UNIVERSITY OF RUHUNA

Faculty of Engineering

End-Semester 8 Examination in Engineering: November 2016

Module Number: EE8207 **Module Name: Optimization Techniques for Engineers**

[Three Hours]

[Answer all questions]

Q1 a) The payoff matrix for a two person zero sum game is given below.

$$\begin{bmatrix} a & b \\ c & d \end{bmatrix}$$

Prove that the optimal strategy for the row player is given by

$$\begin{bmatrix} \frac{d-c}{D} & \frac{a-b}{D} \end{bmatrix},$$

and the optimal strategy for the column player is given by.

$$\begin{bmatrix} \frac{d-b}{D} \\ \frac{a-c}{D} \end{bmatrix},$$

where D= (a+d) – (b+c)

[6 marks]

b) Telstra and Optus are two mobile telephone companies competing for the same market. Both companies have two strategies. This can be modelled as a two person zero sum game. The payoff matrix for the two strategies are given below. Note: since this is a zero sum game, payoff matrix shows the payoff to the row plyer, in this case Telstra.

$$\begin{array}{cc} & \text{Optus} \\ \text{Telstra} & \begin{bmatrix} 3 & -5 \\ -2 & t \end{bmatrix} \end{array}$$

i) Find the optimal strategies for the two players when t=2.
ii) Find the value of the game?
iii)Is this a fair game?
Iv) What value of t will make this a fair game?

[4 marks]

Q2 a) Explain how to modify the transportation algorithm when the total supply is more than the total demand. [3 Marks]

b) Daily power demand of the cities Jaffna, Galle, Negombo, Batticaloa and Hambantota is 40,000 kwh each. Daily production at power plant located at Galle, Negombo and Hambantota is 70,000 kwh each. Table Q2 shows the distances between cities. It costs Rs 4 to transport 1000 kwh over one kilometer. You are required to find a power transportation plan that will meet the requirements at all cities while minimizing the total cost.

i) Find an initial solution using the North West corner rule
ii) What special condition exist?

iii) Explain how you proceed to solve the problem

iv) Find the minimum transportation cost.

Table Q2: Distances between cities in kilometers

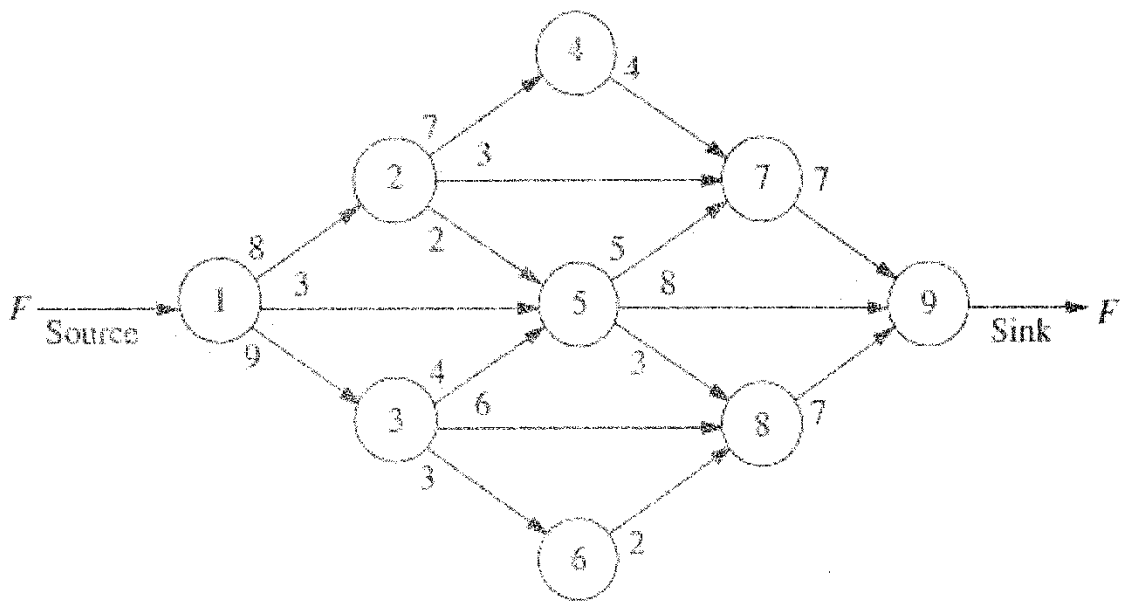
	Jaffna	Galle	Negombo	Batticaloa	Hambantota
Galle	400	0	250	330	175
Negombo	320	210	0	400	300
Hambantota	450	250	350	300	0

[7 marks]

Q3 a) List the steps involved in evaluating maximum flow through a network, using Ford Fulkerson algorithm

[3 Marks]

b)



Q3: A network of oil pipes

Figure Q3 Shows a network of oil pipes. The capacities of arcs are the numbers printed on the arcs nearest to the node. For example the capacity of arc 6-8 is 2. Find the flow pattern that gives the maximum flow from source to sink? Prove that the answer you got is the maximum?

[7 marks]

Q4 a) Discuss two situations where minimum spanning tree algorithm can be used in engineering.

[3 Marks]

b) Table Q4 Show a network of villages and the distances between them. The Government has decided to install cable television network connecting all villages. What is the minimum length of cables required to connect all villages.?

[7 Marks]

c)

Table Q4: Distance between villages

	A	B	C	D	E	F	G	H	I	J
A	45	45	64	67	145	75				
B			80	60	87					
C				82	77	58				
D					56	59	59			
E							48	53		75
F								61	50	55
G								52	111	55
H										
I										54

Q5 A container whose capacity 15, is waiting to be loaded with different items. Only one of each item can be loaded. Table Q5 shows the weights , and values of the items.

Table Q5: Weights and the corresponding values of items

Item	weight	value
1	3	12
2	8	14
3	3	8
4	4	9
5	4	10
6	5	11

The objective is to load the container to maximize the total value of the items without exceeding its capacity.

a) Develop a mathematical model to solve the above problem. Your model should clearly indicate the variables, objective function, decision variables, functional

constraints and non negativity constraints [5 Marks]

b) Solve the model manually. Note: answers without supporting calculations carry no marks.

[5 marks]