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UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER II
SESSION 2021/2022**

COURSE NAME : INDUSTRIAL ENGINEERING AND
QUALITY MANAGEMENT

COURSE CODE : BNM 31903

PROGRAMME CODE : BNM

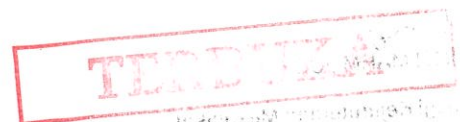
EXAMINATION DATE : JULY 2022

DURATION : 3 HOURS

INSTRUCTION : 1. ANSWER ALL QUESTIONS
2. THIS FINAL EXAMINATION IS
CONDUCTED VIA **CLOSED BOOK**
3. STUDENT ARE **PROHIBITED** TO
CONSULT THEIR OWN MATERIAL OR ANY
EXTERNAL RESOURCES DURING THE
EXAMINATION CONDUCTED VIA CLOSED
BOOK

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

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- Q1**
- (a) Outline the uniqueness of industrial engineering (IE)? (2 marks)
- (b) Industrial engineering (IE) known as the design or improvement of a system of people, machines, information, and money to achieve some goal with efficiency, quality and safety. Identify the task of industrial engineer in term of human, machine and quality. (3 marks)
- (c) List **FOUR (4)** examples of ergonomics environmental problems. (2 marks)
- (d) Outline **FOUR (4)** main risk factors for office related Cumulative Trauma Disorder (CTD). (4 marks)
- (e) **Figure Q1 (e)** shows several examples of bad posture at a desk. Suggest **NINE (9)** improvements for an ergonomics computer workstation. (9 marks)
- Q2**
- (a) Transportation model finds the least-cost means of shipping supplies from several origins to several destinations. List **THREE (3)** important information needed to be applied transportation model. (3 marks)
- (b) The three blood banks in Muar, Johor are coordinated through a central office that facilitates blood delivery to hospital in Johor. The cost to ship a standard container of blood from each bank to each hospital are shown in **Table Q2 (b)**. Also given are the biweekly number of container available at each bank and the biweekly number of containers of blood needed at each hospital. Identify the minimized total shipment cost. (5 marks)
- (c) An owner of European Ignition Manufacturing needs to expand his capacity. He is considering three locations, which is Athens, Brussel and Lisbon for a new plant. The company wishes to find the most economical location for an expected volume of 2000 units per year. The fixed cost per year at the sites are \$30,000, \$60,000 and \$110,000 for Athens, Brussel and Lisbon respectively. The variable costs are \$75 per unit, \$45 per unit and \$25 per unit for Athens, Brussel and Lisbon respectively. The expected selling price of each ignition system produced is \$120.
- (i) Calculate the total cost for all locations considered. (3 marks)

- (ii) Construct a graph for performing the locational cost volume analysis.
(4 marks)
- (iii) Calculate the crossover point between Athens and Brussle as well as between Brussle and Lisbon.
(2 marks)
- (iv) Interpret the answer from **Q2 (c) (iii)** for suitable location preferred.
(2 marks)
- (v) Calculate the expected profit for 2000 units.
(1 mark)

- Q3**
- (a) Quality is defined as meeting customer needs or conformance to requirements. Outline **TWO (2)** quality dimensions with examples.
(4 marks)
 - (b) Differentiate quality control and quality assurance, with respect to their definition and application.
(4 marks)
 - (c) Total quality management (TQM) can be achieved when an organization or business continuously make improvement to achieve goals or objectives, by involving the whole organization. Figure out **TWO (2)** benefits that an organization gains when TQM is applied.
(4 marks)
 - (d) A management system is the way where an organization manages the interrelated parts of its business in order to achieve its objectives. These objectives can relate to various scope such as product or service quality, environmental performance, and health and safety in the workplace. Management system standards are established and published as guidelines to the organization in managing business.
 - (i) State the international and national body that establish management system standards.
(2 marks)
 - (ii) One of management system standards available and widely used by organizations worldwide is ISO9001 Quality Management System (QMS). Describe **THREE (3)** requirements of ISO9001 that relate to leadership and management responsibility.
(6 marks)



- Q4** (a) Reliability is the probability that a product will perform its intended function satisfactorily for an intended life under certain stated environmental conditions. Outline reliability of a product with respect to numerical value and its intended life. (4 marks)
- (b) Design of a system or product that consists of many components reflect its reliability. Discuss the relationship between reliability and number of components in a system or product. Support your discussion with appropriate example. (6 marks)
- (c) In Agro Bank Pagoh, loan applications are processed through three clerks in which each clerk checks different sections of the application in series. The reliability of each clerk is 0.90, 0.85, and 0.99 respectively.
- (i) Draw a diagram to represent this system. (2 marks)
- (ii) Determine the reliability of the system. (2 marks)
- (d) Harun Medic Supplies, a medical equipment manufacturer, subjected 100 heart pacemakers to 5,000 hours of testing. Halfway through the testing, 7 pacemakers failed.
- (i) Determine the failure rate percentage, FN (%) (2 marks)
- (ii) Identify the number of failures per unit-year for the heart pacemaker. (4 marks)

- Q5** (a) There are several factors might contribute to variation. List **FOUR (4)** sources of variation with its **TWO (2)** examples for each source. (4 marks)
- (b) The ABC Manufacturing Company wishes to monitor and control the product's dimension during casting process. Each set of data is based on measurements described in **Table Q5 (b1)**. The values of A_2 , D_3 and D_4 are shown in **Table Q5 (b2)**.
- (i) Determine the control limits for the X-bar chart. (9 marks)
- (ii) Determine the control limits for the R-chart. (2 marks)
- (iii) Plot the X-bar chart for preliminary data with trial control limits. (2 marks)
- (iv) Plot the R-chart for preliminary data with trial control limits. (2 marks)
- (v) Discuss the quality condition of the dimension measurements. (1 mark)

- END OF QUESTIONS -



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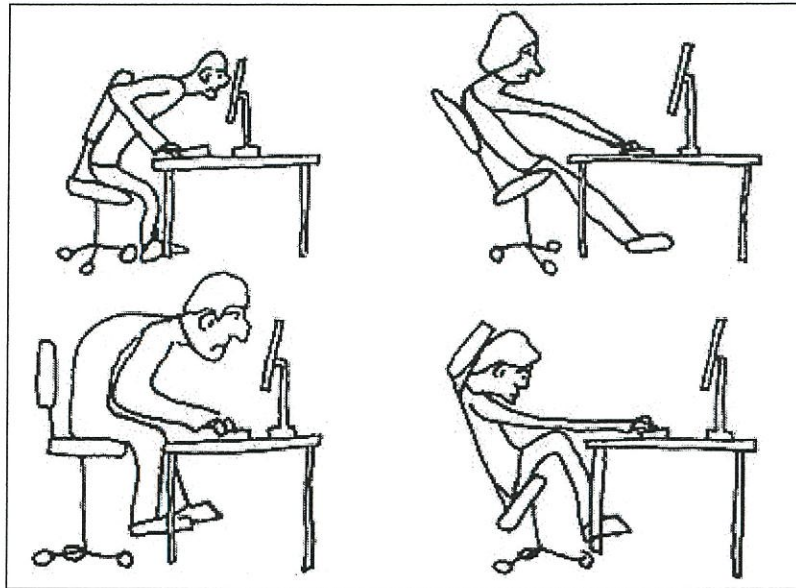


Figure Q1 (e)

Table Q2(b)

	TO				
FROM	Hospital A	Hospital B	Hospital C	Hospital D	Supply
Bank 1	\$8	\$9	\$11	\$16	50
Bank 2	\$12	\$7	\$5	\$8	80
Bank 3	\$14	\$10	\$6	\$7	120
Demand	90	70	40	50	250

TERBUKA

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Table Q5 (b1)

Subgroup Number	Date	Time	Measurements (mm)				
			X ₁	X ₂	X ₃	X ₄	X ₅
1	April 1	00:00	8.0	9.4	7.6	8.8	8.9
2		02:00	9.3	8.8	9.2	9.2	8.2
3		04:00	7.4	7.4	7.9	9.0	8.1
4		06:00	9.3	8.0	7.4	7.9	8.2
5		08:00	9.4	7.9	9.6	9.4	9.2
6	April 2	00:00	8.7	9.3	8.8	8.9	8.7
7		02:00	8.0	8.5	8.1	8.4	8.4
8		04:00	9.6	8.3	8.3	7.9	8.9
9		06:00	8.4	7.6	8.7	8.5	8.0
10		08:00	9.4	8.7	9.0	9.6	9.4
11	April 3	00:00	8.5	8.1	9.6	8.3	8.2
12		02:00	8.5	8.5	8.0	9.0	9.4
13		04:00	8.0	9.2	8.2	8.5	8.4
14		06:00	8.1	8.8	9.4	8.4	7.9
15		08:00	7.8	9.6	9.0	8.0	8.3

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Table Q5 (b2)

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

OBSERVATIONS IN SAMPLE, <i>n</i>	CHART FOR AVERAGES				CHART FOR STANDARD DEVIATIONS				CHART FOR RANGES					
	FACTORS FOR CONTROL LIMITS		CENTRAL LINE		FACTORS FOR CONTROL LIMITS		CENTRAL LINE		FACTORS FOR CONTROL LIMITS		CENTRAL LINE			
	A	A ₂	A ₃	C ₄	B ₃	B ₄	B ₅	B ₆	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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