

Indian Statistical Institute, Bangalore
MS (QMS) First Year
First Semester - Statistical Process Control I

Final Exam
Maximum marks: 50

Date: March 11, 2021
Duration: 2 hours

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

1. Answer whether the following are True or False. Justify your answer in two or three sentences:
 - a. The process capability index C_{pl} of a turning process is 0.93 and the total % of rejection is 4.2%. Then the C_{pu} of the process will be 0.9785.
 - b. Suppose two plotted points in a pre-control chart fall outside the pre-control limits, then the process needs resetting.
 - c. Suppose the normal probability plot indicates that the spring thickness is normally distributed. Then the standard deviation of the spring thickness will approximately equal to $0.5 \times (97.5^{\text{th}} \text{ percentile} - 50^{\text{th}} \text{ percentile})$ computed using the normal probability plot method
 - d. A double sampling plan designed for the incoming inspection of clamping accessories purchased by a furniture manufacturing firm as $N = 7500$, $n_1 = 50$, $n_2 = 50$, $c_1 = 0$ and $c_2 = 2$. If the fraction defective $p = 0.06$, then the corresponding ASN will be 74.
 - e. A company wish to find a single sampling plan for a situation where lots of size $N = 5500$ are shipped from a supplier. The supplier's process operates at a fallout level of 0.80% defective. The company want the AOQL from inspection activity to be 2.5%. The sample size of the Dodge - Romig sampling plan satisfying the aforementioned requirements is 33?

[10]

2. The case depth of 12 induction hardened piston rods are given in the table below.

2.48	2.56	2.53	2.49	2.43	2.52
2.55	2.52	2.45	2.56	2.46	2.53

- a. Check whether the case depth is normally distributed using the normal probability plot method.
- b. Estimate the process mean and standard deviation.
- c. Suppose the specification on case depth is 2.5 ± 0.2 mm, compute the process capability indices and comment on the capability of the process.

- d. Assuming that a piston rod with case depth below the lower specification limit can be reworked and those with case depth above upper specification limit to be scrapped, estimate the % of rework and scrap?

[15]

3. The data given below are temperature readings in °C from a chemical process taken every two minutes. The target value is 950.

Sample Number	Temperature	Sample Number	Temperature
1	953	11	966
2	945	12	966
3	962	13	937
4	945	14	946
5	955	15	954
6	963	16	935
7	955	17	959
8	950	18	939
9	949	19	948
10	941	20	958

- a. Estimate the process mean and standard deviation
 b. Set up and draw an *EWMA* control chart using $\lambda = 0.1$

[15]

4. Suppose a product is shipped in lots of size $N = 8500$. The receiving inspection procedure used is a single sampling plan with $n = 50$ and $c = 2$.

- a. Construct the *OC* curve for the plan?
 b. Compute *AQL* and *LTPD* for a producer's risk of $\alpha = 0.05$ and consumer's risk of $\beta = 0.12$?

[15]