

THE LNM INSTITUTE OF INFORMATION TECHNOLOGY
DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

 Optimization Techniques and Applications
Mid-Term Examination

Time: 90 minutes

Date: 26/09/2017

Maximum Marks: 30

1. Formulate the following problem as LP model.

A pharmaceutical company has 50 kg of A, 90 kg of B and 60 kg of C ingredients available per month. The company can use these materials to make three basic pharmaceutical products namely 5 – 10 – 5, 5 – 5 – 10 and 20 – 5 – 10, where the number in each case represent the percentage of weightage of A, B and C, respectively in each of the products. The cost of these materials is as follows:

The selling prices of these products are Rs 40.5, Rs 43 and 45 per kg respectively. There is a capacity restriction of the

Ingredient	Cost per kg
A	80
B	20
C	50
Inert ingredients	20

company for product 5 – 10 – 5, because of which the company cannot produce more than 30 kg per month. Determine how much of each of the products the company should produce in order to maximize its monthly profit. [4]

2. Solve the following LP problem applying penalty (Big-M) method.

Maximize $Z = x_1 + 2x_2 + 3x_3 - x_4$

subject to the following constraints

- $x_1 + 2x_2 + 3x_3 = 15$
- $2x_1 + x_2 + 5x_3 = 20$
- $x_1 + 2x_2 + x_3 + x_4 = 10$

and $x_1, x_2, x_3, x_4 \geq 0$

[6]

3. Apple Company has three major departments for manufacturing two of its model M_1 and M_2 . The monthly capabilities of the departments are given as follows: The marginal profit per unit from model M_1 is Rs 400 and from model M_2 is Rs 100.

	Per Unit Time Requirements		Hours Available this month
	Model M_1	Model M_2	
Dept-I	4.0	2.0	1,600
Dept-II	2.5	1.0	1,200
Dept-III	4.5	1.5	1,600

Assuming that the company can sell any quantity of either product due to favourable market condition. Determine the optimum output for both the models, the highest possible profit for this month and the slack time in the three departments. Formulate the above problem as LP model. [5]

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4. Obtain the dual problem of the following LP problem:

Minimize $Z = x_1 + 2x_2$

subject to the constraint

- $2x_1 + 4x_2 \leq 160$
- $x_1 - x_2 = 30$
- $x_1 \geq 10$

and $x_1, x_2 \geq 0$

[4]

5. Use Dual Simplex method solve the following LP problem:

Minimize $Z = x_1 + x_2$

subject to

- $2x_1 + x_2 \geq 2$
- $-x_1 - x_2 \geq 1$

and $x_1, x_2 \geq 0$

[5]

6. A trucking firm has received an order to move 3,000 tonnes of industrial materials to a destination 1,000 km away. The firm has available, at the moment, a fleet of 150 class-A, 15-tonne trailer trucks and another fleet of 100 class-B 10-tonne trailer trucks. The operating costs of these trucks are Rs 3 and Rs 4 per tonne per km respectively. Based on the past experience, the firm has a policy of retaining at least one class-A truck with every two class-B trucks in reverse. It is desired to know how many of these two classes of vehicles should be despatched to move the materials at minimal operating costs. Formulate this problem as an LP model.

[6]

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