customer satisfaction if not addressed properly. As part of the quality analysis report, management wants to assess the likelihood of defects occurring in different combinations so that corrective actions can be prioritized effectively. Based on the above information, determine the probability that:

- (i) clutch plate has neither type A nor type B defect,
- (ii) clutch plate has type A defect given that it already has type B defect, and
- (iii) clutch plate has type B defect given that it does not have type A defect. (9)
- (c) Explain dependent and independent events with the help of examples. (3)

OR

- (d) A consumer electronics company employs a field salesperson who, based on past data, successfully converts about 30% of customer interactions into sales. If 5 customers are contacted on a particular day, what is the probability of:

- (i) No sales,
- (ii) Exactly two sales,
- (iii) At least 3 sales. (9)

- (e) An automobile firm has got the delivery of 200 Music systems to be installed in their luxury cars. After inspection by the engineer the defects per set is recorded below :

No. of defects	0	1	2	3	4
No. of sets	158	36	4	2	0

- Fit a poison distribution to the above data. ($e^{-0.25} = 0.7788$) (6)

- (f) Two sets of candidates are competing for the positions on the board of directors of a company. The probabilities that the first and second sets will win are 0.6 and 0.4 respectively. If the first set wins, the probability of introducing a new product is 0.8 and corresponding probability of the second set wins is 0.3. What is the probability that the product will be introduced. (3)
3. (a) What is scatter diagram? Indicate different types of correlation with the help of scatter diagram for two variables. (4)
- (b) A financial analyst is studying the relationship between the ranking of companies based on their advertising expenditure and sales performance. The coefficient of rank correlation between these two variables is found to be 0.25. If the sum of the squares of differences in ranks ($\sum D^2$) is 90, determine the number of companies (N) included in the study. (4)
- (c) A newly appointed sales manager was given the task to analyse the sales and market share of the company for last ten years. The sales manager collects data from the past records for the last 10 years which is given below :

Market Share (%)	40	45	50	55	30	55	40	45	40	50
Sales ('000000 ₹)	12	14	14	16	13	17	16	15	19	14

You are required to calculate following :

- (i) Two regression equations,
- (ii) Coefficient of correlation between Market share and Sales,

(iii) Find out standard error of estimate of Sales on Market Share. (10)

OR

(d) A marketing survey was conducted upon 150 respondents (online shoppers) where the age of buyer (in years) and amount spent (in '000 rupees) on online shopping was recorded as under :

Amount Spent (in '000)	Age of Buyer (in years)				Total
	40-50	50-60	60-70	70-80	
50-55	10	5	7	10	32
55-60	5	20	15	8	48
60-65	5	12	10	7	34
65-70	8	16	5	7	36
Total	28	53	37	32	150

You are required to calculate Karl Pearson coefficient of correlation between Age of the buyer and amount spent. (14)

(e) "Regression analysis is used to find the cause-and-effect relationships whereas correlation indicates the possibility of association between two variables." Do you agree? Comment. (4)

4. (a) Madhur Sugar Ltd. collected the sales data over seven years from 2017 to 2024 from the sales department which is given below:

Year	2017	2018	2019	2020	2021	2022	2023	2024
Sales (₹ lakh)	40	45	46	42	47	49	46	52

You are required to :

- Fit a straight-line trend using method of least square,
 - Obtain trend values for each year,
 - Convert the annual trend equation into quarterly trend,
 - Shift the origin to 2024.
 - Eliminate trend using additive model
- (14)
- (b) Out of following two regression lines, find the line of regression of X on Y, Y on X and the value of correlation :

$$2X + 3Y = 7 \text{ and } 5X + 4Y = 9 \quad (4)$$

OR

- (c) The production of commodity during 2019-2024 is given below :

Year	2019	2020	2021	2022	2023	2024
Production ('000 tonnes)	20	24	26	30	36	40

You are required to find:

- Fit a straight-line trend using second degree parabola,

- (ii) Compute the trend values for the years 2019 through 2024
- (iii) Predict the production for the year 2026 (10)
- (d) With which component of a time series would you mainly associate each of the following :
- (i) A sudden strike in a factory causes production to halt for two weeks.
 - (ii) Sales of woollen garments increase sharply every winter.
 - (iii) The economy experiences a slowdown leading to reduced business activity across industries due to US-Iran war.
 - (iv) The gradual rise in literacy rate over several decades. (4)
- (e) A researcher is examining the relationship between two variables, X and Y, using regression analysis. During the analysis, the following pairs of regression coefficients were obtained in different scenarios :
- (i) b_{xy} is -0.6 and b_{yx} is 0.9,
 - (ii) b_{xy} is 3 and b_{yx} is 0.5, (4)

Based on the properties of regression coefficients, identify which of the above cases are theoretically possible. Justify your answer using appropriate reasoning.

5. (a) Following is data given for five commodities :

Commodity	Base Year		Current Year	
	Quantity	Expenditure	Expenditure	Price
A	50			
B	100	600	1120	20
C	60	400	480	4
D	30	480	720	12
E	40	600	576	24
		640	864	24

You are required to find out price index by :

- Laspeyres's Method,
- Paasche's Method,
- Fisher's Ideal Index Method,

Also, prove that fisher's ideal index satisfies both time and factor reversal tests. (9)

- (b) A leading NBFC in Delhi provides instant personal loans through its mobile app. During a financial year, the company disbursed loans to 4,000 customers. The average loan amount sanctioned was ₹2,40,000, with a standard deviation of ₹50,000. Assume that the loan amounts follow a normal distribution. You are required to find:

- The number of customers who received loans between ₹2,00,000 and ₹3,50,000.
- The probability that a randomly selected customer received a loan exceeding ₹1,50,000.

- (iii) The maximum loan amount received by the lowest one-third of customers.

(Given: Table values of area for $Z = 0.8$ is 0.2881, $Z=2.2$ is 0.4861, $Z=1.8$ is 0.4641 and $Z=0.43$ is 0.167)

(9)

OR

- (c) The monthly income of a person is Rs. 10,500. It is given that the cost-of-living index for a particular month is 136. Find out the amount spent by that person on food and clothing using following data :

Item	Expenditure	Index
Food	?	180
Rent	1470	100
Clothing	?	150
Fuel and power	1680	110
Miscellaneous	1890	80

(9)

- (d) A customer support centre of a telecom company receives an average of 96 customer calls per hour on its helpline. The management wants to analyse short-term call traffic to optimize staffing at the support desk. Based on this information, find out the probability that:

(i) the support desk receives not more than three calls in a given minute,

(ii) the support desk receives at least three calls in a given minute.

(5)

(e) Which probability distribution is appropriate to use in the following cases:

- (i) The life span of a CT scan machine,
- (ii) The number of cars passing through a toll plaza,
- (iii) The number of defective radios in a lot of 100,
- (iv) The water level in a reservoir. (4)

1. (क) कारण बताते हुए, निम्नलिखित स्थितियों में उपयोग किए जाने वाले औसत का उल्लेख कीजिए :

- (i) दुकान में बेचे जाने वाले जूतों के जोड़े का औसत आकार निर्धारित करने के लिए,
- (ii) किसी कंपनी में औसत वेतन निर्धारित करने के लिए,
- (iii) किसी फैशन शो में भाग लेने वाले प्रतिभागियों की औसत सुंदरता का पता लगाने के लिए,
- (iv) विभिन्न शहरों में प्रति व्यक्ति आय का पता लगाना। (4))

(ख) यदि 5 के मान के सापेक्ष पहले चार क्षण -4, 22, -117 और 560 हैं, तो माध्य के सापेक्ष संगत क्षणों का निर्धारण कीजिए। (5)

(ग) श्री देवव्रत, जो एक संभावित कॉर्पोरेट खरीदार हैं, ने दो कंपनियों द्वारा उत्पादित पॉलीथीन बैगों की तुलना की और बैगों के फटने के दबाव का परीक्षण किया तथा निम्नलिखित परिणाम दर्ज किए :