UTHM
Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2017/2018

COURSE NAME	:	OPTIMIZATION OPERATION RESEARCH
COURSE CODE	:	BWB 32203
PROGRAMME CODE	:	BWQ
EXAMINATION DATE	:	DECEMBER 2017/JANUARY 2018
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **ALL** QUESTIONS

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

Q1 (a) You and several friends are about to prepare a lasagna for dinner. The tasks to be performed, their immediate predecessors and their estimated durations are as in **Table Q1(a)**.

Table Q1(a): Activities of Preparing for Dinner

Activity	Predecessor(s)	Duration (minutes)
A: Buy the mozzarella cheese	-	30
B: Slice the mozzarella	*A*	5
C: Beat 2 eggs		2
D: Mix eggs and ricotta cheese	*C*	3
E: Cut up onions and mushrooms		7
F: Cook the tomato sauce	*E*	25
G: Boil large quantity of water		15
H: Boil the lasagna noodles	*G*	10
I: Drain the lasagna noodles	*H*	2
J: Assemble all the ingredients	*I, F, D, B*	10
K: Preheat the oven		15
L: Bake the lasagna	*J, K*	30

(i) Construct the project network for preparing this dinner.

(9 marks)

(ii) Analyse the slack for each activity and determine the critical path for the project.

(5 marks)

(iii) Because of a phone call, you were interrupted for 6 minutes when you should have been cutting the onions and mushrooms. By how much will the dinner be delayed? If you use your food processor, which reduces the cutting time from 7 to 2 minutes, will the dinner still be delayed?

(3 marks)

(b) Compare the starting solutions obtained by the northwest corner rule and Vogel methods.

Table Q1(b): Transportation Problem

		Destination			Supply
		1	2	3	
Source	1	1	2	6	7
	2	0	4	2	12
	3	3	1	5	11
Demand		10	10	10	

(8 marks)

Q2 (a) Newell and Jeff are the two barbers in a barber shop they own and operate. They provide two chairs for customers who are waiting to begin a haircut, so the number of customers in the shop varies between 0 and 4. For $n = 0$, 1, 2, 3, 4, the probability P_n that exactly n customers are in the shop is P_0=1/16, P_1=4/16, P_2=6/16, P_3=4/16, P_4=1/16.

(i) Calculate L. How would you describe the meaning of L to Newell and Jeff?

(3 marks)

(ii) For each of the possible values of the number of customers in the queuing system, specify how many customers are in the queue. Then calculate L_q. How would you describe the meaning of L_q to Newell and Jeff?

(4 marks)

(iii) Given that an average of 4 customers per hour arrive and stay to receive a haircut, determine W and W_q. Describe these two quantities in terms meaningful to Newell and Jeff.

(5 marks)

(b) The World Health Council is devoted to improving health care in the underdeveloped countries of the world. It now has five medical teams available to allocate among three such countries to improve their medical care, health education and training programs. Therefore, the council needs to determine how many teams (if any) to allocate to each of these countries to maximize the total effectiveness of the five teams. The teams must be kept intact, so the number allocated to each country must be an integer. The measure of performance being used is *additional person-years of life.* (For a particular country, this measure equals the *increased life expectancy* in years times the country's population). **Table Q2** gives the estimated additional person-years of life (in multiples of 1,000) for each country for each possible allocation of medical teams. Which allocation maximises the measure of performance?

Table Q2: Data for the World Health Council Problem

Medical Teams	Thousands of Additional Person-Years of Life		
	Country		
	1	**2**	**3**
0	0	0	0
1	45	20	50
2	70	45	70
3	90	75	80
4	105	110	100
5	120	150	130

(13 marks)

Q3 (a) Consider the game having the following payoff table as shown in **Table Q3(a)**. Determine the value of the game and generate the optimal mixed strategy for each player according to the minimax criterion using graphical procedure.

Table Q3(a): Payoff Table

Strategy		*Player 2*		
		1	**2**	**3**
Player 1	**1**	4	3	1
	2	0	1	2

(5 marks)

(b) Consider the game having the payoff table as shown in **Table Q3(b)**.

Table Q3(b): Payoff Table

Strategy		*Player 2*		
		1	**2**	**3**
Player 1	**1**	-3	1	2
	2	1	2	1
	3	1	0	-2

(i) Formulate the problem of finding optimal mixed strategies according to the minimax criterion as a linear programming problem.

(5 marks)

(ii) Propose optimal mixed startegies using simplex method.

(15 marks)

Q4 (a) Describe the process of simulation.

(7 marks)

(b) The number of cars arriving per hour at Taman U's Car Wash during the past 200 hours of operation is observed as shown in **Table Q4**.

Table Q4: Number of Cars Arriving

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

Based on the **Table Q4** above:

(i) Prepare a probability and cumulative probability distribution for the number of car arrivals.

(4 marks)

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

(2 marks)

(iii) Generate random number intervals for the number of car arrivals.

(2 marks)

(iv) Simulate 15 hours of car arrivals and compute the average number of car 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 -