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

Midterm Exam   Date: February 28, 2019
Maximum marks: 50   Duration: 3 hours

1.

a) State the conditions under which DNOM approach of control chart will work for short production run.

b) Define the control chart procedure when process standard derivations are different for different parts in short production run.

c) The front cover of A/C is injection moulded for different models are 100% impacted for defects. The batch size of each part in relatively small and suggest a suitable SPC method to analyze the data.

Part No.	No. of Defects	Part No.	No. of Defects
1121	17	6081	24
1121	15	6081	25
1121	22	6081	19
1121	19	6081	20
1121	13	5073	18
1232	10	5073	19
1232	05	5073	22
1232	07	5073	13
1232	11	5073	08
1232	08	5073	14

Is this process under statistical control?   [2 + 3 + 5 = 10]

2. Suggest the modified limit of $\bar{X}$ chart as well as pre-control chart when $c_p = c_{pk} = 1.25$ for a normally distributed product characteristic?   [6]

3. Write short notes on any three   [5 x 3 = 15]

a) SPC implementation steps

b) Process control v/s Process adjustment

c) Group control chart method

d) Limitation of T^2 control chart

4.

a) State three drawbacks of group control chart.

b) Calculate the one-sided Average Run Length when the process is under control for no. of stream(s) is 4 and 7.   [3 + 4 = 7]

5. Calculate suitable process capability Index for the specification $20 \pm {}^{0.5}_{0.3}$ with estimate of $\bar{x} = 9.97$ and $s = 0.103$.   [4]

6.

a) Contract the phase II limit of a T^2 control chart for $p = 10$ characteristics. Suppose that a preliminary samples ($m = 20$, $n = 10$) were used to estimate the mean vector and covariance matrix ($\alpha = 0.005$).

b) For a bivariate normally distributed process the mean values and the covariance matrix was estimated as follows

$$\bar{x} = \begin{bmatrix} 20 \\ 32 \end{bmatrix} \quad \bar{s} = \begin{bmatrix} 75 & 50 \\ 50 & 60 \end{bmatrix}$$

The following are the values of sample average based on $n = 20$.

$\overline{x_1}$	$\overline{x_2}$
18	31
21	30

Check whether the process under control.   [4 + 6 = 10]