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UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER II
SESSION 2018/2019**

COURSE NAME : MANAGEMENT SCIENCE I
COURSE CODE : BPB 20403
PROGRAMME CODE : BPA
EXAMINATION DATE : JUNE / JULY 2019
DURATION : 3 HOURS
INSTRUCTION : ANSWER ALL QUESTIONS

THIS QUESTION PAPER CONSISTS OF SIX (6) PAGES

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- Q1** (a) Arif is considering the possibility of teaching swimming to kids during the school holiday. The cost of renting the pool during the ten week period for which Arif would need is RM1,700. Arif would also be charged an admission, towel service, and life guarding fee of RM7 per pupil. Arif estimate an additional RM5 cost per student to hire several assistants. Arif plan to charge RM75 per student for a ten-week swimming class.
- (i) Calculate the number of pupils Arif needs to enroll in the swimming class to break even. (3 marks)
 - (ii) Compute the number of pupils to enroll, if Arif want to make a profit of RM5,000 for the school holiday. (4 marks)
 - (iii) Determine the fee should be charged per pupil in order to realize profit goal of RM5,000 if Arif plans to enroll 60 pupils. (3 marks)
- (b) Sketch a break-even chart showing the profit and loss around the break-even point. (10 marks)

- Q2** (a) The three blood banks in Johor Bahru are coordinated through a central office that facilitates blood delivery to four hospitals in the region. The cost to ship a standard container of blood from each bank to each hospital is shown in the **Table Q2**. Also given are the number of containers available at each bank and the number of containers of blood needed at each hospital.

Table Q2: Bank supplies, hospital demand and shipping cost (RM)

From	To				Supply
	Hospital 1	Hospital 2	Hospital 3	Hospital 4	
Bank 1	9	7	10	10	40
Bank 2	10	13	14	8	55
Bank 3	15	10	17	6	45
Demand	50	30	35	25	140

Compute the optimal solution by using the Stepping Stone method. (15 marks)

- (b) As part of a quality improvement initiative, Consolidated Electronics plan a complete a three-day training program on teaming and a two-day training program on problem solving for their employees. The manager of quality improvement has requested that at least eight training programs on teaming and at least ten training programs on problem solving be offered during the next six months. In addition, senior-level management has specified that at least 25 training programs must be offered during this period. Consolidated Electronics uses a consultant to teach the training programs. During the next six months, the consultant has 84 days of training available. Each training program on teaming costs RM10,000 and each training program on problem solving costs RM8,000.

Formulate a linear programming model to minimise the cost for this problem.
(5 marks)

- Q3** (a) The Only Maths Company is in the business of buying and selling grain. An important aspect of the company's business is arranging for the purchased grain to be shipped to customers. If the company can keep freight costs low, profitability will improve. The company recently purchased three rail cars of grain at Penang; six rail cars at Shah Alam; and five rail cars at Johor Bahru. Twelve carloads of grain have been sold. The locations and the amount sold at each location are shown in **Table Q3(a)**.

Table Q3(a): Locations and the amount sold at each location

Locations	Number of rail car loads
Kuantan	2
Seremban	4
Kedah	3
Melaka	3

All shipments must be routed through either Kuala Lumpur or Putrajaya. **Table Q3(b)** shows the shipping costs from Penang, Shah Alam and Johor Bahru to Kuala Lumpur and Putrajaya.

Table Q3(b): Shipping cost (RM) from Penang, Shah Alam and Johor Bahru to destinations

Locations	To	
	Kuala Lumpur	Putrajaya
Penang	8	6
Shah Alam	3	8
Johor Bahru	9	3

Table Q3(c) shows the shipping costs from Kuala Lumpur and Putrajaya to Kuantan, Seremban, Kedah and Melaka.

Table Q3(c): Shipping costs (RM) from Kuala Lumpur and Putrajaya to destinations

From	To			
	Kuantan	Seremban	Kedah	Melaka
Kuala Lumpur	22	17	30	18
Putrajaya	15	35	20	25

- (i) Illustrate a network representation of this problem. (5 marks)
 - (ii) Formulate a linear programming model of the problem. (5 marks)
- (b) The Petroco gasoline distributor in Jackson, supplies service stations in nine other southeastern cities. The location and the distance, in kilometres, to the service stations are given in the network shown in **Figure Q3(d)**.

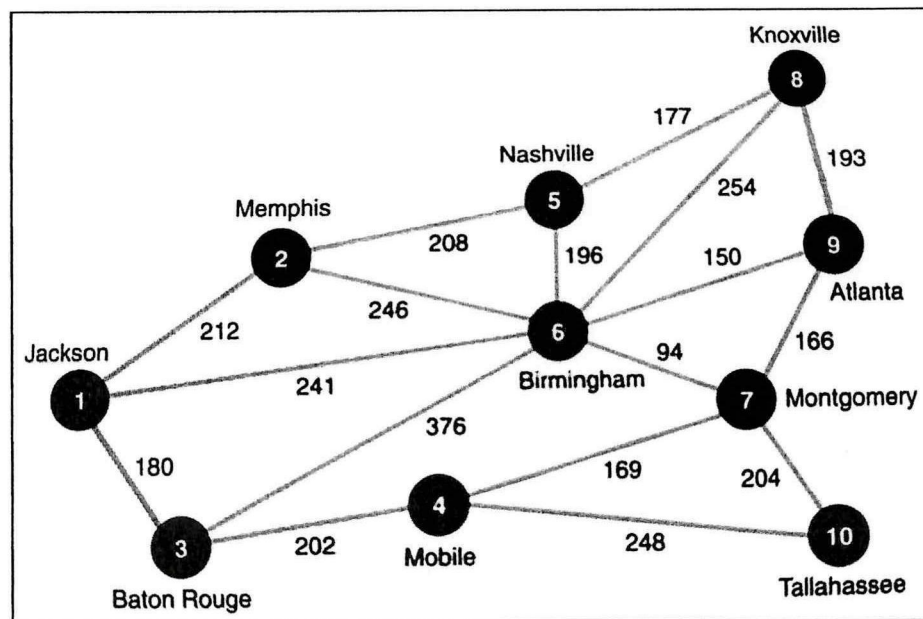


Figure Q3(d): The proximity of distributor in to its service stations

Propose a minimal spanning tree network that will connect all the cities and indicate the total distance.

(10 marks)

- Q4** A garment manufacturer has a production line making two styles of shirts. Style I requires 200 grams of cotton thread, 300 grams of dacron thread, and 300 grams of linen thread. Style II requires 200 grams of cotton thread, 200 grams of dacron thread and 100 grams of linen thread. The manufacturer makes a net profit of RM19 on Style 1 and RM15 on Style II. He has in hand an inventory of 2.4 kg of cotton thread, 2.6 kg of dacron thread and 2.2 kg of linen thread. His immediate problem is to determine a production schedule, given the current inventory to make a maximum profit.
- (a) Formulate an integer linear programming model. (5 marks)
- (b) Illustrate the constraints for this problem with a standard scale in sketching. Use dots to indicate all feasible integer solutions. (7 marks)
- (c) Determine the optimal solution to the LP Relaxation, and round down to find a feasible integer solution. (4 marks)
- (d) Identify the optimal integer solution for this problem. (2 marks)
- (e) Compare the solution obtained in **Q4(c)** by rounding down with **Q4(d)**. (2 marks)

- Q5** Ashworth Industries would like to make a price and production decision on two of its products. Define Q_A and Q_B as the quantities of products A and B to produce and P_A and P_B as the price for products A and B . The weekly quantities of A and B that are sold are functions of the prices, according to the following expressions:

$$Q_A = 5500 - 200P_A + 50P_B$$

$$Q_B = 4500 - 225P_B + 100P_A$$

The fixed cost and the variable cost for product A are RM2,000 and RM18 per unit respectively. The fixed cost and the variable cost for product B are RM1,000 and RM12 per unit respectively.

- (a) Ashworth Industries normally priced the products at RM25 and RM20 for product A and B , respectively.

Identify the number of products need to be sold and the gross profit with this pricing policy.

(6 marks)

- (b) Formulate an expression for gross profit as a function of the selling prices for the two products.

(4 marks)

- (c) (i) Calculate the optimal prices for Ashworth Industries to charge.

(6 marks)

- (ii) Determine the number of units of each products need to be sold and the gross profit based on answer in **Q5c(i)**.

(4 marks)