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UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
(ONLINE)
SEMESTER II
SESSION 2019/2020**

COURSE NAME : INDUSTRIAL ENGINEERING
COURSE CODE : BDA 40703
PROGRAMME : BDD
EXAMINATION DATE : JULY 2020
DURATION : 3 HOURS
INSTRUCTION : ANSWER ANY **FIVE (5)** FROM **SIX (6)**
QUESTIONS PROVIDED

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

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- Q1** (a) Cumulative Trauma Disorder (CTD) is one of the threats to employees in the workplace. Employees who develop CTD often experience pain and injuries, and in some cases may require surgery.
- (i) Explain **TWO (2)** potential causes of CTD. (4 marks)
- (ii) Suggest **THREE (3)** interventions that can reduce the risk of CTD. (6 marks)
- (b) As an Industrial Engineer at Tababa Company, you are required to design a standing workplace for one employee which includes a stand desk. Suggest the standing workplace using appropriate ergonomics concepts. Support your suggestion with suitable illustration and working postures explanation. (10 marks)

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Q2 (a) Name **TWO (2)** quantitative methods that can be used in selecting facility location with cost effective.

(4 marks)

(b) A company supplies various types of animal feed to industries in Asia. This company plans to find a new location since the transportation costs are high. Currently, more than 600,000 tons of animal feed are to be shipped to major customer locations as shown in **Table 1**.

Table 1: Location and supply data

Location	Coordinate		Supplied (Ton)
	X	Y	
A	7	13	5,000
B	8	12	92,000
C	11	10	70,000
D	11	7	35,000
E	12	4	9,000
F	13	11	227,000
G	14	10	16,000
H	15	5	153,000

(i) Propose the economic location using Minisum method.

(6 marks)

(ii) Based on new location in **Q2(b)**, estimate the Supply-Distance score.

(2 marks)

(c) FL company is considering several locations for a new plant. Annual fixed cost and variable cost are as shown in **Table 2**. Using total cost graph, propose the range in volume over which each location would be best.

(8 marks)

Table 2: Fixed cost and variable cost data

Location	Fixed Cost (RM)	Variable Cost (RM / unit)
A	32.0 million	1,000
B	9.6 million	520
C	13.6 million	360
D	18.0 million	260

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- Q3** (a) Five sheet metal jobs are waiting to be assigned at work centre. **Table 3** shows the processing times and due date information.
- (i) Determine the sequence of jobs to minimize the average processing time for the five jobs based on First Come First Serve (FCFS), Shortest Processing Time (SPT), and Earliest Due Date (EDD) sequencing rules (8 marks)
 - (ii) Based on results in **Q3(a)**, decide the best sequence rules for starting the job. Justify your decision. (2 marks)

Table 3: Sheet metal job data

Job	Processing Time (days)	Due date (days)
A	6	8
B	2	6
C	8	18
D	3	15
E	9	23

- (b) At the end of each month, a research and development team writes status reports for the projects at work. The team leaders, Andrew and Julie, submit them to the R&D director on the first Monday of each month. Unfortunately, they forgot to check their calendar one month until late Friday evening. To their surprise, they discovered that the month ended on Sunday and the reports were due the following Monday morning. As they had not started writing them, they decided to come to work early Saturday morning, so they could finish the reports before Monday morning. They split the work as follows: Andrew writes and edits the reports while Julie collates data and draws all the necessary graphs. Assume that Julie starts her work on a report as soon as Andrew is finished with it and that Andrew works continuously. Times for the reports (in hours) are shown in **Table 4**. Propose the order of the tasks using Johnson's rule, the makespan and idle time. (10 marks)

Table 4. Average processing time (minute)

Projects	Andrew	Julie
A	4	2
B	3	5
C	5	1
D	7	3
E	8	6

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Q4 Forecasting is an important activity to help a company managing a smooth production planning. A few monthly sales data for a company involves with the manufacturing of passenger lifts is shown in **Table 5**. Analyze the given information to forecast sales for the month of January the next coming year using the following methods:

(a) Naïve (1 mark)

(b) 3-period simple moving average and 3-period weighted moving average using weightage factors of 0.5, 0.3 and 0.2. (4 marks)

(c) Simple exponential smoothing using $\alpha = 0.2$. Assume the forecast for month of October is 24. (5 marks)

(d) Using linear trend method. Use Table Q4(b) as guide.

$$m = \frac{n \sum xy - \sum x \sum y}{n \sum x^2 - (\sum x)^2} \quad c = \frac{\sum y - m \sum x}{n}$$

(7 marks)

Table 5: Sales data for imported vehicles

July	Aug	Sep	Oct	Nov	Dec
18	19	24	21	25	27

(e) A production planner in the company said that, “If we want to forecast for the month of June the next coming year using the data in **Table 6**, we can use the method of simple exponential smoothing and linear trend.” Evaluate this statement and provide your comment whether is it true? Support your answer with brief explanation.

(3 marks)

Table 6: Linear trend computational data

Month	Sales	X	Y	XY	X ²
July	18	1	18	18	1
Aug	19	2	19	38	4
Sep	24	3	24	72	9
Oct	21	4	21	84	16
Nov	25	5	25	125	25
Dec	27	6	27	162	36

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- Q5** (a) JIT (just in time) partnerships exist when a supplier and purchaser work together to remove waste and drive down costs. Elaborate **FOUR (4)** goals of JIT partnerships. (4 marks)
- (b) RDO, Inc., sells three models of radar detector units. It buys the three basic models (E, F, and G) from a Japanese manufacturer and adds one, two, or four lights (component D) to further differentiate the models. D is bought from a domestic producer. Lead times are one week for all items except C, which is two weeks. There are ample supplies of the basic units (E, F, and G) on hand. There are also 10 units of B, 10 units of C, and 25 units of D on hand. Lot-sizing rules are lot-for-lot ordering for all items except D, which must be ordered in multiples of 100 units. There is a scheduled receipt of 100 units of D in week 1. The master schedule calls for 40 units of A to be produced in week 4, 60 units of B in week 5, and 30 units of C in week 6. Create a material requirements plan for D and its parents. Overall product structure tree is shown in **Figure Q5**. (16 marks)
- Q6** (a) Differentiate between Quality Control and Quality Assurance. Support your comparison with suitable explanation. (4 marks)
- (b) **Table 7** shows the lengths for circuit board manufactured in Albina company.
- (i) Solve the average and range for subgroup 20, 21, 22, 23, 24 and 25. Use three decimal points. (3 marks)
- (ii) Determine upper and lower control limits for \bar{X} chart. Use the information in **Table Q6(b)(ii)** to compute the control chart limits. (7 marks)
- (iii) Construct \bar{X} control chart. (4 marks)
- (iv) Based on Q6(b)(iii), evaluate whether the process is in control. Justify your answer. (2 marks)

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Table 7: Circuit board lengths

Subgroup Number	Lengths					Average \bar{X}	Range R
	X ₁	X ₂	X ₃	X ₄	X ₅		
1						5.010	0.038
2						5.001	0.019
3						5.008	0.036
4						5.003	0.022
5						5.003	0.026
6						4.996	0.024
7						5.000	0.012
8						4.997	0.030
9						5.005	0.014
10						4.998	0.017
11						4.994	0.008
12						5.001	0.011
13						4.998	0.029
14						4.990	0.039
15						5.006	0.016
16						4.997	0.021
17						5.001	0.026
18						5.007	0.018
19						4.998	0.021
20	5.000	5.010	5.013	5.020	5.003		
21	4.988	5.001	5.009	5.005	4.996		
22	5.004	4.999	4.990	5.006	5.009		
23	5.010	4.989	4.990	5.009	5.014		
24	5.015	5.008	4.993	5.000	5.010		
25	4.982	4.984	4.995	5.017	5.013		

Table 8: Factors for calculating \bar{X} and R control charts

Size of sample (n)	Factor for UCL and LCL for \bar{X} -charts (A ₂)	Factor for LCL for R-charts (D ₃)	Factor for UCL for R-charts (D ₄)
2	1.880	0	3.267
3	1.023	0	2.574
4	0.729	0	2.282
5	0.577	0	2.114
6	0.483	0	2.004
7	0.419	0.076	1.924
8	0.373	0.136	1.864
9	0.337	0.184	1.816
10	0.308	0.223	1.777

- END OF QUESTION -

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FIGURE

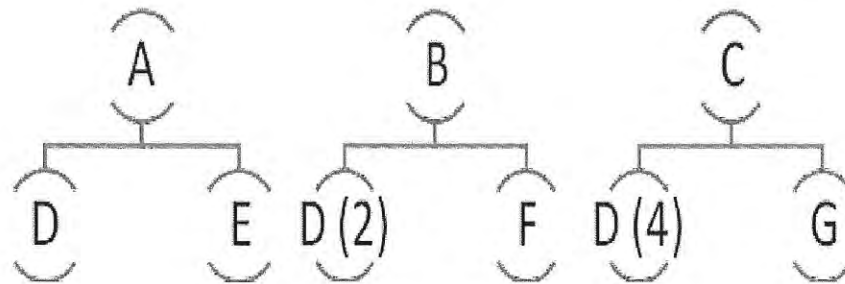


FIGURE Q5

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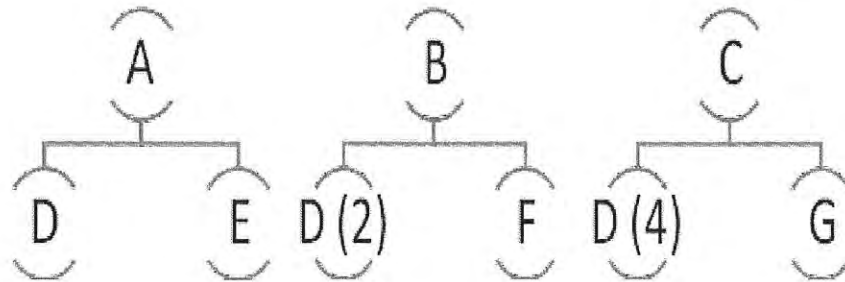


FIGURE Q5

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