UNIVERSITI TUN HUSSEIN ONN
MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2011/2012

COURSE NAME	:	TOTAL QUALITY MANAGEMENT
COURSE CODE	:	BPB20803 / BPB2083
PROGRAMME	:	3 BPA
EXAMINATION DATE	:	JANUARY 2012
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **ALL** QUESTIONS

THIS QUESTION PAPER CONSISTS OF SIX (6) PAGES

Q1 Control charts for X bar and R are to be established on certain dimension part, measured in millimeters. Data were collected in subgroup sizes of 6 and are shown in **Table Q1** below.

Table Q1: Data on Dimension Part Measured in Millimeters

SUBGROUP NUMBER	X BAR	R	SUBGROUP NUMBER	X BAR	R
1	20.35	0.34	14	20.41	0.36
2	20.40	0.36	15	20.45	0.34
3	20.36	0.32	16	20.34	0.36
4	20.65	0.36	17	20.36	0.37
5	20.20	0.36	18	20.42	0.73
6	20.40	0.35	19	20.50	0.38
7	20.43	0.31	20	20.31	0.35
8	20.37	0.34	21	20.39	0.38
9	20.48	0.30	22	20.39	0.33
10	20.42	0.37	23	20.40	0.32
11	20.39	0.29	24	20.41	0.34
12	20.38	0.30	25	20.40	0.30
13	20.40	0.33			

(a)   Calculate:-

    i)   The trial central line.
    ii)   Control limits.

(7 marks)

(b)   Assume asignable causes, calcúlate:-

    i)   Revised central limits and central line.

(8 marks)

Q2 One hundred product labels are inspected every day for surface nonconformities. Results for the past 25 days are 22, 29, 25, 17, 20, 16, 34, 11, 31, 29, 15, 10, 33, 23, 27, 15, 17, 17 19, 22, 23, 27, 29, 33 and 21.

(a) Plot the points on graph paper (run chart).

(5 marks)

(b) Determine if the process is stable.

(5 marks)

(c) Determine the trial central line and control limits.

(5 marks)

Q3 The performance of the first is reflected in the inspection results of electric carving knives as tabulated in **Table Q3** below:-

Table Q3: Data on Inspection Results of Carving Knives

DATE	NUMBER INSPECTED	NUMBER NONCONFORMING	DATE	NUMBER INSPECTED	NUMBER NONCONFORMING
Sept. 6	500	5	Sept. 23	525	10
7	550	6	24	650	3
8	700	8	27	675	8
9	625	9	28	450	23
10	700	7	29	500	2
13	550	8	30	375	3
14	450	16	Oct. 1	550	8
15	600	6	4	600	7
16	475	9	5	700	4
17	650	6	6	660	9
20	650	7	7	450	8
21	550	8	8	500	6
22	525	7	11	525	1

(a) Determine central line and control limit of each subgroup.

(7 marks)

(b) Assume that any out of control points have assignable causes, determine the standard value for the fraction nonconforming for the next production.

(8 marks)

Q4   Control charts for X bar and *s* are to be established on the Brinell hardness of hardened tool steel in kilograms per square millimeter. Data for subgroup sizes of 8 are shown in **Table Q4** below.

Table Q4: Data on Hardness of Hardened Tool Steel in
Kilograms per Square Millimeter

SUBGROUP NUMBER	X BAR	s	SUBGROUP NUMBER	X BAR	s
1	540	26	14	551	24
2	534	23	15	522	29
3	545	24	16	579	26
4	561	27	17	549	28
5	576	25	18	508	23
6	523	50	19	569	22
7	571	29	20	574	28
8	547	29	21	563	33
9	584	23	22	561	23
10	552	24	23	548	25
11	541	28	24	556	27
12	545	25	25	553	23
13	546	26			

(a)   Determine the trial central line and control limits for X bar and *s* charts.

(7 marks)

(b)   Assume that out-of-control points have assignable causes, calculate the revised limits and central line.

(8 marks)

Q5   Data in liters are as follows: 4.56, 4.65, 4.66, 4.34, 4.65, 4.40, 4.50, 4.55, 4.69, 4.29, 4.58, 4.71, 4.61, 4.66, 4.46, 4.70, 4.65, 4.61, 4.54, 4.55, 4.54, 4.54, 4.47, 4.64, 4.72, 4.47, 4.64, 4.72, 4.47, 4.66, 4.51, 4.43, 4.34

(a)   Calculate central line and control limits for a moving average and moving range chart using a time period of 3.

(7 marks)

(b)   State any out-of-control points?

(8 marks)

Q6 The Get-Well Hospital has completed a quality improvement project on the time to admit a patient using X bar and R charts. The hospital now wishes to monitor the activity using median and range charts. Based on latest data in minutes as in **Table Q6**, calculate the central line and control limit.

(13 marks)

Table Q6: Data on Admission Patient in Minutes

Subgroup Number	Observation			Subgroup Number	Observation		
	X1	X2	X3		X1	X2	X3
1	6.0	5.8	6.1	13	6.1	6.9	7.4
2	5.2	6.4	6.9	14	6.2	5.2	6.8
3	5.5	5.8	5.2	15	4.9	6.6	6.6
4	5.0	5.7	6.5	16	7.0	6.4	6.1
5	6.7	6.5	5.5	17	5.4	6.5	6.7
6	5.8	5.2	5.0	18	6.6	7.0	6.8
7	5.6	5.1	5.2	19	4.7	6.2	7.1
8	6.0	5.8	6.0	20	6.7	5.4	6.7
9	5.5	4.9	5.7	21	6.8	6.5	5.2
10	4.3	6.4	6.3	22	5.9	6.4	6.0
11	6.2	6.9	5.0	23	6.7	6.3	4.6
12	6.7	7.1	6.2	24	7.4	6.8	6.3

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Q7 An *X* and *R* chart is to be maintained on the pH value for the swimming pool water of a leading hotel. One reading is taken each day for 30 days. Data are 7.8, 7.9, 7.7, 7.6, 7.4, 7.2, 6.9, 7.5, 7.8, 7.7, 7.5, 7.8, 8.0, 8.1, 8.0, 7.9, 8.2, 7.3, 7.8, 7.4, 7.2, 7.5, 6.8, 7.3, 7.4, 8.1, 7.6, 8.0, 7.4 and 7.0.

(a) Plot the data on graph paper

(4 marks)

(b) Determine the trial central line and limits

(4 marks)

(c) Determine the process of stability

(4 marks)

END OF QUESTION PAPER

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

OBSERVATIONS IN SAMPLE, n	CHART FOR AVERAGES FACTORS FOR CONTROL LIMITS			CHART FOR STANDARD DEVIATIONS FACTOR FOR CENTRAL LINE	FACTORS FOR CONTROL LIMITS				CHART FOR RANGES 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