

INDIAN STATISTICAL INSTITUTE

MS in QMS

TEST ON STATISTICAL PROCESS CONTROL

Date: 10 September 2024 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. Provide brief justification for your answers
 - a. The characteristic doesn't need to be normally distributed to monitor it using an I-MR chart.
 - b. In the normal probability plot method, the process standard deviation can be estimated as $(95^{\text{th}} \text{ percentile} - 50^{\text{th}} \text{ percentile})/2$
 - c. When monitoring attribute characteristics to ensure process stability, separate control charts for central tendency and dispersion measures are unnecessary.
 - d. The daily number of defects detected in the final inspection and testing of a product is monitored using a u chart with a central line of 0.5. Suppose in a day, 18 defects are detected out of 120 products tested; then that day the process is out of control.
 - e. Suppose the C_{pu} of a process is 0.98, then the % of rejection above USL is 0.164

[10]

2. Briefly explain the following:
 - a. Homogenization
 - b. Phase I and Phase II of the control chart application

[10]

3. The weights of nominal 1-kg containers of a concentrated chemical ingredient are shown in the Table below:

0.9475	0.9775	0.9965	1.0075	1.018
0.9705	0.986	0.9975	1.01	1.02
0.977	0.996	1.005	1.0175	1.025

- a. Check whether the weight is normally distributed using normal probability plot method?
- b. Estimate the process mean and standard deviation?

- c. Suppose the specification on weight is 0.98 ± 0.05 , perform process capability analysis and comment on the capability of the process.
- d. If any product is out of specification, it can be reworked, estimate the total % of rework.

[16]

4. The commercial loan operation of a financial institution has a standard for processing new loan applications in 24 hours. The table below shows the number of applications processed each day for the last 20 days and the number of applications that required more than 24 hours to complete. Set up the fraction nonconforming control chart for this process. Plot the preliminary data in the Table given below on the chart. Is the process in statistical control? Give your comments.

Day	Number of Applications	Number Late	Day	Number of Applications	Number Late
1	200	3	11	219	0
2	250	4	12	238	8
3	240	2	13	250	4
4	300	5	14	302	6
5	200	2	15	219	8
6	250	4	16	246	3
7	246	3	17	251	6
8	258	5	18	273	7
9	275	2	19	245	3
10	274	1	20	260	1

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