Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2014/2015

COURSE NAME	:	QUALITY CONTROL
COURSE CODE	:	BPB 24303
PROGRAMME	:	2 BPB
EXAMINATION DATE	:	JUNE 2015 / JULY 2015
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **ALL** QUESTIONS

THIS QUESTION PAPER CONSISTS OF **NINE (9)** PAGES

Q1 WAX company has problem in their production performance in terms of productivity and quality. During the observations, production manager found that unorganised workplace and improper arrangement are some of the contributing factors. You are appointed by the manager to set-up 5S in their production area in order to solve the problem.

(a) Develop a general process map using appropriate mapping symbols on 5S implemention based on 5S criteria.

(10 marks)

(b) Discussion has been made amongst employees to identify the actual causes as presented in **Table Q1(b).**

Table Q1(b)

No	Causes	Quantity
1	Awareness amongst employees	44
2	Lack of standard operation procedure	36
3	Lack or training	5
4	Lack of time	3
5	Machine performance problem	3
6	Inventory management problem	3
7	Workplace problem	2
8	Improper schedule for 5S	2
9	Lack of budget	1
10	Lack of co-operation	1

(i) Draw Pareto chart based on data from **Table Q1(b)**.

(3 marks)

(ii) Explain the applicability of 80/20 rule for this problem based on Pareto chart analysis developed in question **Q1(b)(i)**.

(2 marks)

(c) Propose **FIVE (5)** solutions for improvement based on two main causes as stated in **Table Q1(b)** using Tree Diagram.

(10 marks)

Q2 (a) NSX company has set up 3 production lines and each of the production lines has different type of products and machines as illustrated in **Table Q2(a)**.

Table Q2(a)

Production Line	Product type
1	A, B, C
2	A, D, K
3	A, E

(i) Identify **ONE (1)** appropriate sampling technique for NSX company.
(2 marks)

(ii) Explain **ONE (1)** reason based on the sampling technique discussed in **Q2(a)(i)**.
(2 marks)

(b) Measurement data for P chart collected is shown in **Table Q2(b)**.

Table Q2(b)

SAMPLE	SAMPLE QUANTITY	DEFECTS	PROPOSITION
1	100	10	0.10
2	95	6	0.06
3	110	7	0.06
4	142	6	0.04
5	100	5	0.05
6	98	6	0.06
7	76	3	0.04
8	125	10	0.08
9	100	5	0.05
10	125	6	0.05
11	111	7	0.06
12	116	10	0.09
13	92	3	0.03
14	98	10	0.10
15	162	5	0.03
16	87	6	0.07
17	105	7	0.07
18	110	6	0.05
19	98	3	0.03
20	96	7	0.07
21	100	5	0.05
22	100	6	0.06
23	97	7	0.07
24	122	6	0.05
25	125	3	0.02
26	110	7	0.06
27	100	5	0.05
Sum	2900		1.58

Calculate:

(i) $\bar{\bar{P}}$

(2 marks)

(ii) $\bar{n}$

(2 marks)

(iii) Upper Control Limit (UCL)

(3 marks)

(iv) Lower Control Limit (LCL)

(3 marks)

(c) The height of product K is specified between 2.95 and 3.05 kg. 100 samples have been measured with resulting mean of 3.02 milimeters and standard deviation of 0.01.

Calculate population process capability:

(i) Cp_u

(3 marks)

(ii) Cp_l

(3 marks)

(iii) Cp_k

(3 marks)

(d) Life test has been conducted on product K for 300 hours. Out of 30 parts, 2 parts have failed during the test.

Calculate failures per operating hours.

(2 marks)

Q3 (a) NTT company is required by its customer to monitor the production process through Statistic Process Control (SPC). The measurement is based on weight.

Propose **ONE (1)** type of control chart for monitoring central tendency and dispersion if the subgroups = 10.

(4 marks)

(b) Discuss **THREE (3)** types of variation in the production process.

(6 marks)

(c) Measurement data for control chart collected is shown in **Table Q3(c)**.

Table Q3(c)

SUBGROUP			MEASUREMENTS				AVERAGE	RANGE
NUMBER	DATE	TIME	X1	X2	X3	X4	X	R
1	01-Feb	8:00	3.02	3.01	2.96	2.98	3.00	0.05
2		9:00	3.01	3.02	2.98	2.96	3.00	0.05
3		10:00	3.01	3.02	2.98	2.96	3.00	0.05
4		11:00	3.01	3.02	2.98	2.96	3.00	0.05
5		12:00	3.01	3.02	2.98	2.96	3.00	0.05
6	02-Feb	8:00	3.01	3.02	2.98	2.96	3.00	0.05
7		9:00	3.01	3.02	2.98	2.96	3.00	0.05
8		10:00	3.01	3.02	2.98	2.96	3.00	0.05
9		11:00	3.01	2.97	2.98	3.01	2.99	0.04
10		12:00	3.01	2.97	2.98	3.01	2.99	0.04
11	03-Feb	8:00	2.98	2.97	2.98	3.01	2.99	0.04
12		9:00	2.98	2.97	2.98	3.01	2.99	0.04
13		10:00	2.98	2.97	2.98	3.01	2.99	0.04
14		11:00	2.98	2.97	2.98	3.01	2.99	0.04
15		12:00	2.98	2.97	2.98	2.97	2.98	0.01
16	04-Feb	8:00	2.98	2.97	2.98	2.97	2.98	0.01
17		9:00	2.98	2.97	2.98	2.97	2.98	0.01
18		10:00	2.98	2.97	2.98	2.97	2.98	0.01
19		11:00	2.98	2.97	2.98	2.97	2.98	0.01
20		12:00	2.98	3.02	2.98	2.97	2.99	0.05
21	05-Feb	8:00	2.98	3.02	2.98	2.97	2.99	0.05
22		9:00	2.98	3.02	2.98	2.97	2.99	0.05
23		10:00	2.98	3.02	2.98	2.97	2.99	0.05
24		11:00	2.98	3.02	2.98	2.97	2.99	0.05
25		12:00	3.01	3.02	2.98	2.97	3.00	0.05
26	06-Feb	8:00	2.98	3.02	2.98	2.97	2.99	0.05
27		9:00	2.98	3.02	2.98	2.97	2.99	0.05
28		10:00	2.98	3.02	2.98	2.97	2.99	0.05
29		11:00	2.98	3.02	2.98	2.97	2.99	0.05
30		12:00	3.01	3.02	2.98	2.97	3.00	0.05
Sum							89.77	1.24

Calculate:

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

(3 marks)

(ii) $\bar{R}$

(3 marks)

(iii) Upper Control Limit (UCL_x)

(3 marks)

(iv) Lower Control Limit (LCL_x)

(3 marks)

(v) Upper Control Limit (UCL_R)

(3 marks)

Q4 (a) Differentiate between series and parallel components for reliability.

(3 marks)

(b) KSX company has received many claims from customers within one month after using their product.

Suggest **THREE (3)** types of test for monitoring the initial failure of product.

(6 marks)

(c) A system has 6 components, A, B, C, D, E and F, with reliability values of 0.985, 0.890, 0.985, 0.999, 0.970 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 0.979, 0.986 and 0.994, respectively.

Calculate the system reliability if the components are in parallel.

(3 marks)

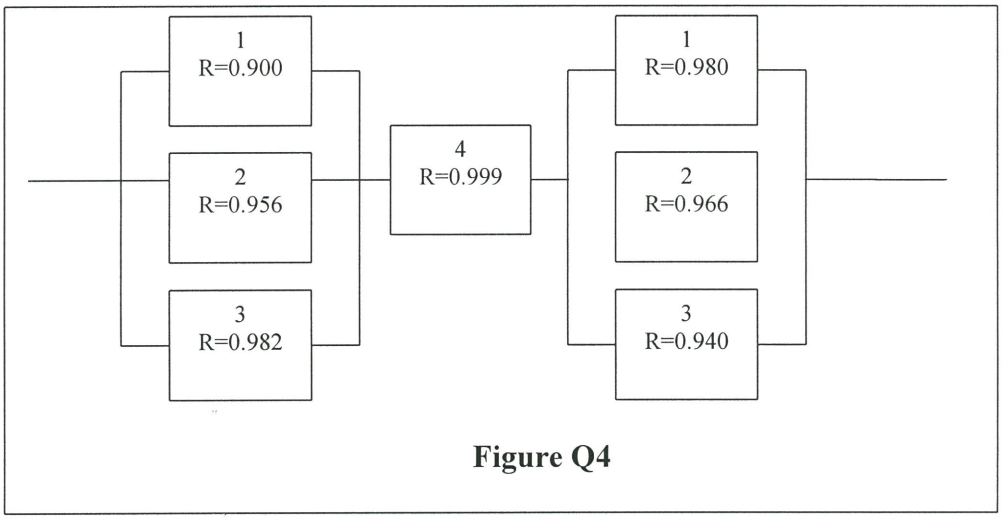

Figure Q4

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

(4 marks)

(f) KSX company has conducted life test for their new product. Four of the items failed after 5, 13, 16 and 21 hours. Five items were still operating at the end of 23 hours.

Calculate:

(i) Failure rate for an item that has the test of 10 items terminated at the end of 23 hours.

(3 marks)

(ii) Mean life based on failure rate from **Q4(f)(i)**. Assume that there is a constant failure rate for the test.

(3 marks)

-END OF QUESTIONS-

FINAL EXAMINATION
EQUATIONS AND TABLE

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Process Capability

$$CPU = \frac{(USL - \mu)}{(3 * \sigma_{Within})} \qquad PPU = \frac{(USL - \mu)}{3 * \sigma_{Overall}}$$

$$CPL = \frac{(\mu - LSL)}{(3 * \sigma_{Within})} \qquad PPL = \frac{(\mu - LSL)}{3 * \sigma_{Overall}}$$

$Cpk = \text{minimum}\{CPU, CPL\}$ $Ppk = \text{minimum}\{PPU, PPL\}$

$\overline{\overline{X}}$ Control Chart and $\overline{R}$ Control Chart

$$UCL_{\overline{X}} = \overline{\overline{X}} + A_2\overline{R}$$

$$LCL_{\overline{X}} = \overline{\overline{X}} - A_2\overline{R}$$

$$UCL_R = D_4\overline{R}$$

$$LCL_R = D_3R$$

Subgroup	X-bar chart		S-chart		R-chart	
	Using Ra	Using Sa				
n	A2	A3	B3	B4	D3	D4
2	1.886	2.659	0	3.267	0	3.268
3	1.023	1.954	0	2.568	0	2.574
4	0.729	1.628	0	2.266	0	2.282
5	0.577	1.427	0	2.089	0	2.114
6	0.483	1.287	0.03	1.97	0	2.004
7	0.419	1.182	0.118	1.882	0.076	1.924
8	0.373	1.099	0.185	1.815	0.136	1.864
9	0.337	1.032	0.239	1.761	0.184	1.816
10	0.308	0.975	0.284	1.716	0.223	1.777
11	0.285	0.927	0.322	1.678	0.256	1.744
12	0.266	0.886	0.354	1.646	0.283	1.717
13	0.249	0.85	0.382	1.619	0.307	1.693
14	0.235	0.817	0.407	1.593	0.328	1.672
15	0.223	0.789	0.428	1.572	0.347	1.653

P Control Chart

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

$$CL = \bar{p}$$

$$LCL = \bar{p} - 3\sqrt{\frac{\bar{p}(1-\bar{p})}{n_i}}$$