Menoufia University
Faculty of Engineering, Shebin El-Kom,
Basic Engineering science Department
First Semester Examination, 2017-2018
Date of Exam: 19/5/2018

Subject: Operations research (1)
Code : BES 603
Year : postgraduate students
Time Allowed : 3 hours
Total Marks: 100 marks

Answer the following questions

(Question 1)

a) Reddy Mikks produces both interior and exterior paints from two raw materials , M_1 and M_2.The following table provides the basic data of the problem:

	Tons of raw material per ton of		Maximum daily availability (tons)
	Exterior paint	Interior paint	
Raw material, M_1	6	4	24
Raw material, M_2	1	2	6
Profit per ton ($1000)	5	4	

A market survey indicates that the daily demand for interior paint cannot exceed that for exterior paint by more than 1 ton. Also, the maximum daily demand for interior paint is 2 tons. Determine the optimum (best) product mix of interior and exterior paints that maximizes the total daily profit.

(1) Graphical method

(2) Simplex method

(3) Write the dual problem

b) Determine the maximum value of the function

$$f(x_1, x_2) = 4x_1 + 6x_2 - 2x_1^2 - 2x_1x_2 - 2x_2^2$$

By the steepest ascent method with initial point $x_0 = (1, 1)$ and $r = \frac{1}{4}$ for 3 iterations.

c) Solve the following problem

Maxmize $z = 5x_1 + 4x_2$
subject to

$$x_1 + x_2 \leq 5$$
$$10x_1 + 6x_2 \leq 45$$
$$x_1,\ x_2 \text{ nonnegative integer variables}$$

d) For the payoff matrix $M = \begin{bmatrix} 2 & -4 \\ -1 & 3 \end{bmatrix}$, use the Game theory principle to find the optimal strategies of the two players.

e) How do you test the positive, negative, or indefiniteness of a square matrix [A]? Then what is the type of the following matrix?

$$A = \begin{bmatrix} 4 & -3 & 0 \\ -3 & 0 & 4 \\ 0 & 4 & 2 \end{bmatrix}$$

f) Find the maximum of the function $x^5 - 10x^2 + 2$ in the interval [0, 1] using unrestricted search.

g) Discuss with details the principles of goal programming approach and its applications.

h) Find the efficient solution for the following multi-objective optimization problem when $w_1 = 0.4$ and $w_2 = 0.6$.

$$Min\ z = x_1 + 6\,x_2$$

$$Min\ z = 6\,x_1 + x_2$$

subject to

$$2\,x_1 + 4\,x_2 \geq 16$$

$$3\,x_1 + 2\,x_2 \geq 12$$

$$x_1,\ x_2 \geq 0$$

With my best wishes