Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2019/2020

COURSE NAME	:	TOTAL QUALITY MANAGEMENT
COURSE CODE	:	BPB 20803
PROGRAMME CODE	:	BPA
EXAMINATION DATE	:	DECEMBER 2019 / JANUARY 2020
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWERS **ALL** QUESTIONS

THIS QUESTION PAPER CONSISTS OF **SEVEN (7)** PAGES

Q1 The net weight (in gram) of a dry bleach product is to be monitored by x-bar and R control charts using a sample size of n=5. The measurement data is shown in **Table Q1.**

Table Q1: Measurement Data

Sub Group	Sample				
	X1	X2	X3	X4	X5
1	15.8	16.3	16.2	16.1	16.6
2	16.3	15.9	15.9	16.2	16.4
3	16.1	16.2	16.5	16.4	16.3
4	16.3	16.2	15.9	16.4	16.2
5	16.1	16.1	16.4	16.5	16.0
6	16.1	15.8	16.7	16.6	16.4
7	16.1	16.3	16.5	16.1	16.5

(a) Calculate:

(i) x-bar

(4 marks)

(ii) X-double bar

(2 marks)

(iii) R, range

(4 marks)

(iv) R-bar

(2 marks)

(v) $UCL_{x\text{-bar}}$

(2 marks)

(vi) $LCL_{x\text{-bar}}$

(2 marks)

(vii) UCL_R

(2 marks)

(viii) LCL_R

(2 marks)

(b) Plot the x-bar chart on the graph paper based on the answers in **Q1 (a)(i), Q1 (a)(ii), Q1 (a)(v) and Q1 (a)(vi).**

(5 marks)

Q2 (a) Define statistical process control in industrial application.

(2 marks)

(b) Discuss **FOUR (4)** type of control charts for attributes data.

(8 marks)

(c) The Greetings Company has been making the birthday card for a number of years. The company use *p*-chart to keep track the number of non-conforming cards that are created each time a batch. Use the data in **Table Q2** to construct a fraction non-conforming *p*-chart.

Table Q2: Non-conforming Birthday Cards

Subgroup Number	Number Inspected n	Number Nonconforming np
1	500	20
2	500	21
3	500	19
4	500	15
5	500	18
6	500	20
7	500	19
8	500	28
9	500	17
10	500	20

Calculate:

(i) The fraction non-conforming, *p*

(5 marks)

(ii) The central line and control limits.

(5 marks)

(iii) Plot *p*-chart on the graph paper based on the answers in **Q2(c)(i) and (ii).**

(5 marks)

Q3 (a) List **SEVEN (7)** basic quality tools for quality improvement.

(7 marks)

(b) Explain the application of **THREE (3)** quality tools based on your answer in **Q3(a).**

(6 marks)

(c) Control charts for x-bar and standard deviation (*S*) are to be established to monitor tensile strength of a metal part. Data for subgroup size of 5 are shown in **Table Q3.**

Table Q3: Tensile Strength in Newton per Square Meter

Subgroup Number	x-bar	Standard Deviation, *S*	Information
1	540	26	
2	534	23	
3	545	24	
4	561	27	
5	576	25	
6	523	50	
7	571	29	
8	547	29	
9	584	23	New operator
10	552	24	

Calculate:

(i) The central line.

(4 marks)

(ii) The control limits for x-bar.

(4 marks)

(iii) The control limit for *S* chart.

(4 marks)

Q4 (a) List **THREE (3)** roles of top management in implementing total quality management. (3 marks)

(b) Illustrate **FOUR (4)** steps in the preparation phase of total quality management. (8 marks)

(c) Discuss **SEVEN (7)** criteria for The Malcom Baldrige National Quality Award. (14 marks)

-END OF QUESTIONS-

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SEMESTER / SESSION : SEMESTER I/ 2019/2020 PROGRAMME CODE : BPA
COURSE NAME : TOTAL QUALITY MANAGEMENT COURSE CODE : BPB 22803

APPENDIX I

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

OBSERVATIONS IN SAMPLE, n	CHART FOR AVERAGES			CHART FOR STANDARD DEVIATIONS					CHART FOR RANGES					
	FACTORS FOR CONTROL LIMITS			FACTOR FOR CENTRAL LINE	FACTORS FOR CONTROL LIMITS				FACTOR FOR CENTRAL LINE	FACTORS FOR CONTROL LIMITS				
	A	A_2	A_3	c_4	B_3	B_4	B_5	B_6	d_2	d_3	D_1	D_2	D_3	D_4
2	2.121	1.880	2.659	0.7979	0	3.267	0	2.606	1.128	0.853	0	3.686	0	3.267
3	1.732	1.023	1.954	0.8862	0	2.568	0	2.276	1.693	0.888	0	4.358	0	2.574
4	1.500	0.729	1.628	0.9213	0	2.266	0	2.088	2.059	0.880	0	4.698	0	2.282
5	1.342	0.577	1.427	0.9400	0	2.089	0	1.964	2.326	0.864	0	4.918	0	2.114
6	1.225	0.483	1.287	0.9515	0.030	1.970	0.029	1.874	2.534	0.848	0	5.078	0	2.004
7	1.134	0.419	1.182	0.9594	0.118	1.882	0.113	1.806	2.704	0.833	0.204	5.204	0.076	1.924
8	1.061	0.373	1.099	0.9650	0.185	1.815	0.179	1.751	2.847	0.820	0.388	5.306	0.136	1.864
9	1.000	0.337	1.032	0.9693	0.239	1.761	0.232	1.707	2.970	0.808	0.547	5.393	0.184	1.816
10	0.949	0.308	0.975	0.9727	0.284	1.716	0.276	1.669	3.078	0.797	0.687	5.469	0.223	1.777
11	0.905	0.285	0.927	0.9754	0.321	1.679	0.313	1.637	3.173	0.787	0.811	5.535	0.256	1.744
12	0.866	0.266	0.886	0.9776	0.354	1.646	0.346	1.610	3.258	0.778	0.922	5.594	0.283	1.717
13	0.832	0.249	0.850	0.9794	0.382	1.618	0.374	1.585	3.336	0.770	1.025	5.647	0.307	1.693
14	0.802	0.235	0.817	0.9810	0.406	1.594	0.399	1.563	3.407	0.763	1.118	5.696	0.328	1.672
15	0.775	0.223	0.789	0.9823	0.428	1.572	0.421	1.544	3.472	0.756	1.203	5.741	0.347	1.653
16	0.750	0.212	0.763	0.9835	0.448	1.552	0.440	1.526	3.532	0.750	1.282	5.782	0.363	1.637
17	0.728	0.203	0.739	0.9845	0.466	1.534	0.458	1.511	3.588	0.744	1.356	5.820	0.378	1.622
18	0.707	0.194	0.718	0.9854	0.482	1.518	0.475	1.496	3.640	0.739	1.424	5.856	0.391	1.608
19	0.688	0.187	0.698	0.9862	0.497	1.503	0.490	1.483	3.689	0.734	1.487	5.891	0.403	1.597
20	0.671	0.180	0.680	0.9869	0.510	1.490	0.504	1.470	3.735	0.729	1.549	5.921	0.415	1.585

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APPENDIX II

Trial Central Line and Control Limits

$$\overline{\overline{X}} = \frac{\sum_{i=1}^{g} \overline{X_i}}{g} \quad and \quad \overline{R} = \frac{\sum_{i=1}^{g} R_i}{g}$$

$$UCL_{\overline{X}} = \overline{\overline{X}} + A_2 \overline{R} \qquad UCL_R = D_4 \overline{R}$$

$$LCL_{\overline{X}} = \overline{\overline{X}} - A_2 \overline{R} \qquad LCL_R = D_3 \overline{R}$$

Trial Central Line and the Control Limits

$$\overline{p} = \frac{\sum np}{\sum n}$$

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

$$LCL = \overline{p} - 3\sqrt{\frac{\overline{p}(1-\overline{p})}{n}}$$

Trial Central Line and The Control Limits

$$\overline{s} = \frac{\sum_{i=1}^{g} \overline{s_i}}{g} \qquad \overline{\overline{X}} = \frac{\sum_{i=1}^{g} \overline{X_i}}{g}$$

$$UCL_{\overline{X}} = \overline{\overline{X}} + A_3 \overline{s} \qquad UCL_s = B_4 \overline{s}$$

$$LCL_{\overline{X}} = \overline{\overline{X}} - A_3 \overline{s} \qquad LCL_s = B_3 \overline{s}$$