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UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER I
SESSION 2019/2020**

COURSE NAME : OPTIMIZATION
OPERATION RESEARCH

COURSE CODE : BWB 32203

PROGRAMME CODE : BWQ

EXAMINATION DATE : DECEMBER 2019/JANUARY
2020

DURATION : 3 HOURS

INSTRUCTION : ANSWER ALL QUESTIONS
ONLY

THIS QUESTION PAPER CONSISTS OF **FIVE (5)** PAGES

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Q1 An electronic firm manufactures integrated circuits for radios, televisions and stereos. For the next month, they have available 1500 units of materials and 920 hours of labor. The requirements and profit for each of the products are given in **Table Q1**.

Table Q1

Products	Unit of Material	Hour of Labor	Profit (RM)
Radio	2	1	8
Television	12	8	60
Stereo	15	6	45

- (a) Construct a linear programming model that represents the product mix problem. (3 marks)

- (b) Using the simplex method, recommend an optimal solution for the company. (17 marks)

Q2 Surya Roshni Sdn Bhd has three factories, known as factory X, Y and Z. They supply goods to four dealers spread out all over the country. The production capacities of these factories are 200, 500 and 200 per month, respectively. However, the total for supplies and demands are not same making it unbalanced. The detail of profit (in RM) distribution is shown in **Table Q2**.

Table Q2

Dealer \ Factory	A	B	C	D	Capacity
X	12	18	6	25	200
Y	8	7	10	18	500
Z	14	3	11	20	200
					900
Demand	180	320	100	400	1000

- (a) Estimate an initial solution of suitable allocation to maximize the total net return by using Vogel's Approximation Method (VAM). (10 marks)

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2

- (b) Using the modified distribution (MODI) method, recommend an optimal solution for the company.

(10 marks)

Q3 Alice will be turning 18 years old, and her mother, Janice has planned and organized a memorable special birthday party for Alice. Janice has an estimated time of 18 days to complete this party. She has listed the following activity information for this project as in **Table Q3**.

Table Q3

Activity	Description	Preceding Activity	Optimistic (<i>a</i>)	Most Likely (<i>m</i>)	Pessimistic (<i>b</i>)
A	Decide on key details	-	1	2	3
B	Organize entertainment	A	3	4	5
C	Hire equipment	A	6	7	8
D	Create slideshow	A	8	9	10
E	Organize speeches	A	6	7	8
F	Catering	B,C,D,E	3	4	5
G	House preparation	B,C,D,E	1	2	3
H	Checklist of the day	F,G	0.17	0.33	0.67

- (a) Calculate the expected time (*t*) for each activity. (2 marks)
- (b) Illustrate the project network for Birthday Party Alice using the program evaluation and review technique (PERT). (7 marks)
- (c) Point out the critical path using the critical path method (CPM). (3 marks)

TERBUKA 3

- (d) Predict the probability of Alice Birthday Party's completion, which is less the 18 days.

(8 marks)

- Q4** (a) List **FOUR (4)** types of classification for service facility in queuing system. (4 marks)

- (b) In a departmental store, one cashier is assigned to serve the customers with salary of RM2 per hour and the customers pick up their needs by themselves. The arrival rate is 9 customers for every 5 minutes and the cashier can serve 10 customers in 5 minutes. Assume that the arrival rate follows a Poisson distribution and the service rate follow an exponential distribution. Calculate

- (i) the average number of customer in the system. (2 marks)

- (ii) the average waiting time in the system. (2 marks)

- (iii) the average number of customer in the queue. (2 marks)

- (iv) the average waiting time in the queue. (2 marks)

- (v) the probability of system utilization. (2 marks)

- (vi) the total daily cost for the system. (6 marks)

- Q5** (a) Explain **FOUR (4)** steps in dynamic programming and list **TWO (2)** examples of problem that can be solved using dynamic programming. (6 marks)

- (b) The manager of a car wash company wish to determine a new policy for managing the business. He wants to do simulation for the daily demand for a number of days. He had recorded the number of cars arriving per hour during the past 200 hours of operation as shown in **Table Q5(b)**.

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Table Q5(b)

Number of Cars Arriving	Frequency
2	10
3	20
4	30
5	25
6	30
7	35
8	50
Total	200

- (i) Construct the cumulative probability distribution and random number interval for the number of car arrivals.
(6 marks)
- (ii) Test and do the simulation for 15 hours of car arrivals by using random numbers of 52, 37, 82, 69, 98, 96, 33, 50, 88, 90, 50, 27, 45, 81 and 66. Give your conclusion.
(8 marks)

- END OF QUESTIONS -

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