LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

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

THIRD SEMESTER – NOVEMBER 2015

ST 3817 - STATISTICAL QUALITY CONTROL

Date : 07/11/2015 Dept. No. Max. : 100 Marks

Time : 09:00-12:00

PART A

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

1. What are chance and assignable causes of variation?
2. How will you interpret a control chart?
3. When do you prefer S chart to R chart?
4. Write the need for CUSUM chart.
5. Explain process capability.
6. State any two advantages of multivariate control chart.
7. Mention any two uses of an OC curve for control charts.
8. What are the uses of acceptance sampling?
9. What is an average run length?
10. Define natural tolerance limits.

PART B

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

11. Explain the OC function and average run length calculation of the fraction non-conforming control chart.
12. What are the various patterns in the control chart?
13. The following table gives the number of non-conformities observed 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	21	24	16	12	15	5	28	20
Sample no.	9	10	11	12	13	14	15	16
Number of non-conformitites	31	25	20	24	16	19	10	16

14. Describe the concept of geometric moving average control chart.
15. A process is in statistical control with $\overline{\overline{X}}$ = 41.5, $\overline{R}$ = 2.5 and n = 3. Specifications are 40 ±5. The quality characteristic is normally distributed.
    a. Estimate the potential capability (b) estimate the actual capability and obtain CPM.
16. Explain the acceptance sampling problem with its advantages and disadvantages.
17. Explain the double sampling plan and obtain the expression for AOQ and ATI.
18. Obtain the acceptance and rejection lines of a sequential sampling plan for attributes. How are the OC and ASN values obtained for this plan?

PART C

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

19. a. Obtain the control limits for $\overline{X}$ and R charts. **(5)**

b. 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
$\overline{X}$	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
$\overline{X}$	105	103	102	105	104	105	106	102	105	103
R	4	2	3	4	5	3	5	2	4	2

(a) Compute the control limits for the future production.

(b) Assume that the quality characteristic is normally distributed. Estimate the process standard deviation.

(c) What are the 3-σ natural tolerance limits of the process?

(d) What would be your estimate of the process fraction nonconforming if the specifications on the characteristics were 103 ± 4? **(6 + 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 = 100, K = 2, H = 10 X_i values are 107, 102, 108, 96, 110, 112. **(6)**

(c) Repeat the calculations with a headstart of H/2 = 5. What is your conclusion now? **(6)**

21. (a) Set up an EWMA control chart for the process mean with the target value μ_0 = 15, σ = 1, λ= 0.2 and L = 3 to the data given below and interpret the result.

Subgroup i	1	2	3	4	5	6	7	8	9	10	11	12
x_i	13	14	11	12	15	13	14	14	18	17	15	16

(10)

(b) Draw the OC curve for a single sampling plan n = 100 and c = 2. Also obtain the expressions for AOQ and ATI after rectification**.** **(10)**

22. Explain the DMAIC procedure in detail.

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