Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2019/2020

COURSE NAME	:	INDUSTRIAL QUALITY CONTROL
COURSE CODE	:	BWB 31403
PROGRAMME CODE	:	BWQ / BWA
EXAMINATION DATE	:	DECEMBER 2019 / JANUARY 2020
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **ALL** QUESTIONS

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

PART A (10 marks)

Answer all questions. Write your answer in the answer script.

Q1 A technician measures the same unit multiple times, the results will usually show some variability. This variability is called
A. conformance to standards
B. technician variation
C. reproducibility
D. repeatability

Q2 A np chart measures the
A. number of nonconforming units
B. number of standard deviations
C. count of nonconformities
D. Poisson factor

Q3 A c chart measures the
A. number of nonconforming units
B. number of standard deviations
C. count of nonconformities
D. Poisson factor

Q4 The capability ratio that it most desirable is
A. 1.00
B. 0.50
C. 0.75
D. 1.30

Q5 The statistical process control tool, which is used to record data is called
A. check sheet
B. cause and effect diagram
C. scatter diagram
D. matrix diagram

Q6 One of the advantages of exponentially weighted moving average (EWMA) control chart compared to the Shewhart control chart is
A. robustness to non-normality
B. simpler to implement
C. detecting larger shift
D. all of the above

Q7 A s chart might be used as a measure of dispersion rather than R chart except
A. more sensitive to variations
B. easier to understand
C. more accurate
D. all of the above

Q8 The purpose of most measurement systems capability studies is to
A. determine how much of the total observed variability is due to the operator
B. combine the components of variability in the measurement system
C. assess whether the instrument is capable, that is, whether it is suitable for the intended application
D. all of the above

Q9 The statistical process control (SPC) problem-solving tool that does not have a fixed form is a
A. scatter diagram
B. check sheet
C. control chart
D. cause and effect diagram

Q10 The producer's risk is the risk
A. of accepting lots of good quality
B. of rejecting lots of bad quality
C. of accepting lots of bad quality
D. of rejecting lots of good quality

PART B (90 marks)

Q1 (a) Explain **TWO (2)** roles of statistical process control in succeeding the modern definition of quality.

(4 marks)

(b) Define the following terms:

(i) Phase I operation
(ii) Phase II operation

(4 marks)

(c) Distinguish by using an example the difference between reproducibility and repeatability in measurement system.

(4 marks)

(d) Construct a Pareto diagram with the cumulative line for the analysis of automobile accidents which are due to improper driving as in **Table Q1(d)**. From the diagram, identify improvement of opportunities.

Table Q1(d)

Type of Improper Driving	%
Improper Turn	3.6
Driving Too Fast	28.1
Following Too Closely	8.1
Right-Of-Way Violations	30.1
Driving Right of Centre	3.3
Improper Overtaking	3.2
Other	23.6

(8 marks)

Q2 (a) Define a cyclic pattern in a control chart. Illustrate with an example to visualize it.

(4 marks)

(b) Explain **ONE (1)** advantage of CUSUM control chart and EWMA control chart over the Shewhart control chart? State **ONE (1)** reason when and why EWMA chart is preferred over CUSUM control chart.

(6 marks)

(c) Explain the process performance of control chart as in **Figure Q2(c).**

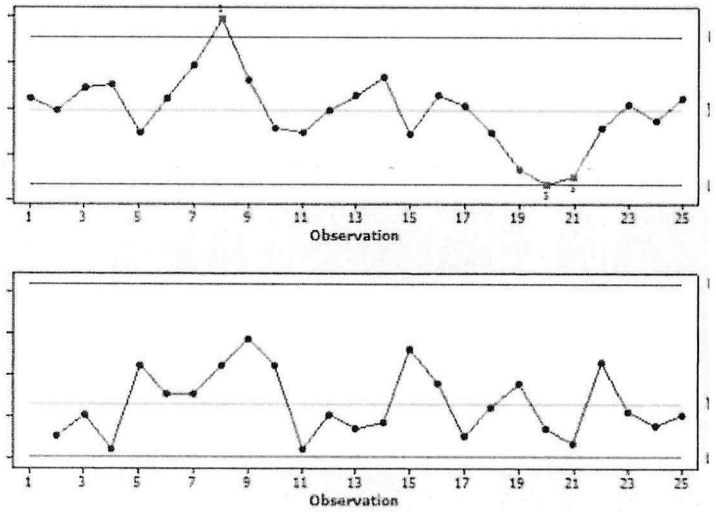

Figure Q2(c)

(4 marks)

Q3 The purity of a chemical product is measured on each batch. Purity determinations for 20 successive batches are shown in **Table Q3**.

Table Q3

Batch Number	Purity	Batch Number	Purity
1	0.81	11	0.81
2	0.82	12	0.83
3	0.81	13	0.81
4	0.82	14	0.82
5	0.82	15	0.81
6	0.83	16	0.85
7	0.81	17	0.83
8	0.80	18	0.87
9	0.81	19	0.86
10	0.82	20	0.84

Use these data to produce an appropriate control charts. Critiques on the pattern of the chart. Suggest another appropriate chart for the same problem.

(14 marks)

Q4 **Table Q4** gives the number of nonconforming blower motor in an electric hairdryer samples of size 300.

Table Q4

Sample Number	Number of Nonconforming Motors	Sample Number	Number of Nonconforming Motors
1	12	14	3
2	3	15	0
3	9	16	5
4	4	17	7
5	0	18	8
6	6	19	16
7	6	20	2
8	1	21	5
9	8	22	6
10	11	23	0
11	2	24	3
12	10	25	2
13	9		

(a) Construct an appropriate control chart. Justify on the chart selection. Comment on the pattern of the chart.

(10 marks)

(b) Assume the assignable causes can be found for any points plot out of control. Determine the revised control limits.

(4 marks)

(c) Justify the action that should be taken in order to reduce the number of nonconforming blower motors. Provide relevant evidence.

(6 marks)

Q5 Control charts for x and s are maintained for a normally distributed quality characteristic. The sample size is $n = 4$; x and s are computed for each sample. After 50 samples, the summary statistics are

$$\sum_{i=1}^{50} \bar{x}_i = 1000 \quad \text{and} \quad \sum_{i=1}^{50} s_i = 72$$

(a) Calculate the control limit for the $\bar{x}$ and s control charts.

(5 marks)

(b) If the specification limits are 19 ± 4.0, derive your conclusions regarding the capability of the process to produce items conforming to specifications.

(3 marks)

(c) Assuming that if an item exceeds the upper specification limit it can be reworked, and if it is below the lower specification limit it must be scrapped. Analyse the percentage of scrap and rework based on the current process.

(6 marks)

(d) If the process mean were centered at 19, revise the effect on the percentage of scrap and rework. Critique the findings in **Q5(c)** and **Q5(d)** in terms of quality improvement.

(8 marks)

– **END OF QUESTIONS** –

FINAL EXAMINATION

SEMESTER / SESSION : SEM I / 2019/2020 PROGRAMME CODE : BWQ/BWA
COURSE NAME : INDUSTRIAL QUALITY CONTROL COURSE CODE : BWB 31403

				$\overline{X}$ and R Charts			$\overline{X}$ and S Charts		
n	d_2	d_3	C_4	A_2	D_3	D_4	A_3	B_3	B_4
2	1.128	0.8525	0.7979	1.880	—	3.267	2.659	—	3.267
3	1.693	0.8884	0.8862	1.023	—	2.574	1.954	—	2.568
4	2.059	0.8798	0.9213	0.729	—	2.282	1.628	—	2.266
5	2.326	0.8798	0.9400	0.577	—	2.114	1.427	—	2.089
6	2.534	0.8480	0.9515	0.483	—	2.004	1.287	0.030	1.970
7	2.704	0.8332	0.9594	0.419	0.076	1.924	1.182	0.118	1.882
8	2.847	0.8198	0.9650	0.373	0.136	1.864	1.099	0.185	1.815
9	2.970	0.8078	0.9693	0.337	0.184	1.816	1.032	0.239	1.761
10	3.078	0.7971	0.9727	0.308	0.223	1.777	0.975	0.284	1.716
11	3.173	0.7873	0.9754	0.285	0.256	1.744	0.927	0.321	1.679
12	3.258	0.7785	0.9776	0.266	0.283	1.717	0.886	0.354	1.646
13	3.336	0.7704	0.9794	0.249	0.307	1.693	0.850	0.382	1.618
14	3.407	0.7630	0.9810	0.235	0.328	1.672	0.817	0.406	1.594
15	3.472	0.7562	0.9823	0.223	0.347	1.653	0.789	0.428	1.572
16	3.532	0.7499	0.9835	0.212	0.363	1.637	0.763	0.448	1.552
17	3.588	0.7441	0.9845	0.203	0.378	1.662	0.739	0.466	1.534
18	3.640	0.7386	0.9854	0.194	0.391	1.607	0.718	0.482	1.518
19	3.689	0.7335	0.9862	0.187	0.403	1.597	0.698	0.497	1.503
20	3.735	0.7287	0.9869	0.180	0.415	1.585	0.680	0.510	1.490
21	3.778	0.7272	0.9876	0.173	0.425	1.575	0.663	0.523	1.477
22	3.819	0.7199	0.9882	0.167	0.434	1.566	0.647	0.534	1.466
23	3.858	0.1759	0.9887	0.162	0.443	1.557	0.633	0.545	1.455
24	3.895	0.7121	0.9892	0.157	0.451	1.548	0.619	0.555	1.445
25	3.931	0.7084	0.9896	0.153	0.459	1.541	0.606	0.565	1.435