[G/A-G]

SEAT No._____ No. of Printed Pages: 2

SARDAR PATEL UNIVERSITY

B.Sc. Semester – IV Examination (2014 – 2017 Batch) 2022 - 23

Thursday, 6th October, 2022

Statistics

US04CSTA01 (Statistical Techniques)

Time : 12.30 to 2.30 pm M.Marks : 70

Note: (i) Statistical table is allowed in the examination hall (ii) Use of Scientific calculator permitted.

Q.1 Multiple choice questions (1×10)

(1) When two variables are uncorrelated then two lines of regression are
(a) parallel (b) perpendicular (c) Coincide (d) All of these

(2) An investigator reports that the arithmetic mean of two regression coefficients of a regression line is 0.7 and the correlation coefficient is 0.75. Are the results
(a) Valid (b) Invalid (c) Inconclusive (d) None of these

(3) The best fitted trend line is one for which sum of squares of residuals or errors is
(a) Positive (b) Zero (c) Maximum (d) Minimum

(4) The control chart that are used to deal with the characteristic which are not possible to measure, but can observed as absent or present from the product
(a) Xbar chart (b) P chart (c) R Chart (d) C chart

(5) A restaurant has been experiencing higher sales during the weekends of compared to the weekdays. Daily restaurant sales patterns for this restaurant over a week is an example of _____ component of time series.
(a) Trend (b) Seasonal (c) Cyclic (d) Irregular

(6) In the regression line $Y = a + bX$, the following is always true:
(a) $\sum(Y - \hat{Y}) = 0$ (b) $\sum Y = \sum \hat{Y}$ (c) $\sum(Y - \hat{Y})^2$ is minimum (d) All of the above

(7) The forecasts on the basis of a time series are _____
(a) 100% true (b) True to great extent (c) Never True (d) None of these

(8) A rise in price before EID is an example of
(a) Cyclic trend (b) Secular trend (c) Irregular trend (d) Seasonal trend

(9) Spearman's rank correlation coefficient is minimum when ranking are
(a) Same (b) Opposite (c) Random (d) None of these

(10) In semi – average method, if the time series data contains odd number of values then we drop
(a) First Value (b) Last Value
(c) Middle Value (d) First and last both

Q.2 Fill in the blanks (4×1)

(1) If all sample points fall within two control limits, the process is said to be under control, and it may be concluded that only the _____ of variations are present in the process.

(2) Simple average method is used to find the _____

(3) Two judges in a debate contest gives all the participants same rank then the rank correlation coefficient be _____

(4) If two variables are independent of each other the correlation coefficient between them must be _____

True or False (4×1)

(5) The faults due to assignable causes can be removed.

(6) The slope of the regression line of Y on X is also called the regression coefficient of X on Y.

(7) The points falling below LCL of $\bar{X}$ chart indicate improvement in the production process.

(8) Value of b in the equation $Y = a + bX$ is always positive.

Q.3 Short Type Questions (Attempt Any Ten) (10×2)

(1) List out the components of Time Series analysis. Write in brief about any one of them.

(2) State the limits of ρ. When it will be minimum? Justify your answer by giving counter example.

(3) Write in brief on Theory of Runs.

(4) What do you mean by Time Series analysis?

(5) What is curve fitting? Write down the normal equations for estimating unknown constants in the equation $Y = aX^b$

(6) With reference to SQC, quality means what?

(7) Prove that two independent variables are uncorrelated but converse is not true.

[P.T.O.]

(8) List out the various components of time series analysis. Write in brief about any one of them.

(9) The least squares trend line for an annual time series data regarding sale of cars (In' 000 units) from 2010 to 2017 is $Y = 1.2 + 0.5X$. Identify an intercept and slope of this trend line. Interpret the slope in this trend line.

(10) If one or more points fall below LCL in construction of fraction defective chart, what would you conclude from that?

(11) Fifteen samples of size four are selected from a production line.
(a) What is the value of the A_2 factor used to determine lower and upper control limits for mean?
(b) What are the values of D_3 and D_4 factors used to determine the lower and upper control limits for range?

(12) Find the correlation coefficient between X and $X + 2a$, where 'a' is any positive constant.

Q.4 Long Answer Questions (Attempt Any Four) (4×8)

(1) In usual notation, prove that $\rho = 1 - \frac{6\sum di^2}{n(n^2-1)}$. Derive the limits of ρ and comment on it.

(2) An experiment was carried out at different temperatures and mass is recorded. The results are listed below:

Temperature(^{0}C)(X)	15	20	25	30	35	50	70
Mass(Y)	2.1	2.6	2.9	3.3	4.0	5.1	7.0

Calculate the equations of the regression line of Y on X and X on Y. Draw scatter diagram and plot both the regression lines and plot the point $(\overline{X}, \overline{Y})$ on diagram. What quantity might be expected at 37^0C?

(3) The following table shows the number of diabetic patients ('000) in a city from 2013 to 2021. Fit an equation of the form $Y = ab^X$ and forecast the number of diabetic patients for the year 2022 and 2023.

Year	2013	2014	2015	2016	2017	2018	2019	2020	2021
No. of patients	4.5	6.1	8.2	11.0	14.9	20.1	27.1	36.6	49.4

(4) (a) State the various causes of variations in the production process. Write in brief about each one of them.
(b) If X and Y are two independent variables with mean 5 and 10 and variance 4 and 9 respectively. Find the correlation coefficient between U and V where $U = 2X + 3Y$ and $V = 2X - 3Y$.

(5) Do as directed:
(i) Prove that the correlation coefficient is an independent of change of origin and scale.
(ii) The tangent of an angle between two regression line is given to be 0.6 and $S_Y = S_X/2$ then find the correlation coefficient between X and Y.

(6) (a) Two regression lines intersect at which points? Obtain an angle between two regression lines. Interpret the cases when $r = 0, \pm 1$.
(b) Write in brief about Moving average method with its merits and demerits.

(7) (a) Differentiate between (i) p and np chart (ii) Variable and Attribute chart.
(b) 25 boxes each containing 100 items were selected at random and no. of non – conforming items in each box, were as follows:

Box No.	No. of non-conforming items	Box No.	No. of non-conforming items	Box No.	No. of non-conforming items	Box No.	No. of non-conforming items	Box No.	No. of non-conforming items
1	10	6	7	11	9	16	12	21	11
2	12	7	12	12	14	17	11	22	11
3	10	8	10	13	16	18	6	23	11
4	11	9	6	14	21	19	10	24	6
5	6	10	11	15	20	20	10	25	9

Set up 3σ limits for no. of non – conforming items. Is the process under control?

(8) Calculate quarterly trend values using least squares method.

Quarter	Sale of Cars (In 000 units)				
	2017	2018	2019	2020	2021
I	45	48	49	52	60
II	54	56	63	65	70
III	72	63	70	75	83
IV	60	56	65	72	86

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