



UTHM

Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER I
SESSION 2013/2014**

COURSE NAME : MANAGEMENT SCIENCE I
COURSE CODE : BPB 2043 / BPB 20403
PROGRAMME : 2 BPA
EXAMINATION DATE : DECEMBER 2013/JANUARY 2014
DURATION : 3 HOURS
INSTRUCTION : ANSWER ALL QUESTIONS

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

- Q1** Eastman Publishing Company is considering publishing a paperback textbook on spreadsheet applications for business. The fixed cost of manuscript preparation, textbook design, and production setup is estimated to be RM80,000. Variable production and material costs are estimated to be RM3 per book. Demand over the life of the book is estimated to be 4,000 copies. The publisher plans to sell the text to college and university bookstores for RM20 each.
- (a) Determine the breakeven point. (4 marks)
 - (b) Illustrate the breakeven point by sketching the corresponding breakeven analysis graph. (6 marks)
 - (c) Calculate profit or loss can be anticipated with a demand of 4,000 copies. (3 marks)
 - (d) Calculate the minimum price per copy that the publisher must charge to break even if the demand is 4,000 copies. (4 marks)
 - (e) Calculate profit or loss, if the publisher believes that the price per copy could be increased to RM25.95 and not affect the demand of 4,000 copies. (3 marks)

- Q2** (a) The Hickory Cabinet and Furniture Company produces sofas, tables, and chairs at its plant in Greensboro, North Carolina. 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** as follows:

Table Q2

	Resource Requirements			Profit
	Wood (board ft.)	Upholstery (yd.)	Labor (hr.)	
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 maximize the profit for this problem. (6 marks)

- (b) Consider the following linear programming model:

Maximize 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 range of optimality for the coefficients of objective function. (8 marks)
- (ii) Determine the shadow price for binding constraints. (6 marks)

- Q3** (a) The distribution system for the Herman Company consists of three plants, two warehouses, and four customers. Plant capacities and shipping costs per unit (in RM) from each plant to each warehouse are shown in Table Q3(a):

Table Q3(a)(i)

Plant	Warehouse		Capacity
	W ₁	W ₂	
P ₁	4	7	450
P ₂	8	5	600
P ₃	5	6	380

Customer demand and shipping costs per unit (in RM) from each warehouse to each customer are as follows:

Table Q3(a)(ii)

Warehouse	Customer			
	C ₁	C ₂	C ₃	C ₄
W ₁	6	4	8	4
W ₂	3	6	7	7
Demand	300	300	300	400

- (i) Illustrate a network representation of this problem. (5 marks)
- (ii) Formulate a linear programming model of the problem.

(5 marks)

- (b) Don Yale, president of Hardrock Concrete Company, has plants in three locations and is currently working on three major construction projects, located at different sites. The shipping cost per truckload of concrete, plant capacities, and project requirements are provided in Table Q3(b):

Table Q3(b)

FROM \ TO	PROJECT A	PROJECT B	PROJECT C	PLANT CAPACITIES
PLANT 1	RM10	RM4	RM11	70
PLANT 2	RM12	RM5	RM8	50
PLANT 3	RM9	RM7	RM6	30
PROJECT REQUIREMENTS	40	50	60	150

Using the Stepping Stone method;

- (i) Compute the optimal solution. (8 marks)
- (ii) Calculate the total cost. (2 marks)

- Q4** (a) Consider the following all-integer linear programming (LP) model :

$$\text{Maximize } 5x_1 + 8x_2$$

Subject to

$$6x_1 + 5x_2 \leq 30$$

$$9x_1 + 4x_2 \leq 36$$

$$1x_1 + 2x_2 \leq 10$$

$$x_1, x_2 \geq 0 \text{ and integer}$$

- (i) Illustrate the constraints for this problem with a standard scale in sketching. Use dots to indicate all feasible integer solutions. (5 marks)
- (ii) Determine the optimal solution to the LP Relaxation, and round down to find a feasible integer solution. (4 marks)
- (iii) Identify the optimal integer solution for this problem. (2 marks)
- (iv) Compare the solution obtained in Q4 (ii) by rounding down with Q4 (iii).

(2 marks)

- (b) Roxie LaMothe, owner of a large horse breeding farm near Orlando, is planning to install a complete water system connecting all of the various stables and barns. The location of the facilities and the distances between them is given in the network shown in Figure Q4.

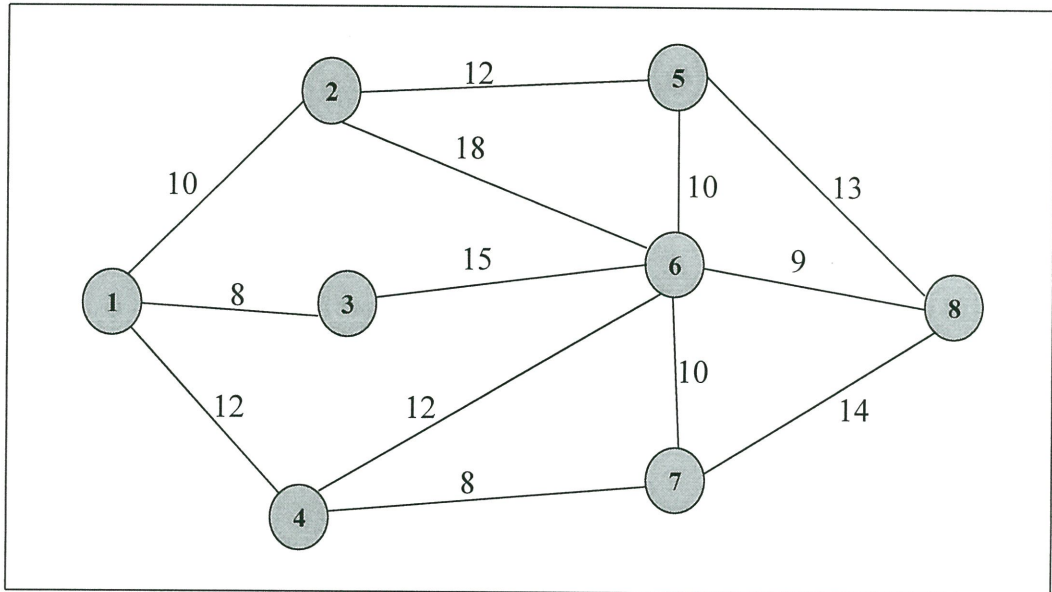


Figure Q4

Propose to Roxie LaMothe, the least expensive way to provide water for each facility.

(7 marks)

- 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.

Determine 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 **Q5(c)(i)**.
(4 marks)

-END OF QUESTION-