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UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER I
SESSION 2014/2015**

COURSE NAME : MANAGEMENT SCIENCE I
COURSE CODE : BPB 2043 / BPB 20403
PROGRAMME : 2 BPA
EXAMINATION DATE : DECEMBER 2014/JANUARY 2015
DURATION : 3 HOURS
INSTRUCTION : ANSWER ALL QUESTIONS

THIS QUESTION PAPER CONSISTS OF FIVE (5) PAGES

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- 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 pupil, 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 pupils Rajini and Kamal need to enroll in their class to break even. (3 marks)
- (ii) Compute the number of pupils 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 pupil in order to realize their profit goal of RM5,000 if Rajini and Kamal plan 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** Mutiara Indah Furniture Corporation manufactures office desks at three locations: Kuantan, Batu Pahat and Ipoh. The plants distribute the desks through regional warehouses located in Damansara, Seremban and Melaka. The transportation cost (in RM), plant capacities and warehouse requirements are provided in **Table Q2**.

Table Q2: Transportation Cost, Plant Capacities and Warehouse Requirement

FROM \ TO	Damansara Warehouse	Seremban Warehouse	Melaka Warehouse	Plant Capacities
Kuantan	5	4	3	100
Batu Pahat	8	4	3	300
Ipoh	9	7	4	300
Warehouse Requirements	300	200	200	700

- (a) Formulate an initial feasible solution using northwest corner rule. (5 marks)
- (b) Compute the optimal solution using modified distribution (MODI) method. (12 marks)
- (c) Calculate the total cost. (3 marks)

- Q3** (a) Digital Unlimited 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

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 Los Angeles are supplied from a central warehouse in Inglewood. The location of the warehouse and its proximity, in minutes of travel time, to the franchises are given in the network shown in **Figure Q4**.

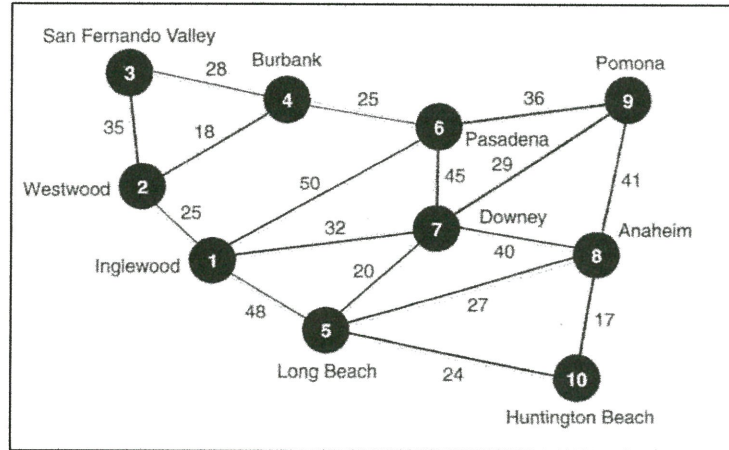


Figure Q4: The proximity (in min) of Inglewood warehouse to its franchises.

Propose the shortest route from the warehouse at Inglewood 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)

- 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)

-END OF QUESTION-