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MEIC-104

M.E./M.Tech., I Semester

Examination, December 2017

Operation Research and Optimization

Time : Three Hours

Maximum Marks : 70

Note: i) Attempt any five questions.

ii) All questions carry equal marks.

1. a) Use graphical method to solve the following L.P.P.

Minimize $Z = 20x_1 + 40x_2$

Subject to the constraints:

$$36x_1 + 6x_2 \geq 108$$

$$3x_1 + 12x_2 \geq 36$$

$$20x_1 + 10x_2 \geq 100$$

$$x_1, x_2 \geq 0$$

b) Use simplex method to solve the following L.P.P.

Maximize $Z = x_1 + 2x_2 + 3x_3$

Subject to constraints:

$$x_1 + 2x_2 + 3x_3 \leq 10$$

$$x_1 + x_2 \leq 5$$

$$x_1, x_2, x_3 \geq 0$$

PTO

2. a) Find the dual of the following L.P.P.

Maximize $Z = 2x_1 + x_2$

Subject to constraints:

$$x_1 + 5x_2 \leq 10$$

$$x_1 + 3x_2 \geq 6$$

$$2x_1 + 2x_2 \leq 8$$

$x_2 \geq 0$, x_1 is unrestricted.

b) What is an Assignment problem and how do you interpret as a linear programming model?

3. a) A vessel is to be loaded with stocks of 3 items. Each unit of item i has a weight w_i and value r_i. The maximum Cargo weight the vessel can take is 5 and the details of the three items are as follows:

i	w_i	r_i
1	1	30
2	3	80
3	2	65

Develop the recursive equation for the above case and find the most available cargo load with out exceeding the maximum cargo-weight by using dynamic programming.

b) State the 'Principle of optimality' in dynamic programming and give a mathematical formulation of dynamic programming.

4. a) Use the Kuhn-Tucker conditions to solve the non-linear programming problem:

Maximize $Z = 8x_1 + 10x_2 - x_1^2 - x_2^2$

Subject to the constraints:

$$3x_1 + 2x_2 \leq 6$$

$$x_1, x_2 \geq 0$$

Contd..

b) Solve graphically the following NLPP

Maximize $Z = 2x_1 + 3x_2$

Subject to constraints:

$x_1 \cdot x_2 \leq 8,$

$x_1^2 + x_2^2 \leq 20$

$x_1, x_2 \geq 0.$

5. a) Use Wolfe's method to solve the following QPP.

Maximize $Z = 4x_1 + 6x_2 - 2x_1^2 - 2x_1x_2 - 2x_2^2$

Subject to constraints:

$x_1 + 2x_2 \leq 2$

$x_1, x_2 \geq 0$

b) Write short notes on:

i) Quadratic programming.

ii) Application of non-linear programming problem.

6. a) Find the optimum solution to the I.P.P.

Maximize $Z = x_1 - 2x_2$

Subject to:

$4x_1 + 2x_2 \leq 15$

$x_1, x_2 \geq 0$ and are integers.

b) What is integer linear programming? Explain the merits and demerits of "Rounding off" a continuous optimal solution to an LPP to obtain an integer solution.

7. a) Use branch and bound method to solve the following integer linear programming problem.

Maximize $Z = 2x_1 + 3x_2$

Subject to:

$5x_1 + 7x_2 \leq 35$

$4x_1 + 9x_2 \leq 36$

$x_1, x_2 \geq 0$ and are integers.

b) If a linear programming problem possesses.

i) Unbounded solution.

ii) Multiple solutions.

iii) Infeasible solution, how can you detect it in course of simplex computations?

8. a) A company manufacturing chemicals has 4 independent investment projects and must allocate a fixed capital budget to one or more of them so that the company's total assets are maximized. The estimated investments and the anticipated cash outflows associated with those projects are given in the table below.

Project	Investment	Cash outflows (lakhs)	
	Rs (lakhs)	Ist year	IInd year
A	105	60	160
B	140	108	40
C	80	200	150
D	100	90	70

The company has earmarked Rs 600 lakhs for investment in first year and Rs 700 lakhs in the second year. If project 1 and 3 are mutually exclusive, then formulate IPP for how should the investment be made so that the company's total assets are maximized?

b) Define following with examples.

i) Linear programming problem

ii) Discrete dynamic programming

iii) Transportation problem.

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