LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

M.Sc. DEGREE EXAMINATION – **STATISTICS**

THIRD SEMESTER – **APRIL 2016**

ST 3817 - STATISTICAL QUALITY CONTROL

Date: 28-04-2016 Dept. No. Max. : 100 Marks

Time: 09:00-12:00

PART A

Answer ALL the questions: (10 X 2 = 20)

1) Define assignable causes of variation?
2) When do you prefer S chart to R chart?
3) Define β risk.
4) Explain process capability.
5) State any two advantages of multivariate control chart.
6) Mention any two uses of an OC curve for control charts.
7) Define sequential sampling plan.
8) How lots have to be chosen in acceptance sampling?
9) What is an average run length?
10) Define specification limits.

PART B

Answer any FIVE questions: (5 X 8 = 40)

11) Explain the OC function and average run length calculation of the control chart for non- conformities.
12) Explain cyclic pattern, mixture, shift in process level, trend and stratification.
13) The following table gives the number of non-conformities observes in 16 successive samples of 100 printed circuit boards. Set up an appropriate control chart to find statistical control.

Sample no.	1	2	3	4	5	6	7	8
Number of non-conformitites	16	18	12	15	24	21	28	20
Sample no.	9	10	11	12	13	14	15	16
Number of non-conformitites	25	19	18	21	16	22	22	19

14) Describe the concept of geometric moving average control chart.
15) Explain confidence internals and tests on Process Capability ratios.
16) A process is in statistical control with $\bar{\bar{X}} = 41.5$ and $\bar{R} = 2.5$, n = 3 specifications are 40 ±5. The quality characteristic is normally distributed.
    (a) Estimate the potential capability (b) estimate the actual capability and obtain C_{pm}.
17) Explain SIPOC diagram and its uses
18) Explain the double sampling plan and obtain the expression for AOQ and ATI.

PART C

Answer any TWO questions: **(2 X 20 = 40)**

19) (a) Obtain the control limits for $\bar{X}$ and R charts. **(6)**

(b) For the data in the following table were collected from a process manufacturing power supplies. The variable of interest is output voltage and n = 5.

Sample number	1	2	3	4	5	6	7	8	9	10
$\bar{x}$ number	103	102	104	105	104	106	102	105	106	104
R	4	5	2	11	4	3	7	2	4	3
Sample number	11	12	13	14	15	16	17	18	19	20
$\bar{x}$ number	105	103	102	105	104	105	106	102	105	103
R	4	2	3	4	5	3	5	2	4	2

I. Compute the control limits for the future production.

II. Assume that the quality characteristic is normally distributed. Estimate the process standard deviation.

III. What are the 3-σ natural tolerance limits of the process?

IV. What would be your estimate of the process fraction nonconforming if the specifications on the characteristics were 105 ± 2? **(5 + 2 + 2+ 5)**

20) (a) Explain the method of tabular CUSUM for monitoring the process mean. **(8)**

(b) Prepare a tabular CUSUM for the following data with μ = 120, K = 3, H = 10
X_i values are 122, 110, 115, 110, 128. **(6)**

(c) Repeat the calculations with a headstart of H/2 = 4. What is your conclusion now?

21) (a) Write down the procedure of Hotelling T^2 control chart.

(b) Set up a moving average control chart for the following data using w = 3 with target mean value as 12.02 and standard deviation of 0.05.

Observation i	1	2	3	4	5	6	7	8	9
x_i	12	12.05	12.5	12.06	12.08	11.95	11.85	12	11.96
Observation i	10	11	12	13	14	15	16	17	18
x_i	12.08	13	12.92	11.88	12.03	12.05	12.07	12.45	13

22) (a) Explain the DMAIC procedure in detail.

(b) How DMAIC problem solving process can be used to improve service quality in railway ticket booking process?

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