

[This question paper contains 16 printed pages.]

Your Roll No.....

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K

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Name of the Paper : Business Statistics

Name of the Course : B.Com. – DSC

Semester : III

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 प्रश्नों के उत्तर दीजिए।
3. प्रश्न के सभी 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.

1. (a) "Different averages serve different purposes but arithmetic mean is an ideal average which can serve all purposes" Comment (3)
- (b) In an industry the mean profit of 95 firms is found to be ₹60 crores with a coefficient of variation of 45%. During the survey, 5 firms could not report their profits before compilation of the data. The profits were later on reported as ₹22, 24, 54, 42, and 58 crores. You are required to find out revised mean, standard deviation and coefficients variation. (6)
- (c) The following is the age distribution of 2,000 employees working in a large textile mill :

Age	Number of Employees	Age	Number of Employees
15 but less than 20	80	45 but less than 50	268
20 but less than 25	250	50 but less than 55	150
25 but less than 30	300	55 but less than 60	75
30 but less than 35	325	60 but less than 65	25
35 but less than 40	287	65 but less than 70	20
40 but less than 45	220		

Because of the heavy losses the management decides to bring down the strength to 40% of the present number according to the following scheme:

- (i) To retrench the first 10% from lower age group,
- (ii) To absorb next 40% in other branches,
- (iii) To make 10% from highest age group retire prematurely.

What will be the age limits of employees retained in the mill and of those transferred to other branches? Also calculate the average age of employees before and after retrenchment. (9)

OR

- (d) Vidyut Ltd., an electric scooter manufacturing firm, recorded the per day sale by two authorized dealers for ten days during festive season given as below:

Dealer A	36	32	37	31	33	40	35	38	30	28
Dealer B	34	31	32	34	35	36	32	36	33	27

You are required to calculate and comment about :

- (i) Average number of electric scooters sold by each dealer,
 - (ii) Standard Deviation and Coefficient of variation for each dealer,
 - (iii) What will be change in above statistics if the daily sales of dealer A are increased by 5 scooter per day due to promotional schemes and daily sales of dealer B is decreased by 10 per day due to decrease in demand? (9)
- (e) A consumer survey provides data on the monthly income of the consumers as follows :

Monthly Income ('000 ₹)	20-30	30-40	40-50	50-60	60-70	70-80	80-90
Number of consumers	5	14	20	25	17	11	8

You are required to :

- (i) Calculate first four moments about the mean
 - (ii) Comment on Skewness and Kurtosis. (6)
- (f) What purpose does coefficient of variation serve? Distinguish between variance and coefficient of variation. (3)
2. (a) A company currently has two active projects, one in Mumbai and the other in Bengaluru. The probability that the Mumbai is successful is 0.4 and the probability that the Bengaluru project is successful is 0.7.

- (i) If the Mumbai project is not successful, what is the probability that the Bengaluru project is also not successful?
- (ii) What is the probability that at least one of the two projects will be successful? (5)
- (b) A machine produces on an average 15% defective chipsets. During the inspection visit of quality manager, a batch is accepted if a sample of 6 chipsets taken from that batch contains no defective chipsets and rejected if the sample contains 4 or more defectives. In other cases, a second sample is taken for quality check by the manager. What is the probability that:
- (i) Batch will be accepted,
- (ii) A second sample will be taken,
- (iii) Batch will be rejected. (9)
- (c) Distinguish between mutually exclusive and independent events with the help of examples. (4)

OR

- (d) A, B, and C are candidates for a director's position at a private firm, with selection chances in the ratio 5:2:3. Their probabilities of implementing changes in organization structure are 0.3, 0.8, and 0.5, respectively. If a change has occurred, find the probability that :
- (i) It is due to B's selection,
- (ii) It is due to A's selection. (6)
- (e) An insurance company is analyzing the risk of accidents on a specific stretch of motorway to adjust their premium rates. Accidents occur on this stretch of motorway at the rate of 5 per month. Find the probability that on a given month there will be:

- (i) no accidents,
(ii) more than 3,
(iii) at least 1 accident. (9)

(Given $e^{-5}=0.00674$)

- (f) When can a Poisson distribution be a reasonable approximation of binomial distribution? (3)

3. (a) A retail company wants to analyze the impact of advertising expenditure on monthly sales revenue. The marketing team collected data for last ten months on the advertising budget (in thousand rupees) and the corresponding sales revenue (in thousand rupees) as shown below :

Advertising Expenditure (^{000 ₹})	9	12	13	20	15	16	18	22	18	17
Sales (^{000 ₹})	67	87	98	73	82	92	82	83	78	88

You are required to calculate following :

- (i) Two regression equations,
(ii) Coefficient of determination between advertising expenditure and sales,
(iii) What will be the change in sales if advertising expenditure is Rs. 30,000?
(iv) Find out standard error of estimate for advertising expenditure on sales. (10)
- (b) In a factory, the correlation coefficient for a sample of certain number of observations of two items produced is 0.917 while the probable error is 0.034. Find out the pairs of observations (N) taken as sample and also find out the limit of correlation coefficient for another sample of same size from same population. (4)

- (c) Explain the concept of standard error of estimates. Also discuss its significance in regression analysis. (4)

OR

- (d) Zenith Consulting, a management consulting firm, is investigating the relationship between consultant productivity scores and client satisfaction ratings within its project teams. The productivity scores and client satisfaction ratings for 10 consultants are given by the firm as below:

Consultant	Productivity Scores	Client Satisfaction Scores
A	52	49
B	55	56
C	47	45
D	54	51
E	50	53
F	46	55
G	46	47
H	40	43
I	44	49
J	49	53

Using Spearman's Rank Correlation Coefficient, determine that;

- (i) Is there any correlation between consultant productivity scores and client satisfaction scores? Also interpret the result.
- (ii) What will be the impact on rank correlation coefficient if the productivity score of the consultant "I" changed from 44 to 45? (9)
- (e) A company wants to analyse the relationship between Employee Training Hours (X) and Employee Productivity Score (Y). The following two regression lines summarize their findings :

$$5Y - 4X - 300 = 0 \text{ and } 6Y - 5X - 350 = 0$$

- (i) Determine the average Employee Training Hours and average Employee Productivity Score.
- (ii) Find the correlation coefficient between training hours and productivity score.
- (iii) Given that the variance of Employee Productivity Score is 25, calculate the standard error of estimate for productivity based on training hours. (9)

4. (a) Sunrise Electronics Ltd. has recorded its annual revenue (in crores) from 2017 to 2024, as given below :

Year	2017	2018	2019	2020	2021	2022	2023	2024
Revenue (in crores ₹)	125	140	150	145	160	172	165	180

You are required to :

- (i) Fit a straight-line trend to the revenue data using the method of least squares.
- (ii) Compute the trend values for the years 2017 through 2024.
- (iii) Convert the annual trend values into monthly trends, also give the reason behind dividing slope coefficient by 144.
- (iv) Shift the origin to the year 2024 while calculating the trend.
- (v) Eliminate trend using additive model. (14)
- (b) In a regression equation for Y on X consisting of 9 observations, the explained and unexplained variations were computed as 24 and 36 respectively. Find out the coefficient of determination and standard error of estimate of Y on X. (4)

OR

P.T.O.

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

Year	2019	2020	2021	2022	2023	2024
Production ('000 units)	15	17	18	19	20	21

You are required to :

- (i) Fit a second-degree parabolic trend,
 - (ii) Compute the trend values for the years 2019 through 2024.
 - (iii) Predict the production for the year 2027. (3)
- (d) With which component of a time series would you mainly associate each of the following, give reasons:
- (i) A sudden supply chain disruption in a semiconductor manufacturer causing one month's halt in production.
 - (ii) Increased online retail sales every October due to festive season promotions.
 - (iii) A multi-year economic boom leading to steadily rising consumer spending and GDP growth.
 - (iv) Gradual increase in average workforce productivity over a decade due to technology adoption.
 - (v) Sharp drop in automotive sales in India following introduction of new import tariffs by the US government. (5)
- (e) Briefly explain the following :
- (i) What is coefficient of determination? How is it important for statistical decision making?
 - (ii) "Coefficient of determination is always positive" Do you agree? Support your argument. (4)

5. (a) During an inflation related survey, the following data was collected by a national agency for five commodities :

Commodity	Base Year		Current Year	
	Price	Expenditure	Expenditure	Quantity
A	12	1440	1540	110
B	14	1120	1350	90
C	10	900	990	110
D	8	1040	1200	120
E	16	960	1050	70

You are required to find out price index by :

- (i) Laspeyres's Method,
 - (ii) Paasche's Method,
 - (iii) Fisher's Index Method.
 - (iv) From above three methods which one is ideal index and why? (9)
- (b) Hriday care, a hospital specialized in heart surgery admitted 4,000 patients during the year 2023-24. Average payments made by patient was ₹2,40,000 with a variance of ₹62,50,00,000. Assuming the distribution of payments to be normal, find and show under normal curve:
- (i) The number of patients who paid between ₹2,00,000 and ₹3,00,000.
 - (ii) The probability that a patient's bill exceeds ₹2,50,000.
 - (iii) The number of patients who paid above ₹150,000 but below ₹2,00,000
(Given: Table values of area for $Z=1.6$ is 0.4452, $Z=2.4$ is 0.4918, $Z=0.4$ is 0.1554, $Z=3.6$ is 0.4998) (9)

OR

- (c) Bright Pay Solutions Pvt. Ltd., a leading FinTech company based in Delhi, wants to review the cost of living for its employees so as to consider the salary hike. The HR department has collected data on the average monthly expenses of its employees for key categories in 2022 (base year) and 2025 (current year). Using the information below, calculate the Cost-of-Living Index and determine how much the monthly salary should be increased to compensate for the rise in living costs if an employee was earning ₹45,000 per month in 2022.

Items	Average Monthly Cost (2022)	Average Monthly Cost (2025)	Weights
Housing & Rent	12,000	15,000	4
Transportation	3,500	5,000	2
Groceries and Food	8,000	10,000	5
Utilities	2,500	3,200	2
Entertainment & Misc.	4,000	5,500	2

(9)

- (d) The probability that a sales representative can sell Product A on any given day is 0.4, and the probability that the same sales representative can sell Product B on the same day is 0.3. The probability that the sales representative sells both products on the same day is 0.08. What is the probability that the sales representative sells at least one of the two products on a given day? Assuming that selling Product A and Product B are independent events, what is the probability that the sales representative sells both products on the same day?

(4)

- (e) Briefly explain the following :

(i) What are the situations where Poisson distribution can be used? Explain with suitable examples.

(ii) Discuss axiomatic approach of probability.

(5)