

CONFIDENTIAL



UTHM
Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER I
SESSION 2017/2018**

COURSE NAME : MANAGEMENT SCIENCE I
COURSE CODE : BPB 20403
PROGRAMME CODE : BPA
EXAMINATION DATE : DECEMBER 2017 / JANUARY 2018
DURATION : 3 HOURS
INSTRUCTION : ANSWER ALL QUESTIONS

TERBUKA

THIS QUESTION PAPER CONSISTS OF SIX (6) PAGES

CONFIDENTIAL

- Q1** (a) Rajini and Kamal are 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 Rajini and Kamal would need is RM1,700. The pool would also charge Rajini and Kamal an admission, towel service, and life guarding fee of RM7 per student, and Rajini and Kamal estimate an additional RM5 cost per student to hire several assistants. Rajini and Kamal plan to charge RM75 per student for a ten week swimming class.
- (i) Calculate the number of students Rajini and Kamal need to enroll in their class to break even. (3 marks)
 - (ii) Compute the number of students they need to enroll, if Rajini and Kamal want to make a profit of RM5,000 for the school holiday. (4 marks)
 - (iii) Determine the fee they need to charge per student in order to realize their profit goal of RM5,000 if Rajini and Kamal plan to enroll 60 students. (3 marks)
- (b) Sketch a break-even chart showing the profit and loss around the break-even point. (10 marks)

- Q2** (a) The Hickory Cabinet and Furniture Sdn Bhd produce sofas, tables, and chairs at its plant in Batu Pahat, Johor. The plant uses three main resources to make furniture: wood, upholstery and labor. The warehouse has a total capacity of 650 pieces of furniture. The resource requirements for each piece of furniture and the total resources available weekly are summarized in **Table Q2(a)** as follows:

Table Q2(a): Resource requirement for each piece of furniture

	Resource Requirements			Profit (RM)
	Wood (meter)	Upholstery (meter)	Labor (hour)	
Sofa	7	12	6	400
Table	5	0	9	275
Chair	4	7	5	190
Total available resources	2,250	1,000	240	

Formulate a linear programming model to maximise the profit for this problem. (5 marks)



(b) Consider the following linear programming model:

Maximise profit, $Z = 4A + 1B$

Subject to

$$10A + 2B \leq 30$$

$$3A + 2B \leq 12$$

$$2A + 2B \leq 10$$

$$A, B \geq 0$$

- (i) Determine the shadow price for binding constraints. (6 marks)
- (ii) Determine the range of feasibility for all the constraints. (9 marks)

Q3 (a) Digital Unlimited Sdn Bhd sells microcomputers to universities and colleges on the East Coast and ships them from three distribution plants. The plants' capacities are shown in **Table Q3(a)(i)**.

Table Q3(a)(i): Plants' Capacities

Plant	Capacity
P ₁ : Selangor	470
P ₂ : Penang	640
P ₃ : Johor	390

Four universities have ordered microcomputers that must be delivered and installed by the beginning of the academic year. The universities' demand are shown in **Table Q3(a)(ii)**.

Table Q3(a)(ii): Universities' Demand

University	Demand
U ₁ : Tech	520
U ₂ : A & M	200
U ₃ : State	400
U ₄ : Central	380

TERBUKA

The shipping and installation costs per microcomputer (in RM) from each plant to each university are shown in Table Q3(a)(iii).

Table Q3(a)(iii): Shipping and Installation Costs

From	To			
	U ₁	U ₂	U ₃	U ₄
P ₁	22	17	30	18
P ₂	15	35	20	25
P ₃	28	21	16	14

(i) Illustrate a network representation of this problem. (5 marks)

(ii) Formulate a linear programming model of the problem. (6 marks)

(b) A burger restaurant franchises in Kuala Lumpur are supplied from a central warehouse in Lembah Pantai. The location of the warehouse and its proximity, in minutes of travel time, to the franchises are given in the network shown in Figure Q3(b).

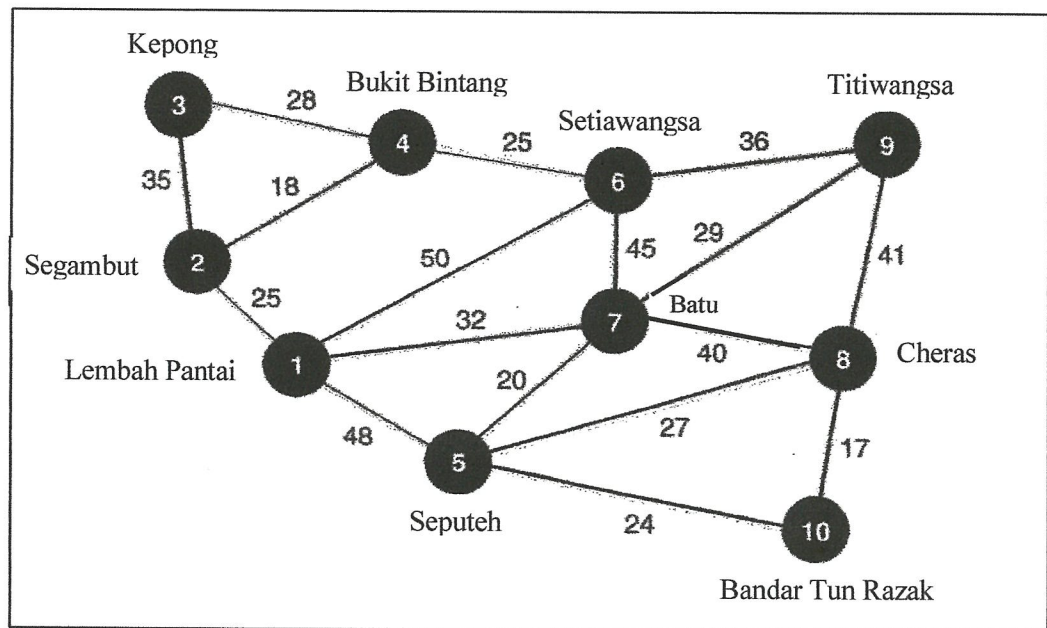


Figure Q3(b): The proximity of Lembah Pantai warehouse to its franchises

Propose the shortest route from the warehouse at Lembah Pantai to each of the nine franchises if the truck supply each franchise on a daily basis.

(9 marks)

- Q4** A jeweler and her apprentice make silver pins and necklaces by hand. They have 80 hours of labour and 36 grams of silver available each week. It requires 8 hours of labour and 2 grams of silver to make a pin and 10 hours of labour and 6 grams of silver to make a necklace. Each pin also contains a small gem of some kind. The demand for pins is no more than six per week. A pin earns the jeweler RM400 in profit, and a necklace earns RM100. The jeweler wants to know how many of each item to make each week to maximize 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)

TERBUKA

- Q5** Lawn King manufactures two types of riding lawn mowers. One is a low-cost mower sold primarily to residential home owners; the other is an industrial model sold to landscaping and lawn service companies. The company is interested in establishing a pricing policy for the two mowers that will maximize the gross profit for the product line. A study of the relationship between sales prices and quantities sold of the two mowers has validated the following price-quantity relationship.

$$q_1 = 950 - 1.5p_1 + 0.7p_2$$

$$q_2 = 2500 + 0.3p_1 - 0.5p_2$$

where

q_1 = number of residential mowers sold

q_2 = number of industrial mowers sold

p_1 = selling price of the residential mower in dollars

p_2 = selling price of the industrial mower in dollars

The accounting department developed cost information on the fixed and variable cost of producing the two mowers. The fixed cost of production for the residential mower is RM10,000 and the variable cost is RM1,500 per mower. The fixed cost of production for the industrial mower is RM30,000 and the variable cost is RM4,000 per mower.

- (a) Lawn King traditionally priced the lawn mowers at RM2,000 and RM6,000 for the residential and industrial mowers, respectively. Gross profit is computed as the sales revenue minus production cost.

Identify the number of mowers will be sold and 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 mowers.

(4 marks)

- (c) (i) Calculate the optimal prices for Lawn King to charge.

(6 marks)

- (ii) Determine units of each mower will be sold and the gross profit based on answer in Q5c(i).

(4 marks)

TERBUKA

-END OF QUESTIONS-