Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
(ONLINE)
SEMESTER I
SESSION 2020/2021

COURSE NAME	:	TOTAL QUALITY MANAGEMENT
COURSE CODE	:	BPB 20803
PROGRAMME CODE	:	BPA
EXAMINATION DATE	:	JANUARY / FEBRUARY 2021
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **ALL** QUESTIONS.

THIS QUESTION PAPER CONSISTS OF **EIGHT (8)** PAGES

Q1 Sports Dynamics Crowd is a company that manufacturers different types of athletic shoes. One of the key goals is to produce high-quality shoes. This has been achieved largely through rigorious inspection, a process that knowns as "inspecting the quality in". However, the firm has always had a high rejection rate at final inspection. This has resulted in too many shoes being scrapped or sold as second hand item. The rejection were based on pass/fail criteria for various charateristics. Thus, quality control manager need a control chart that could respond to the number of defective shoes with constant sample size.

Table Q1: Number of Defective Shoes

SPORTS DYNAMICS CROWD						
Sample	Types of Defects					Number of Defects
	Excess Glue	Abrasion Marks	Sharp Point	Incorrect Sizing	Other	
1	1	2	1			4
2		1			1	2
3				1		1
4	1	1		1		3
5		1	1			2
6					2	2
7	2	2	2			6
8						0
9						0
10		1	2	1		4
11			1			1
12						0
13			1		1	2
14						0
15		1				1
16						0
17		1	0	1		2
18		1	1			2
19						0
20	1	1	0			2
21						0
22				1		1
23		3				3
24				1		1
25	1			2		3

(a) Construct a suitable control chart on a graph paper, that could help to control the number of defective athletic shoes as showns in **Table Q1.**

(11 marks)

(b) Assume assignable causes for any out-of-control points and calculate the revised central line and control limits.

(10 marks)

(c) Explain your answer in **Q1(b)**.

(4 marks)

Q2 Hospital system also facing a few pressing problem such as clinical variation, medical errors, delays in patient discharge and admission. Thus, the Care and Cure Hospital conducted a quality improvement project on the time to admit a patient using X-bar and R charts. The hospital wishes to monitor the activity using mean and range charts based on the observation has been done as shown in **Table Q2.**

Table Q2: Number of Observation

Sub Group Number	Observation			
	X1	X2	X3	X4
1	6.1	5.8	6.0	5.0
2	6.4	6.9	5.2	5.3
3	5.5	5.2	5.8	5.4
4	5.0	5.7	6.5	5.0
5	6.7	6.5	5.5	6.0
6	6.0	5.8	6.0	6.2
7	5.6	5.1	5.2	5.2
8	6.0	5.8	5.0	5.5
9	6.7	7.1	6.2	6.5
10	4.3	6.5	6.4	6.2
11	6.1	6.9	7.0	6.5
12	7.0	6.4	6.1	6.3
13	5.4	6.5	6.5	6.8
14	6.7	5.4	5.7	6.0
15	6.8	6.5	6.0	6.5
16	6.7	6.5	6.0	5.8
17	5.8	6.0	5.9	5.0
18	7.0	6.5	6.0	6.5
19	6.6	7.0	6.8	6.0
20	5.5	5.3	6.0	6.2

(a) Calculate

(i) The center line. (12 marks)

(ii) Upper control limit. (2 marks)

(iii) Lower control limit. (2 marks)

(b) Plot related control charts on a graph paper based on your answer in **Q2(a).** (12 marks)

Q3 Clips Munk Electronic Solution has been in printed circuit board for more than 10 years. Last month, Clips Munk Electronic Solution received shipments of circuit boards from its suppliers by the truckload. The person in charge tracks of the number of damaged, incomplete, or inoperative circuit boards found when the truck is unloaded. The information as shown in **Table Q3** helps them make decisions about which suppliers to use in the future.

Table Q3: Data Sheet for Nonconforming Product

Subgroup Number	Number Inspected	Number Nonconforming
1	50	7
2	50	1
3	50	3
4	50	3
5	50	2
6	50	5
7	50	4
8	50	3
9	50	2
10	50	1
11	50	3
12	50	2
13	50	2
14	50	3
15	50	1
16	50	4
17	50	5
18	50	2
19	50	1
20	50	1

(a) Calculate the center line and control limits based on the information in **Table Q3**.

(4 marks)

(b) Plot related control charts on a graph paper based on your answer in **Q3(a).**

(6 marks)

Q4 (a) Company ABC with no Statistical Process Control (SPC) experiences and experts, develops a conservative proposal, accounting for 25% rework in its manufacturing labor costs, padding materials costs by 10% in anticipation of scrap-page, and allowing for inspection sufficient to smoke out most of the defects calculated at 20% of the basic manufacturing labor

(i) If you work for a company that does not employ SPC, explain the SPC implementation road map for the company.
(15 marks)

(ii) Analyze how the seven tools are used when implementing SPC.
(14 marks)

(b) One of the most fundamental elements of total quality is continual improvement. The concept applies to processes and the people who operate them as well as to the products resulting from the processes.
Discuss **four (4)** rational for continual improvement for service organization.
(8 marks)

- END OF QUESTIONS -

FINAL EXAMINATION **APPENDIX I**

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APPENDIX I

Observations in Sample, n	Chart for Averages: Factors for Control Limits A	A_2	A_3	Factor for Central Line d_2	Chart for Ranges: Factors for Control Limits d_1	D_1	D_2	D_3	D_4	Factor for Central Line c_4	Chart for Standard Deviations: Factors for Control Limits B_3	B_4	B_5	B_6
2	2.121	1.880	2.659	1.128	0.853	0	3.686	0	3.267	0.7979	0	3.267	0	2.606
3	1.732	1.023	1.954	1.693	0.888	0	4.358	0	2.574	0.8862	0	2.568	0	2.276
4	1.500	0.729	1.628	2.059	0.880	0	4.698	0	2.282	0.9213	0	2.266	0	2.088
5	1.342	0.577	1.427	2.326	0.864	0	4.918	0	2.114	0.9400	0	2.089	0	1.964
6	1.225	0.483	1.287	2.534	0.848	0	5.078	0	2.004	0.9515	0.030	1.970	0.029	1.874
7	1.134	0.419	1.182	2.704	0.833	0.204	5.204	0.076	1.924	0.9594	0.118	1.882	0.113	1.806
8	1.061	0.373	1.099	2.847	0.820	0.388	5.306	0.136	1.864	0.9650	0.185	1.815	0.179	1.751
9	1.000	0.337	1.032	2.970	0.808	0.547	5.393	0.184	1.816	0.9693	0.239	1.761	0.232	1.707
10	0.949	0.308	0.975	3.078	0.797	0.687	5.469	0.223	1.777	0.9727	0.284	1.716	0.276	1.669
11	0.905	0.285	0.927	3.173	0.787	0.811	5.535	0.256	1.744	0.9754	0.321	1.679	0.313	1.637
12	0.866	0.266	0.886	3.258	0.778	0.922	5.594	0.283	1.717	0.9776	0.354	1.646	0.346	1.610
13	0.832	0.249	0.850	3.336	0.770	1.025	5.647	0.307	1.693	0.9794	0.382	1.618	0.374	1.585
14	0.802	0.235	0.817	3.407	0.763	1.118	5.696	0.328	1.672	0.9810	0.406	1.594	0.399	1.563
15	0.775	0.223	0.789	3.472	0.756	1.203	5.741	0.347	1.653	0.9823	0.428	1.572	0.421	1.544
16	0.750	0.212	0.763	3.532	0.750	1.282	5.782	0.363	1.637	0.9835	0.448	1.552	0.440	1.526
17	0.728	0.203	0.739	3.588	0.744	1.356	5.820	0.378	1.622	0.9845	0.466	1.534	0.458	1.511
18	0.707	0.194	0.718	3.640	0.739	1.424	5.856	0.391	1.608	0.9854	0.482	1.518	0.475	1.496
19	0.688	0.187	0.698	3.689	0.734	1.487	5.891	0.403	1.597	0.9862	0.497	1.503	0.490	1.483
20	0.671	0.180	0.680	3.735	0.729	1.549	5.921	0.415	1.585	0.9869	0.510	1.490	0.504	1.470

Factors for Computing Central Lines and 3σ Control Limits for $\bar{X}$, s, and R Charts

FINAL EXAMINATION **APPENDIX II**

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APPENDIX II

Trial Central Lines for the X-bar and R-chart

$$\bar{\bar{X}} = \frac{\sum_{i=1}^{g} \bar{X}_i}{g} \quad \text{and} \quad \bar{R} = \frac{\sum_{i=1}^{g} R_i}{g}$$

$$\text{UCL}_{\bar{X}} = \bar{\bar{X}} + A_2\bar{R} \quad \text{UCL}_R = D_4\bar{R}$$
$$\text{LCL}_{\bar{X}} = \bar{\bar{X}} - A_2\bar{R} \quad \text{LCL}_R = D_3\bar{R}$$

Revised Central Line and Control Limits

$$\bar{\bar{X}}_{\text{new}} = \frac{\Sigma X - X_d}{g - g_d} \qquad \bar{R}_{\text{new}} = \frac{\Sigma R \quad R_d}{g - g_d}$$

Trial Central Lines for the X-bar and s-chart

$$\bar{s} = \frac{\sum_{i=1}^{g} \bar{s}_i}{g} \qquad \bar{\bar{X}} = \frac{\sum_{i=1}^{g} \bar{X}_i}{g}$$

$$\text{UCL}_{\bar{X}} = \bar{\bar{X}} + A_3\bar{s} \qquad \text{UCL}_s = B_4\bar{s}$$
$$\text{LCL}_{\bar{X}} = \bar{\bar{X}} - A_3\bar{s} \qquad \text{LCL}_s = B_3\bar{s}$$

Trial Central Line and Control Limits for p-chart

$$\bar{p} = \frac{\Sigma np}{\Sigma n}$$

$$\text{UCL} = \bar{p} + 3\sqrt{\frac{\bar{p}(1-\bar{p})}{n}}$$
$$\text{LCL} = \bar{p} - 3\sqrt{\frac{\bar{p}(1-\bar{p})}{n}}$$

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APPENDIX II

Trial Central Line and Control Limits for np chart

$$\text{Centerline } n\bar{p} = \frac{\sum_{i=1}^{m} np}{m}$$

$$UCL_{np} = n\bar{p} + 3\sqrt{n\bar{p}(1-\bar{p})}$$
$$LCL_{np} = np - 3\sqrt{n\bar{p}(1-\bar{p})}$$

Trial Central Line and Control Limits for c chart

$$\bar{c} = \frac{\sum c}{g}$$

$$UCL = \bar{c} + 3\sqrt{\bar{c}}$$
$$LCL = \bar{c} - 3\sqrt{\bar{c}}$$