LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

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

THIRD SEMESTER – **NOVEMBER 2018**

16/17UPST3MC03 / ST 3817– STATISTICAL QUALITY CONTROL

Date: 29-10-2018 Dept. No. Max. : 100 Marks

Time: 09:00-12:00

Part-A

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

1. Define CTQ with illustrations.
2. Distinguish between specification limits and control limits.
3. State the reasons for popularity of control charts.
4. What is the disadvantage of using warning limits?
5. When do you prefer np chart?
6. Write the major uses of data from a Process capability analysis.
7. What is reference value in tabular CUSUM?
8. Define multivariate quality control.
9. What situations acceptance sampling most likely to be useful?
10. Define type A and type B OC curve.

Part-B

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

11. Briefly explain the eight components of Quality
12. What are chance and assignable causes of variability? What part do they play in the operation and interpretation of a Shewhart control chart?
13. Discuss the advantages of using control charts. How do you choose rational subgroups?
14. A fraction nonconforming control chart with $n = 400$ has the following parameters $UCL = 0.0809, CL = 0.0500$ and $LCL = 0.0191$

    a) Find the width of the control limits in standard deviation units.

    b) What would be the corresponding parameters for an equivalent control chart based on number nonconforming?

c) What is the probability that a shift in the process fraction nonconforming to 0.03 will be detected on the first sample following the shift?

15. Describe process capability ratios with illustrations.
16. Elucidate double sampling plan and obtain the expression for average outgoing quality and average total inspection.
17. Write a short notes on HotellingT^2control chart
18. Write a detailed note on six sigma quality.

Part-C

Answer any TWO questions: **(2 x20 = 40)**

19. a) Suppose samples of size $n = 5$ are taken from the manufacturing process every hour. A quality characteristic is measured, $\bar{x}$ and R charts are computed for each sample. After 25 samples have been analyzed, we have

$$\sum_{i=1}^{25} \bar{x}_i = 662.50 \text{and} \sum_{i=1}^{25} R_i = 9$$

The quality characteristic is normally distributed.

i) Find the control limits for $\bar{x}$ and R charts.

ii) Assume that both chart exhibit control. If specifications are 26.40 ± 0.50. Estimate the fraction nonconforming.

iii) If the process mean were26.40, what fraction nonconforming would result?

b) A control chart for the fraction nonconforming is to be established using a center line of $p = 0.10$.What is the sample size is required if we wish to detect a shift in the process fraction nonconforming to 0.20 with probability $p = 0.50$? **(15 + 5)**

20. a) Explain the tabular CUSUM for monitoring the process mean.

b) Set up an EWMA control chart for the process mean with the target value $\mu_0 = 13$, $\sigma = 1$, $\lambda = 0.10$ and $L = 2.8$ to the data given below and interpret the result.

I	1	2	3	4	5	6	7
x_i	12.15	13.21	12.98	13.00	13.05	12.80	13.02

(5 + 15)

21. Explain the Steps of the DMAIC process.
22. Describe Continuous sampling plans with illustrations and also write few situations where these plans are applied.

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