Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2018/2019

COURSE NAME	:	OPTIMIZATION OPERATION RESEARCH
COURSE CODE	:	BWB 32203
PROGRAMME CODE	:	BWQ
EXAMINATION DATE	:	DECEMBER 2018/JANUARY 2019
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **ALL** QUESTIONS

THIS QUESTION PAPER CONSISTS OF **SIX (6)** PAGES

Q1 (a) A company is in the process of preparing a budget for launching a new product. **Table Q1(a)** provides the associated activities and their durations.

Table Q1(a): Activities of Preparing for Launching

	Activity	*a*	*m*	*b*	Predecessor(s)
A	Forecast sales volume	1	4	7	-
B	Study competitive market	2	2	2	-
C	Design item and facilities	2	5	8	**A**
D	Prepare production schedule	3	4	5	**A**
E	Estimate cost of production	4	6	8	**C, B**
F	Set sales price	0	0	6	**C, B**
G	Prepare budget	3	6	9	**D, E**

(i) Construct the project network with all expected activity time, variances and slacks.

(6 marks)

(ii) Check the slack for each activity and recommend the critical path and completion time for the project.

(5 marks)

(iii) Calculate the probability that the project will be completed within 23 days.

(5 marks)

(b) The ICARE Company has three plants located throughout a state with production capacity 50, 75 and 25 gallons. Each day the firm must furnish its four retail shops R1, R2, R3, & R4 with at least 20, 20, 50, and 60 gallons respectively. The economic problem is to distribute the available product to different retail shops in such a way so that the total transportation cost is minimum. The transportation costs (in RM) are given as in **Table Q1(b)**.

Table Q1(b): Transportation Cost

Retail / Company	R1 (RM)	R2 (RM)	R3 (RM)	R4 (RM)	Supply
P1	3	5	7	6	50
P2	2	5	8	2	75
P3	3	6	9	2	25
Demand	20	20	50	60	150

(i) Estimate the initial solution using Northwest Corner Rule method.
(3 marks)

(ii) Recommend the optimal solution using Stepping-Stone method.
(6 marks)

Q2 (a) There is a sales manager who works under a toy manufacturing organization. There are three excellent sales persons who currently meeting buyers in three different cities. In details, they are now in Austin, Boston and Chicago. The sales manager would like to assign a new task for every sales person and they need to fly to another three cities: Denver, Edmonton, and Fargo. The cost of airplane tickets (in dollars) between these cities are tabulated as shown in **Table Q2(a)**.

Table Q2(a): Cost of Airplane Ticket (in $)

From \ To	Denver	Edmonton	Fargo
Austin	250	400	350
Boston	400	600	350
Chicago	200	400	250

By considering the cost of airplane tickets, the sales manager decides to obtain an optimal solution in setting the destination for each sales person in order to minimize the airfare. Recommend the optimal solution using Hungarian Method.
(7 marks)

(b) Once upon a time there was a city that had no roads. Getting around the city was particularly difficult after rainstorms because the ground became very muddy. Cars got stuck in the mud and people got their boots dirty. The mayor of the city decided that some of the streets must be paved, but did not want to spend more money than necessary because the city also wanted to build a swimming pool. The mayor therefore specified one condition: enough streets must be paved so that it is possible for everyone to travel from their house to anyone else's house only along paved roads.

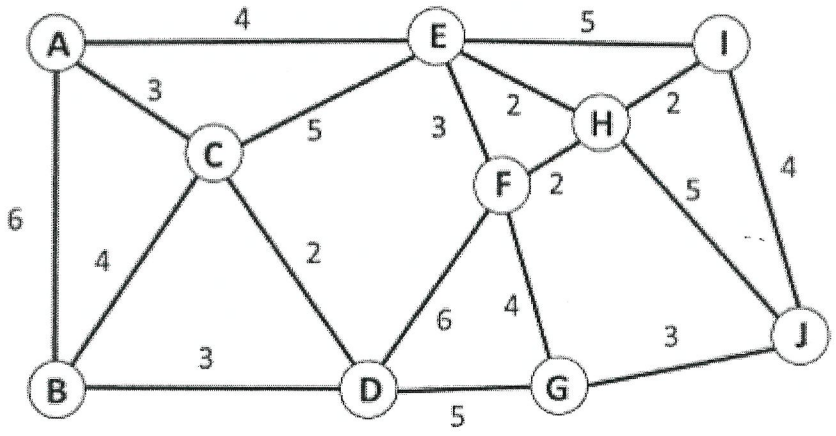

Figure Q2(b): Graph of the Number of Paving Stones Between Each House

Figure Q2(b) shows the layout of the city. The number of paving stones between each house represents the distance of paving that route. Illustrate the best route that connects all the houses using Minimal Spinning Tree method.

(10 marks)

(c) There is a communication network, in which certain pairs of nodes are linked by connections; each connection has a limit to the rate at which data can be sent.

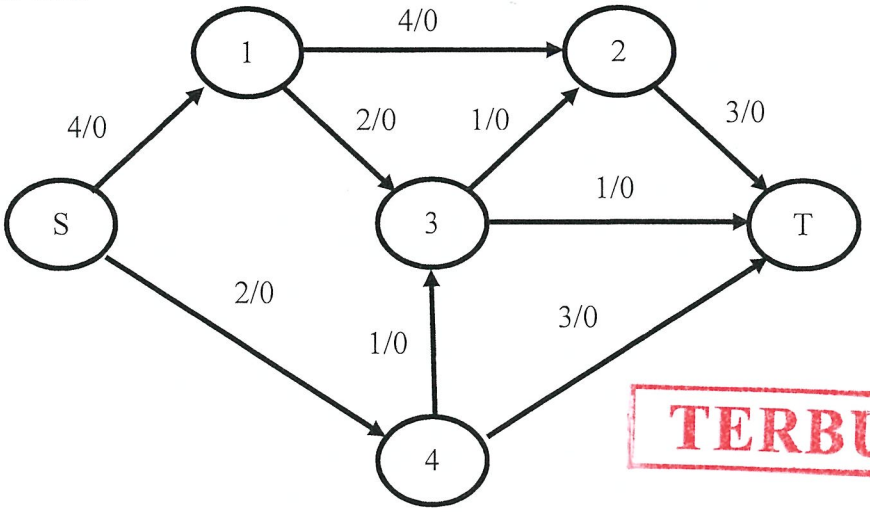

Figure Q2(c): Communication Network

Given two nodes on the network, measure the maximum rate using Maximal Flow method at which one can send data to the other, assuming no other pair of nodes are attempting to communicate.

(8 marks)

Q3 (a) Automata car wash facility operates with only one bay. Cars arrive according to a Poisson distribution with a mean of four cars per hour, and may wait in the facility's parking lot if the bay is busy. The time for washing and cleaning a car is exponential, with a mean of 10 minutes. The cost of car waiting time in line is RM 10 per hour while the service cost of the workers is RM 6 per hour. Cars that cannot park in the lot can wait in the street bordering the wash facility. This means that, for all practical purposes, there is no limit on the size of the system. Calculate :

(i) the average number of cars in the system, L,

(2 marks)

(ii) the average time a car spends in the system, W,

(2 marks)

(iii) the average number of cars in the queue, L_q,

(2 marks)

(iv) the average time a car spends waiting in the queue, W_q,

(2 marks)

(v) the utilization factor for the system, ρ,

(2 marks)

(vi) the percent of idle time, P_0,

(2 marks)

(vii) total daily cost of queuing system.

(5 marks)

(b) Compare the differents between Dynamic Programming and Linear Programming methods.

(4 marks)

(c) Explain four steps in Dynamic Programming.

(4 marks)

Q4 (a) Describe the process of simulation.

(7 marks)

(b) The number of patients arriving per hour at Hospital Ampuan Rahimah during the past 200 hours of operation is observed as shown in **Table Q4(b)**.

Table Q4(b): Number of Patients' Arrival

Number of Patients' Arrival	Frequency
2	10
3	20
4	30
5	25
6	30
7	35
8	50

Based on the **Table Q4(b)** above:

(i) prepare a probability and cumulative probability distribution for the number of patients' arrivals.

(4 marks)

(ii) calculate the mean of the distribution obtained in **Q4(b)(i)**.

(2 marks)

(iii) construct random number intervals for the number of patients' arrivals.

(2 marks)

(iv) simulate 15 hours of patients' arrivals and compute the average number of patients' arrivals per hour. Use the random numbers 52, 37, 82, 69, 98, 96, 33, 50, 88, 90, 50, 27, 45, 81 and 66 for the simulation. Compare the average with the mean obtained in **Q4(b)(ii)**.

(10 marks)

- END OF QUESTIONS -