T-IV

JAIPURIA INSTITUTE OF MANAGEMENT
LUCKNOW NOIDA JAIPUR INDORE

JAIPURIA INSTITUTE OF MANAGEMENT, NOIDA
PGDM / PGDM (M) / PGDM (SM)
FOURTH TRIMESTER (Batch 2019-21)
END TERM EXAMINATIONS, OCT-2020

SET-I

Course Name	**Quality Management**	Course Code	**OM403**
Max. Time	**2 hours**	Max. Marks	**40 MM**

INSTRUCTIONS:

- **Attempt all questions.**
- **Students can use MS Excel.**
- **Answers should be rich in content, pointwise and precise**
- **Control charts are not required to be plotted**

<table>
<tr><th>Q. No.</th><th>Question</th><th>Marks</th></tr>
<tr><td>1.</td><td>Discuss in detail various quality related costs. A quality improvement program has been instituted in an organization to reduce total quality costs. Discuss the impact of such a program on prevention, appraisal, and failure costs.</td><td>8</td></tr>
<tr><td>2.</td><td>a) Discuss the 80-20 rule in terms of quality management.
b) In a printing company, data from the previous month show the following types of error, with the unit cost (in dollars) of rectifying each error. Management is focused on reducing the unit costs. Construct a Pareto chart and discuss results. Also comment if management has a fixed monthly allocation of $18000, which areas they should tackle.

<table><tr><th>Error Categories</th><th>Frequency</th><th>Unit Cost ($)</th></tr><tr><td>Typographical</td><td>4000</td><td>0.20</td></tr><tr><td>Proofreading</td><td>3500</td><td>0.50</td></tr><tr><td>Paper tension</td><td>80</td><td>50.00</td></tr><tr><td>Paper misalignment</td><td>100</td><td>30.00</td></tr><tr><td>Inadequate binding</td><td>120</td><td>100.00</td></tr></table></td><td>3+4</td></tr>
<tr><td>3</td><td>A soft drink bottling company is interested in controlling its filling operation. Random samples are selected and the fill weight is recorded. Table shows the data for various samples. The specifications on fill weight are 350 ± 5 grams (g). Daily production rate is 20,000 bottles.
(a) Find the trial control limits for the $\bar{X}$ and R charts.
(b) Assuming special causes for out-of-control points, find the revised control limits after eliminating out of control points.
(c) Considering the given specification limit of 350 ± 5 grams and assuming the distribution of fill weights to be normal, how many bottles are nonconforming daily?</td><td>3+4+4+4</td></tr>
</table>

(d) If the cost of rectifying an under filled bottle is $0.08 and the lost revenue of an overfilled bottle is $0.03, what is monthly revenue lost on average?

Sample	Observations (g)				Sample	Observations (g)			
1	352	348	350	351	13	352	350	351	348
2	351	352	351	350	14	356	351	349	352
3	351	346	342	350	15	353	348	351	350
4	349	353	352	352	16	353	354	350	352
5	351	350	351	351	17	351	348	347	348
6	353	351	346	346	18	353	352	346	352
7	348	344	350	347	19	346	348	347	349
8	350	349	351	346	20	351	348	347	346
9	344	345	346	349	21	348	352	351	352
10	349	350	352	352	22	356	351	350	350
11	353	352	354	356	23	352	348	347	349
12	348	353	346	351	24	348	353	351	352

4 The number of customers who are not satisfied with the service provided in a retail store is found for 20 samples of size 100 and is shown in Table. **5+5**

(a) Find the control limits for the control chart of the proportion of dissatisfied customers.

Sample	Number of Dissatisfied Customers	Sample	Number of Dissatisfied Customers
1	2	11	5
2	5	12	4
3	4	13	2
4	3	14	5
5	4	15	3
6	2	16	12
7	3	17	3
8	2	18	2
9	4	19	5
10	11	20	2

(b) Revise the control limits, assuming special causes for points outside the control limits.

Management believes that the average dissatisfaction rate is 3%, so establish control limits based on this value and comment on the ability of the store to meet this standard as per revised limits.

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*Formula and Table to be provided along with question paper

Process S.D. for Range charts = $\frac{\bar{R}}{d_2}$

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Tables of Constants for Control charts

Table 8A - Variable Data — ref : AIAG manual for SPC

	X bar and R Charts				X bar and s charts			
	Chart for Averages	Chart for Ranges (R)			Chart for Averages	Chart for Standard Deviation (s)		
Subgroup size (n)	Control Limits Factor A_2	Divisors to Estimate σ_x d_2	Factors for Control Limits D_3	D_4	Control Limits Factor A_3	Divisors to estimate σ_x c_4	Factors for Control Limits B_3	B_4
2	1.880	1.128	-	3.267	2.659	0.7979	-	3.267
3	1.023	1.693	-	2.574	1.954	0.8862	-	2.568
4	0.729	2.059	-	2.282	1.628	0.9213	-	2.266
5	0.577	2.326	-	2.114	1.427	0.9400	-	2.089
6	0.483	2.534	-	2.004	1.287	0.9515	0.030	1.970
7	0.419	2.704	0.076	1.924	1.182	0.9594	0.118	1.882
8	0.373	2.847	0.136	1.864	1.099	0.9650	0.185	1.815
9	0.337	2.970	0.184	1.816	1.032	0.9693	0.239	1.761
10	0.308	3.078	0.223	1.777	0.975	0.9727	0.284	1.716
15	0.223	3.472	0.347	1.653	0.789	0.9823	0.428	1.572
25	0.153	3.931	0.459	1.541	0.606	0.9896	0.565	1.435

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<table>
<tr><th>Q. No.</th><th>Question</th><th>Marks</th></tr>
<tr><td>1.</td><td>Discuss in detail Juran's Trilogy. What are the reasons for mass inspection not being a feasible alternative for quality improvement?</td><td>7</td></tr>
<tr><td>2.</td><td>The net weight (in oz) of a dry bleach product is to be monitored by $\bar{X}$ and R control charts using a sample size of n = 5. Data for 20 preliminary samples are as follows:
<table>
<tr><th>Sample Number</th><th>X1</th><th>X2</th><th>X3</th><th>X4</th><th>X5</th><th>Sample Number</th><th>X1</th><th>X2</th><th>X3</th><th>X4</th><th>X5</th></tr>
<tr><td>1</td><td>15.8</td><td>16.3</td><td>16.2</td><td>16.1</td><td>16.6</td><td>11</td><td>16.2</td><td>16.4</td><td>15.9</td><td>16.3</td><td>16.4</td></tr>
<tr><td>2</td><td>16.3</td><td>15.9</td><td>15.9</td><td>16.2</td><td>16.4</td><td>12</td><td>15.9</td><td>16.6</td><td>16.7</td><td>16.2</td><td>16.5</td></tr>
<tr><td>3</td><td>16.1</td><td>16.2</td><td>16.5</td><td>16.4</td><td>16.3</td><td>13</td><td>16.4</td><td>16.1</td><td>16.6</td><td>16.4</td><td>16.1</td></tr>
<tr><td>4</td><td>16.3</td><td>16.2</td><td>15.9</td><td>16.4</td><td>16.2</td><td>14</td><td>16.5</td><td>16.3</td><td>16.2</td><td>16.3</td><td>16.4</td></tr>
<tr><td>5</td><td>16.1</td><td>16.1</td><td>16.4</td><td>16.5</td><td>16.0</td><td>15</td><td>16.4</td><td>16.1</td><td>16.3</td><td>16.2</td><td>16.2</td></tr>
<tr><td>6</td><td>16.1</td><td>15.8</td><td>16.7</td><td>16.6</td><td>16.4</td><td>16</td><td>16.0</td><td>16.2</td><td>16.3</td><td>16.3</td><td>16.2</td></tr>
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<tr><td>8</td><td>16.2</td><td>16.1</td><td>16.2</td><td>16.1</td><td>16.3</td><td>18</td><td>16.0</td><td>16.2</td><td>16.4</td><td>16.5</td><td>16.1</td></tr>
<tr><td>9</td><td>16.3</td><td>16.2</td><td>16.4</td><td>16.3</td><td>16.5</td><td>19</td><td>16.4</td><td>16.0</td><td>16.3</td><td>16.4</td><td>16.4</td></tr>
<tr><td>10</td><td>16.6</td><td>16.3</td><td>16.4</td><td>16.1</td><td>16.5</td><td>20</td><td>16.4</td><td>16.4</td><td>16.5</td><td>16.0</td><td>15.8</td></tr>
</table>
a) Does the process exhibit statistical control? Justify your answer.
b) Estimate the process mean and standard deviation.
c) If the specifications are at 16.2 ± 0.5, what conclusions would you draw about process capability? Justify your answer.
d) What fraction of containers produced by this process is likely to be below the lower specification limit of 15.7 oz?</td><td>15</td></tr>
<tr><td>3.</td><td>a) Explain the difference in interpretation between an observation falling below the lower control limit on an $\bar{X}$ chart and one falling below the lower control limit on an R chart. Discuss the impact of</td><td>8</td></tr>
</table>

	each on the revision of control charts in the context of response time to fire alarms. b) Suppose someone has gone for Covid 19 testing. What will be Type I and Type II errors in this scenario. Justify your answer. c) Discuss the importance of acceptance sampling. Explain single and double sampling inspection plans.	
4.	Light bulbs are tested for their luminance, with the intensity of brightness desired to be within a certain range. Random samples of five bulbs are chosen from the output, and luminance is measured. The sample mean $\bar{X}$ and the standard deviation s are found. After 30 samples, the following summary information is obtained: $\sum_{i=1}^{30} \bar{X}_i = 2550, \sum_{i=1}^{30} s_i = 195,$ The specifications are 90 ± 15 lumens. a) Find the control limits for $\bar{X}$ and s charts. b) Comment on the ability of the process to meet specification. What proportion of the output is nonconforming? c) If the process mean is moved to 90 lumens, what proportion of output will be non-conforming? What suggestions would you make to improve the performance of the process?	10

.....X.....

* Tables to be provided along with question paper

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