UNIVERSITY OF RUHUNA

Faculty of Engineering

Mid-Semester 7 Examination in Engineering: June 2015

Module Number: EE7241 **Module Name: Optimization**

[Two Hours]

[Answer all questions]

Q1 a) In a two person game both players have more than one strategy. Explain an easy numerical way to identify Nash Equilibria in the pay off matrix.

[2 marks]

b) Two mobile telephone companies Telstra and Optus are competing for the same market. Both companies are planning on five strategies A, B, C, D, and E. The payoff matrix for different combinations of strategies are given in table Q1.

Table Q1: Pay off Matrix

Optus \ Telstra	A	B	C	D	E
A	1	2	1	2	2
B	4	0	1	2	4
C	0	1	-1	2	0
D	1	1	0	1	0
E	2	-2	2	0	3

i) What is the best strategy for Telstra?. [3 marks]

ii) What is the value of the game? [2 marks]

iii) Is this a fair game? [1 mark]

Q2. a) There are four men m1, m2, m3, m4 and four women w1, w2, w3, and w4. Their preferences are given below.

Men's preferences	Women's preferences
m1 : w1 w2 w3 w4	w1 : m1 m2 m3 m4
m2 : w1 w2 w3 w4	w2 : m1 m2 m3 m4
m3 : w1 w2 w3 w4	w3 : m1 m2 m3 m4
m4 : w1 w2 w3 w4	w4 : m1 m2 m3 m4

Group men and women into four pairs using men optimal algorithm so that there are no rouge couples.

[4 marks]

b) An engineering company received four new contracts. Each contract requires one

electrical engineer and one mechanical engineer. Company has four mechanical engineers Raja, Nimal, Kamal and Leela. The four electrical engineers are Upul, Bandu, Hamza and Manel. Each engineer's preferences are given below.

Mechanical engineer preferences

Raja	Upul	Hamza	Manel	Bandu
Nimal	Upul	Hamza	Manel	Bandu
Kamal	Upul	Hamza	Manel	Bandu
Leela	Upul	Hamza	Manel	Bandu

Electrical engineer preferences

Upul	Raja	Kamal	Leela	Nimal
Bandu	Raja	Kamal	Leela	Nimal
Hamza	Raja	Kamal	Leela	Nimal
Manel	Raja	Kamal	Leela	Nimal

Using the solution obtained in a) above write down the best groups using the Electrical engineer optimum algorithm. (you are not required to calculate)

[4 marks]

Q3. a) Explain the following terms used in linear programming problems.

i) Dual price [1 mark]

ii) Reduced cost [1 mark]

b) Maharage and Company makes two types of electrical components, X and Y. Type X requires 30 mins of processing time of plant A and 40minutes of processing time of plant B. Type Y requires 35 minutes of processing time of plant A and 40 minutes of processing time of plant B. For the coming week processing time available in plants A and B are 3500 and 4000 minutes respectively. At the start of current week, 40 units of type X and 50 units type Y are available. Estimated demand for the current week is 75 and 90 units of types X and Y respectively.

The company policy is to maximize the total number of components of type X and Y available at the end of the week.

i) Formulate the above problem as a linear programming model

ii) Solve the linear programming model to find out the number of components of types X and Y that needs to be produced.

[6 Marks]

Q4 a) Explain the following terms used in a large lingo model

i) Sets section [1 mark]

ii) Data section [1 mark]

iii) Model equations section [1 mark]

b)

```
min = 84*a + 72*B + 60*c ;
90*A + 20*b + 40*C >= 200 ;
30*A + 80*b + 60*C >= 180 ;
10*A + 20*b + 60*C >= 150 ;
```

The following output was given when the above LP was run on Lingo

```
Global optimal solution found.
  Objective value:                              241.7143
  Infeasibilities:                              0.000000
  Total solver iterations:                             3
```

Variable	Value	Reduced Cost
A	1.142857	0.000000
B	0.000000	17.71429
C	2.428571	0.000000

Row	Slack or Surplus	Dual Price
1	241.7143	-1.000000
2	0.000000	-0.7714286
3	0.000000	-0.4857143
4	7.142857	0.000000

i) What is the value of the objective function?

[1 mark]

ii) What is the value of objective function if the first equation is modified to `90*A + 20*b + 40*C >= 201 ?`

[1 mark]

iii) By how much the objective function change if the third equation is modified to `10*A + 20*b + 60*C >= 149 ?`

[1 mark]