



UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER I
SESSION 2016/2017**

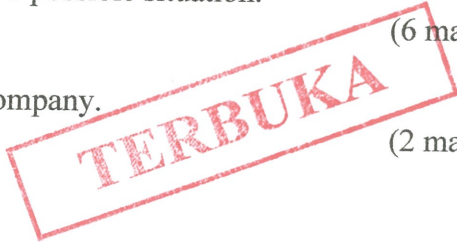


COURSE NAME : MANAGEMENT SCIENCE I
COURSE CODE : BPB 20403
PROGRAMME CODE : BPA
EXAMINATION DATE : DECEMBER 2016 / JANUARY 2017
DURATION : 3 HOURS
INSTRUCTION : ANSWERS ALL QUESTIONS

THIS QUESTION PAPER CONSISTS OF SIX (6) PAGES

Q1 A company sells a product which has a variable cost of RM3 a unit. Fixed costs are RM10,000. It has been estimated that if the price is set at RM5 a unit, the sales volume will be 10,000 units. But, if the price is reduced to RM4 a unit, the sales volume will rise 15,000.

- (a) Determine the breakeven points for the two possible situations. (6 marks)
- (b) Calculate the profit or loss that can be anticipated by considering the two possible situations. (6 marks)
- (c) Illustrate a breakeven chart to compare the two possible situation. (6 marks)
- (d) Explain the best breakeven solution for the company. (2 marks)



Q2 The Interstate Truck Rental firm has accumulated extra trucks at three of its truck leasing outlets, as shown in the **Table Q2(i)**:

Table Q2(i): Number of extra trucks at leasing outlets

Leasing Outlet		Extra Trucks
1.	Atlanta	70
2.	St. Louis	115
3.	Greensboro	60

The firm also has four outlets with shortages of rental trucks, as shown in the **Table Q2(ii)**:

Table Q2(ii): Number of truck shortage at leasing outlets

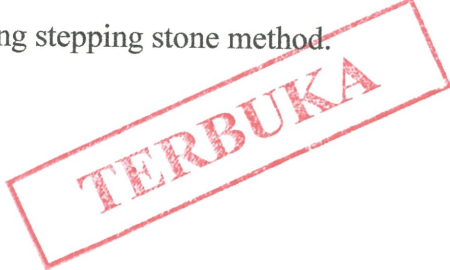
Leasing Outlet		Truck Shortage
A.	New Orleans	80
B.	Cincinnati	50
C.	Louisville	90
D.	Pittsburgh	25

The firm wants to transfer trucks from those outlets with extras to those with shortages at the minimum total cost. The following costs (in RM) of transporting these trucks from city to city have been determined, as shown in the **Table Q2(iii)**:

Table Q2(iii): Transportation cost from city to city

FROM \ TO	A	B	C	D
1.	70	80	45	90
2.	120	40	30	75
3.	110	60	70	80

- (a) Formulate an initial feasible solution using northwest corner rule. (5 marks)
- (b) Compute the optimal solution using stepping stone method. (12 marks)
- (c) Calculate the total cost. (3 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)(i)**:

Table Q3(a)(i): Plant capacities and shipping cost

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 shown in **Table Q3(a)(ii)**:

Table Q3(a)(ii): Customer demand and shipping costs

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

Formulate a linear programming model of the problem.

(11 marks)

- (b) John Clooney, a bush pilot in Alaska, makes regular charter flights in his floatplane to various towns and cities in western Alaska. His passengers include hunters, fishermen, backpackers and campers, and tradespeople hired for jobs in the different localities. He also carries some cargo for delivery. The network of the possible air routes between various towns and cities John might take (with the times, in hours) is shown in **Figure Q3**:

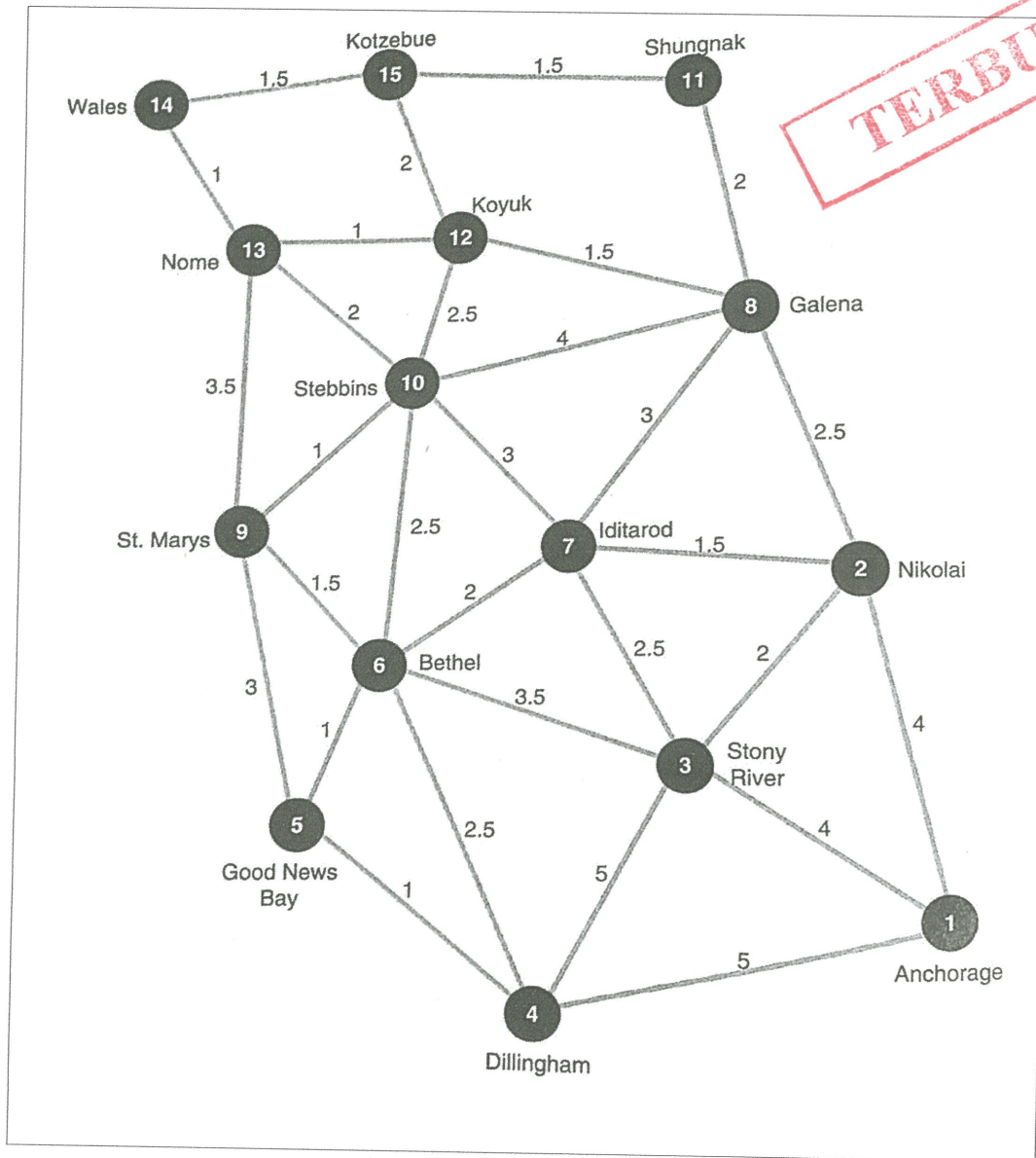


Figure Q3: Air route network between various towns and cities

For safety reasons, he flies point-to-point, flying over at least one town along a route, even though he might not land there. In the upcoming week John has scheduled charter flights for Kotzebue, Nome, and Stebbins.

Propose the shortest route between John’s home base in Anchorage and each of these destinations.

(9 marks)

Q4 Harry and Melissa Jacobson produce handcrafted furniture in a workshop on their farm. They have obtained a load of 600 board feet of birch from a neighbor and are planning to produce round kitchen tables and ladder-back chairs during the next 3 months. Each table will require 30 hours of labor, each chair will require 18 hours, and between them they have a total of 480 hours of labor available. A table requires 40 board feet of wood to make, and a chair requires 15 board feet. A table earns the couple \$575 in profit, and a chair earns \$120 in profit. Most people who buy a table also want four chairs to go with it, so for every table that is produced, at least four chairs must also be made, although additional chairs can also be sold separately. The firm wants to determine the quantity of each product to produce in order 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. (3 marks)
- (c) Determine the optimal solution to the LP Relaxation, and round down to find a feasible integer solution. (8 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)

-END OF QUESTIONS-