[A-19] SEAT No._____ No. of Printed Pages : 3

Sardar Patel University

B.Sc. Semester – IV Examination (NC 2010 Batch)

Time: 10.00 to 1.00 P.M Thursday, 12th April, 2018 Maximum Marks: 70

Course code: US04CSTA01

(Statistical Techniques)

Note: (i) Graph paper will be provided on request (ii) Q.3 to Q.8 each sub question has 4 marks.

Q.1 Multiple Choice Questions (10×1)

(1) With reference to SQC, the probability that any point lie on either side of central line is

(a) $\frac{1}{2}$ (b) $\frac{1}{2^7}$ (c) $\frac{1}{2^6}$ (d) none

(2) Which of the following is not a method of studying trend?

(a) Least square (b) Simple average (c) Free hand curve (d) Semi average

(3) The points falling outside the control limits shows presence of_____causes of variations

(a) Assignable (b) Chance (c) Random (d) None of these

(4) Two regression equations are $Y = -3.75 + 1.25X$ and $X = -1.47 + 0.36Y$, the coefficient of correlation between X and Y be

(a) 1.25 (b) 0.36 (c) 0.45 (d) 0.6708

(5) The ranks given by two different judges to five participants in a debate contest are:

R1	1	2	3	4	5
R2	5	4	3	2	1

The rank correlation coefficient between them is

(a) 0 (b) 1 (c) -1 (d) Can't possible

(6) 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 Two Values (d) Middle Value

(7) If all the points in a scatter diagram lie on the least squares regression line, then the coefficient of correlation must be

(a) 1 (b) -1 (c) 0 (d) either -1 or 1

(8) The following table contains the number of complaints received in a Government department for the first 6 months of a year.

Month	Jan	Feb	Mar	Apr	May	Jun
No. of complaints	36	45	81	90	108	144

If a 3 – month moving average is used to calculate trend, what would be the trend value for the month of March?

(a) 36 (b) 40.5 (c) 54 (d) 72

(9) If $\bar{C} = 2.25$, the lower control limit of $C - chart$ is

(a) 0 (b) 3.75 (c) -2.25 (d) 2.25

(10) Twenty samples of size 5 are taken from a production process. The mean of all sample means is 42.5 and the mean range of the samples is 1.5. What is the UCL for the $\bar{X}$ – chart?

(a) 3.17 (b) 1.5 (c) 0 (d) 43.37

Q.2 Short Type Questions (Attempt Any Six) (6×2)

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

(b) What is the tangent of the angle between two regression lines? When will two regression lines perpendicular to each other?

(c) How will you calculate rank correlation coefficient? If ranks are repeated how will you modify it?

(d) What are the chief sources of assignable causes of variations?

(e) Why do we analyze Time Series?

(f) List out the uses of SQC.

(g) If one or more points fall below LCL in construction of $p -$ chart, what would you conclude from that?

(h) Write down the normal equations for estimating unknown constants in the equation $Y = a + bX + cX^2$.

Q.3(a) Obtain normal equations to fit an equation of line $Y = a + bX$.

(b) Fit an equation $Y = ab^X$ to the data given below:

(P.T.O.)

X	1.0	1.5	2.0	2.5	3.0	3.5	4.0
Y	1.1	1.3	1.6	2.0	2.7	3.4	4.1

Estimate Y when $X = 4.5$

OR

3(a) Using least squares method obtain normal equations for estimating unknown constants in the equation $Y = a + bX + cX^2$.

b) The following table shows literacy rate of India from 1921 to 1961.

Census year (X)	1921	1931	1941	1951	1961
Literacy Rate (Y)	11.4	12.1	13.9	17.3	18.0

Fit an equation of straight line to the data given using least squares method and estimate the literacy rate for the census year 1971 and 1981. Also obtain average annual increase in the literacy rate.

.4(a) In usual notation, Prove that $-1 \leq \rho \leq 1$. Interpret the cases when $\rho = -1, 1$

(b) If X and Y are two independent variables with variances 36 and 16 respectively. Calculate the coefficient of correlation between U and V where $U = X + 2Y$ and $V = X - 2Y$.

OR

.4(a) Write down the properties of correlation coefficient. Prove any one of them.

(b) If X and Y are two independent variables with variances 36 and 16 respectively. Calculate the coefficient of correlation between U and V where $U = X + Y$ and $V = X - Y$.

.5(a) What is regression? Derive the regression equation which could be used to predict X for the given values of Y.

(b) The success of a shopping center can be represented as a function of the distance (in kms) from the center of the population and the number of clients (in hundreds of people) who will visit. The data given in the table below:

Distance	15	19	25	23	34	40
No. of customers	8	7	6	4	2	1

(i) Is there any relationship between these two variables? Justify your answer by calculating most suitable statistical measure and comment on it. (ii) List out the other variables that may affects the value of dependent variable (iii) To receive 1000 customers, at what distance from the center of the population should the shopping center be located?

OR

2.5(a) Do as directed:

(i) Prove that if one of the regression coefficient is greater than one than the other one must be less than one.

(ii) The tangent of an angle between two regression line is given to be 0.6 and $S_Y = 2S_X$ then find the correlation coefficient between X and Y.

(b) The following table consists of one student athlete's time (in minutes) to swim 2000 yards and the student's heart rate (beats per minute) after swimming on a random sample of 10 days.

Swim time	34.12	35.72	34.72	34.05	34.13	35.73	36.17	35.57	35.37	35.57
Heart rate	144	152	124	140	152	146	128	136	144	148

(i) Identify an independent and dependent variable (ii) Does there appear to be any evidence of linear relationship between these two variables? Justify your answer by calculating most suitable statistical measure. (iii) Estimate the heart rate of a student if his swim time is 35.42 minutes.

Q.6(a) Which components of a time-series would you mainly associate each of the following? Why?

(i) A strike in a factory delaying production of a car in a Manesar plant of Maruti Udyog.

(ii) Price hike in Gold

(iii) Fall in death rate due to advances in Science

(iv) The sale of air conditioners increases during summer.

(b) From the following data, find the trend values by the method of semi - averages. Also, estimate the Facebook users for 2019. Also find average monthly increase in the users.

Number of Facebook users in India from 2011 to 2018 (In Millions)

Year	2011	2012	2013	2014	2015	2016	2017	2018
Facebook Users	135.6	165.57	194.11	219.94	242.53	261.83	277.95	291.5

OR

Q.6(a) What is time series? State its importance. Why do we analyze time series?

(b) Population of India (1911 - 1971) as follows:

Year (t)	1911	1921	1931	1941	1951	1961	1971
Population (in crores)	25.0	25.1	27.9	31.9	36.1	43.9	54.7

Fit a straight line trend to the above data by the method of least squares and find the trend values. Estimate the population for 2021.

Q.7 The following table represents the no. of books issued in a college library on 5 working days for a period of 4 weeks. Calculate the daily trend values using least square method.

Week	No. of books issued				
	Mon	Tue	Wed	Thu	Fri
1	25	43	44	46	51
2	18	34	52	49	53
3	12	25	48	51	62
4	19	22	49	61	71

OR

Q.7 Calculate the quarterly seasonal indices using ratio to moving average method.

Quarter	Sale of Cars (In 000 units)				
	2013	2014	2015	2016	2017
I	45	48	49	52	60
II	54	56	63	65	70
III	72	63	70	75	83
IV	60	56	65	72	86

Q.8(a) Differentiate between (i) p and np chart (ii) Variable and Attribute chart.

(b) From a pharmaceutical company samples of 250 bottles were taken daily for 15 days. The number of defective seals in these bottles is given below. Obtain control limits for fraction defectives and comment on it.

Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
No. of defective seals	28	18	40	42	32	62	50	10	30	22	80	62	76	56	30

OR

Q.8(a) State the various causes of variations in the production process. Write in brief about them.

(b) A company manufactures valves for industrial use. Ten samples of 150 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	32	18	07	16	09	29	32	13	18	07

(i) Construct control chart for no. of defectives using 3σ limits. (ii) Is the process in control?