

INDIAN STATISTICAL INSTITUTE

MS in QMS

SUPPLEMENTARY TEST ON STATISTICAL PROCESS CONTROL

Date: 25 November 2019

Time: 2 hours Maximum Marks: 50

Answer as many questions as you can. The maximum you can score is 50

1. Check whether the following statements are true or false. Justify your answers in not more than 3 sentences.
 - a. The estimation of standard deviation using the histogram method and \bar{x} - R method will always yield exactly the same value if computed from the same sample data
 - b. For monitoring attribute characteristic, control charts need to be constructed for both measure of central tendency and measure of variation
 - c. The $I-MR$ control chart can be used to ensure that the process remains in control and capable
 - d. The data is collected in a subgroup of size $n = 4$ from a manufacturing process and computed \bar{x} and R control charts. If the central lines of \bar{x} and R control charts are 10 and 4.12 respectively, then the lower control limit of \bar{x} chart will be 5

[8]

2. Briefly explain the chance and assignable causes of variation

[5]

3. Give step by step details of carrying out process capability analysis using normal probability plot method

[7]

4. Samples of $n = 10$ items are taken from a chemical process at regular intervals. A normally distributed quality characteristic is measured and \bar{x} & s values are calculated for each sample. After 30 subgroups have been analyzed, we have

$$\sum_{i=1}^{30} \bar{x}_i = 450 \quad \text{and} \quad \sum_{i=1}^{30} s_i = 121$$

- a. Compute the control limit for the \bar{x} and s control charts.
- b. Assume that all points on both charts plot within the control limits. Estimate the process mean and standard deviation?
- c. If the specification limits are 15 ± 4.0 , compute the process capability indices C_p & C_{pk} ? What are your conclusions regarding the ability of the process to produce items conforming to specification?
- d. Assuming that if an item exceeds the upper specification limit it can be reworked, and if it is below the lower specification limit it must be scrapped, what percent scrap and rework is the process now producing?
- e. If the process were centered at $\mu = 15.0$, what would be the effect on percent scrap and rework?

[18]

5. The number of insurance claims reworked daily out of 120 claims checked is given in the table below. From the analysis of these data, would you conclude that the insurance claim processing process is in statistical control? What control procedure would you recommend for future production?

Sample	Number reworked	Sample	Number reworked
1	23	13	55
2	48	14	39
3	22	15	28
4	34	16	33
5	23	17	19
6	32	18	49
7	28	19	36
8	31	20	26
9	34	21	22
10	30	22	40
11	35	23	35
12	36	24	36

[12]