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**UNIVERSITI TUN HUSSEIN ONN  
MALAYSIA**

**FINAL EXAMINATION  
SEMESTER I  
SESSION 2011/2012**

**COURSE NAME : QUALITY MANAGEMENT**  
**COURSE CODE : BPB 44002**  
**PROGRAMME : 2 BPB**  
**EXAMINATION DATE : JANUARY 2012**  
**DURATION : 2 HOURS 30 MINUTES**  
**INSTRUCTION : ANSWER ALL QUESTIONS**

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

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Q1 Statistics method is important for analyzing, interpreting and displaying data, which the main purpose to ensure process is stable and predictable.

(a) Explain:

(i) Accurate data

(3 marks)

(ii) Precise data

(3 marks)

(b) Define:

(i) Average

(2 marks)

(ii) Median

(2 marks)

(iii) Mode

(2 marks)

(c) A technician check the resistance value of coils and record the value in Ohm:  $X_1=3.35$ ,  $X_2=3.37$ ,  $X_3=3.28$ ,  $X_4=3.34$  and  $X_5=3.30$ .

Calculate:

(i) Average

(3 marks)

(ii) Standard deviation

(4 marks)

(d) Tensile test on aluminium alloy rods are conducted at three different times, which resulted in three different average values in megapascals (MPa). On the first occasion, five test are conducted with the average of 207 MPa; on the second occasion, six tests, with an average of 203 MPa; and on the last occasion, 3 test, with an average of 206 MPa.

Calculate the weighted average

(6 marks)

- Q2 (a) Variation occurred in every process. Monitoring variation is essential to ensure each process is stable and predictable.
- (i) Explain **THREE (3)** categories of variation (6 marks)
- (ii) Describe **THREE (3)** sources of the variation (6 marks)
- (b) Explain:
- (i) Random variation (2 marks)
- (ii) Non-random variation (2 marks)

**Table Q2(c):** Measurement data for control chart

SUBGROUP NUMBER	DATE	TIME	MEASUREMENTS				AVERAGE $\bar{X}$	RANGE $R$
			$X_1$	$X_2$	$X_3$	$X_4$		
1	12/26	8:50	35	40	32	37	6.36	0.08
2		11:30	46	37	36	41	6.40	0.10
3		1:45	34	40	34	36	6.36	0.06
4		3:45	69	64	68	59	6.65	0.10
5		4:20	38	34	44	40	6.39	0.10
6	12/27	8:35	42	41	43	34	6.40	0.09
7		9:00	44	41	41	46	6.43	0.05
8		9:40	33	41	38	36	6.37	0.08
9		1:30	48	44	47	45	6.46	0.04
10		2:50	47	43	36	42	6.42	0.11
11	12/28	8:30	38	41	39	38	6.39	0.03
12		1:35	37	37	41	37	6.38	0.04
13		2:25	40	38	47	35	6.40	0.12
14		2:35	38	39	45	42	6.41	0.07
15		3:55	50	42	43	45	6.45	0.08
16	12/29	8:25	33	35	29	39	6.34	0.10
17		9:25	41	40	29	34	6.36	0.12
18		11:00	38	44	28	58	6.42	0.30
19		2:35	35	41	37	38	6.38	0.06
20		3:15	56	55	45	48	6.51	0.11
21	12/30	9:35	38	40	45	37	6.40	0.08
22		10:20	39	42	35	40	6.39	0.07
23		11:35	42	39	39	36	6.39	0.06
24		2:00	43	36	35	38	6.38	0.08
25		4:25	39	38	43	44	6.41	0.06
Sum							160.25	2.19

- (c) Measurement data for control chart was collected as Table Q2(c). ( Assume  $A_2$  for a subgroup size ( $n$ ) of 4 is 0.729 and  $D_4$  is 2.282)

Calculate:

- (i)  $\bar{X}$  double bar

(3 marks)

(ii) R bar (3 marks)

(iii) Upper Control Limit ( $UCL_x$ ) (3 marks)

- Q3 (a) Explain:
- i) Process Maps (3 marks)
- ii) Check Sheets (3 marks)

**Table Q3(b): Decision criteria and final rankings**

Decision Criteria	Importance
A	.2
B	.3
C	.5

Final Rankings	
Criterion A	Ranking
Machine 1	1
Machine 2	2
Machine 3	3
Machine 4	4

Criterion B	Ranking
Machine 1	3
Machine 2	2
Machine 3	4
Machine 4	1

Criterion C	Ranking
Machine 1	4
Machine 2	2
Machine 3	1
Machine 4	3

- (b) A company had to choose between four possible machines for a service process with three criteria as Table Q3(b).
- i) Calculate the score of each machine based on decision weight and final rankings (8 marks)
- ii) Base on the above result, decide which machine is the best choice (2 marks)
- (c) The thickness of a component is specified between 30 and 40 millimeters. Thirty components were sampled with resulting mean of 34 millimeters and standard deviation of 3.5.

Calculate:

- (i) Cpu (3 marks)
- (ii) Cpl (3 marks)
- (iii) Cpk (3 marks)

Q4 Reliability is important to ensure the product quality for customer satisfaction.

(a) Define reliability. (3 marks)

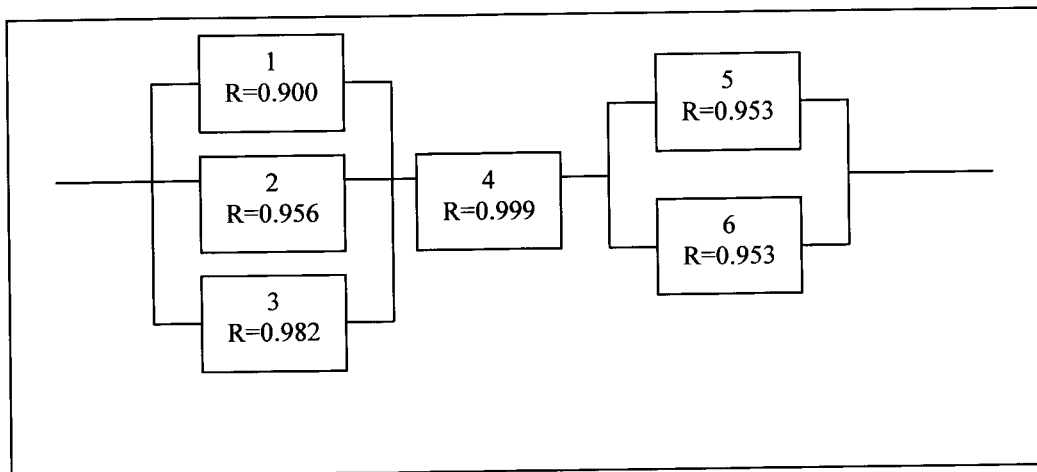
(b) Explain **THREE (3)** phases of the “bathtub-shaped hazard function”. (6 marks)

(c) A system has 5 components, A,B,C,D and E, with reliability values of 0.985, 0.890, 0.985, 0.999 and 0.999, respectively.

Calculate the system reliability if the components are in series. (3 marks)

(d) A system has 3 components, A,B and C, with reliability values of 0.989, 0.996 and 0.994, respectively.

Calculate the system reliability if the components are in parallel. (3 marks)



**Figure Q4(e):** Combination components in parallel and series

(e) Calculate the reliability of the system in Figure Q4(e). (4 marks)

(f) 25 machines had been tested under strenuous condition. Three of the machines failed during the test. 22 machines were still operating at the end of 100 hours.

Calculate the failure rate. (3 marks)

(g) Assume that there is a constant failure rate.

Calculate MTTF (mean time to failure) that has failure rate of 0.025.

(3 marks)

**END OF QUESTION PAPER**