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SARDAR PATEL UNIVERSITY
B.Sc. Semester - IV Examinations

9th April, 2016

Saturday

Course Code: - US04CSTA01
(Statistical Techniques)

Time:-10:30 to 01:30

Marks: - 70

Note: - Simple/ Scientific calculator is allowed.

Q.1. Select an appropriate answer from the given choice. [10]

- Correlation is often assessed by eye, which type of chart is usually used for this purpose?
 - Histogram
 - Bar chart
 - Box plot
 - Scattar plot
- In general, as the weight of a person increases, his speed on the 100 yard dash decreases. This is known as a
 - zero correlation
 - spurious correlation
 - positive correlation
 - negative correlation

3. The Ranks according to two attributes in a sample are given below:-

R ₁	1	2	3	4	5
R ₂	5	4	3	2	1

The rank correlation between them is _____

- 0
 - positive
 - negative
 - none of these
- The line described by the regression equation attempts to
 - pass through as many points as possible.
 - pass through as few points as possible
 - minimize the number of points it touches
 - minimize the squared distance from the points
 - The regression equation for predicting number of speeding tickets (Y) from information about driver age (X) is $Y = -.065(X) + 5.57$. How many tickets would you predict for a twenty-year-old?
 - 7.43
 - 4.27
 - 5.57
 - 1
 - John's parents recorded his height at various ages up to 66 months. Below is a record of the results

Age (months)	36	48	54	60	66
Height (in inches)	35	38	41	43	45

Which of the following is the equation of the least-squares regression line of John's height on age?

- Height = 12*(Age)
 - Age = 3*(Height-22)
 - Height = 60 - 0.22*(Age)
 - Height = 22.3 + 0.34*(Age)
- Seasonal variations repeat during a period of _____
 - One year
 - 5 Year
 - 7 year
 - none of these.
 - Telephone sales for a tele marketing firm are given below.

1998	1999	2000	2001	2002
1500	1400	1600	1650	1750

what is the three year moving average for 2000?

- a) 1525 b) 1500 c) 1550 d) 1600
9. Control charts for variables are based on data that comes from _____.
- a) acceptance sampling b) individual items c) averages of small samples d) averages of large samples
10. A manufacturer uses statistical process control to control the quality of the firm's products. Samples of 50 of Product A are taken, and a defective/acceptable decision is made on each unit sampled. For Product B, the number of flaws per unit is counted. What type(s) of control charts should be used?
- a) p-charts for A and B b) p-chart for A, c-chart for B c) c-charts for both A and B d) p-chart for A, mean and range charts for B

Q.2. Attempt any **Ten** questions from the following questions:- [20]

1. What is correlation? State the types of correlation. Explain them with illustration.
2. The coefficient of rank correlation of the marks obtained by 10 students in two particular subjects was found to be 0.5. It was later discovered that the difference in ranks in two subjects obtained by one of the student was wrongly taken as 3 instead of 7. What should be the correct value of coefficient of correlation?
3. What is the method of Least squares? State the Normal equations of the straight line, Parabola, Exponential curve and Power curve.
4. What is regression? What is linear regression?
5. Why there are two regression lines?
6. For 50 students of a class the regression equation of marks in Statistics (X) on marks in Mathematics (Y) is $3Y - 5X + 180 = 0$. The mean mark in Mathematics is 44 and the variance of marks in Statistics is $9/16$ th of the variance of marks in Mathematics. Find the mean marks in Statistics and coefficient of correlation between marks in two subjects.
7. Name the components of a Time Series and illustrate them with suitable examples.
8. What is Seasonal variation? What is Cyclical variation?
9. State the additive and multiplicative models of Time series. How the additive model and the multiplicative model differ from each other?
10. Discuss the causes of variations in a production process?
11. Give the difference between the charts for variables and charts for attributes.
12. What is defective item and a defect in an item?

Q.3.(a) Prove that $-1 \leq r \leq +1$. Interpret the nature of r . [04]

(b) The following table gives the results of measurements of train resistances; X is the velocity in miles per hour Y is the resistance in pounds per ton. Using method of least squares, fit a second degree parabola $Y = a + bX + cX^2$ to the data given below: [06]

X	20	40	60	80	100	120
Y	5.5	9.1	14.9	22.8	33.3	46

OR

Q.3.(a) Explain how you will fit a straight line by the method of Least Square. [05]

(b) The following are the marks obtained by a group of students in two subjects. Calculate [05]

correlation coefficient.

Economic	78	36	98	25	75	82	92	62	65	36
Statistics	84	51	91	69	68	62	86	68	35	49

- Q.4.(a) Obtain the angle between two regression lines. Interpret for $r = 0$ and $r = \pm 1$. [04]
 (b) Derive the regression line y on x . [06]

OR

- Q.4.(a) An experiment was conducted to determine the mass (Y grams) of a given amount of chemical that dissolved in glycerin at ($X^{\circ}\text{C}$). the results of the experiment are given below: [06]

Temperature($X^{\circ}\text{C}$)	0	10	20	30	40	50
Mass(Y grams)	51.3	51.4	51.9	52.0	52.6	52.8

- (i) Identify an independent and dependent variable. (ii) Obtain the regressions equation of the mass of chemical that dissolve in glycerin at given temperature. [04]
 (iii) Predict the mass of chemical that dissolved in glycerin at 25°C .
 (b) State the properties of regression coefficients. Prove any one of them. [06]
 Q.5.(a) Fit the trend line to the following data by the method of least squares. [05]

Year	2001	2002	2003	2004	2005	2006	2007
Value	83	60	54	21	22	13	23

- (b) The following series of observation is known to have a business cycle with a period of 4 years & 3 years. Find the trend values by the moving average method. [05]

Year	2001	2002	2003	2004	2005
Production('000tons)	506	620	1036	673	588
Year	2006	2007	2008	2009	2010
Production('000 tons)	696	1116	738	663	773

OR

- Q.5.(a) Name the methods for eliminating Trend line from Time series data. Explain any one of them. [05]
 (b) Write the steps for eliminating Seasonal variation from Time series data by Ratio to Trend method.
 Q.6. Coca Cola Company wants to use SPC to monitor its bottle filling process. Every 30 minutes, they took a random sample of four bottles from the production line and carefully measured the amount of cola in each bottle. The results are reported in the table below. [10]

Sample	Amount (Volume) of cola (in ml)			
	1	2	3	4
1	351.2	350.9	350.6	350.7
2	350.3	351.0	351.1	350.8
3	351.4	350.9	351.3	351.2
4	350.8	350.5	351.1	350.1

- (i) Is the volume of cola in a bottle a variable or an attribute?
 (ii) What kind of control chart should be used to monitor the average volume of soda in each bottle? Determine the 3σ control limits for this chart.
 (iii) Plot the average bottle volume for each sample on the appropriate chart. Is the

process in- control with respect to the average volume? What action should be taken?
 (iv) What kind of control chart should be used to monitor the spread or dispersion of values? Determine the 3σ control limits for this chart.
 (v) Plot the volume range for each sample on the appropriate chart. Is the process in control with respect to the volume range? What action should be taken?

OR

Q.6. Explain the construction for p- chart & c - chart. [10]

A company manufactures valves for industrial use. Ten samples of 15 valves each were taken from the production line and tested. The results are reported below:

Sample no.	1	2	3	4	5	6	7	8	9	10
No. of defectives	3	1	0	0	0	2	0	3	1	0

(i) Compute the fraction defective for each sample. (ii) Construct an appropriate chart using 3σ limits. (iii) Is the process in control?
