

**The LNM Institute of Information Technology
Jaipur(Raj)-302031**

**Optimization Techniques & Applications
Self Practice Problems**

Formulation and Modeling

1. An investor has money-making activities A_1, A_2, A_3 and A_4 . He has only one lakh rupees to invest. In order to avoid excessive investment, no more than 50 percent of the total investment can be placed in activity A_2 and /or activity A_3 , Activity A_1 is very conservative while activity A_4 is speculative. To avoid excessive speculation, at least Rs 1/- must be invested in activity A_1 for every Rs 3/- invested in activity A_4 . The data of the return investment is as follows:

Activity	Anticipated Return on investment (%)
A_1	10
A_2	12
A_3	14
A_4	16

The investor wishes to know how much to invest in each in order to maximize the total return on the investment. Formulate this problem as LP model.

2. A pharmaceutical company has developed a new pill to be taken by smokers that nauseate them if they smoke. This new pill is a combination of four ingredients that are costly and is limited supply. The available supply and costs are follows: Blending requirement for this new

Ingredient	Supply Availability(kg)	Cost(Rs/kg)
1	22	28
2	18	25
3	20	52
4	24	26

pill are as follows:

- (a) Ingredient 1 must be at least 45 per cent of the total quantity, but cannot exceed 60 percent of the total.
- (b) Ingredient 2 and 3 must each comprise at least 10 percent of this mixture, but their combined percentage cannot exceed 25 percent of the total quantity.
- (c) Ingredient 4 must not more than 50 percent of the total quantity. Additionally at least 25 kg of the pill must be produced.

Formulate this problem as an LP model to determine optimum blending of Ingredients.

3. Vitamins A and B are found in foods F_1 and F_2 . One unit of food F_1 contains three units of vitamin A and four unit s of vitamin B. One unit of F_2 contains six units of vitamin A and three unit of vitamin B. One unit of food F_1 and F_2 cost Rs 4/- and Rs 5/- respectively. The minimum requirement (for a person) of vitamin A and B is 80 and 100 units respectively. Assuming that any thing in excess of the daily minimum requirement of A and B is not harmful. Formulate this problem as LP model to find out the optimum mixture of food F_1 and F_2 at the minimum cost which meets the daily minimum requirement of vitamin A and B.

4. The ABC Electric Appliances company produces two products: Refrigerators and ranges. The production of these takes place in two separate departments. Refrigerators are produced in department *I* and ranges in department *II*. Both these are sold in weekly basis. Due to the limited facilities in the department the weekly production cannot exceed 25 refrigerators in department *I* and 35 ranges in department *II*. The company regularly employs a total 50 workers in the departments. The production of one refrigerator requires two man-week. A refrigerator contributes of Rs 300 and a range if Rs 200. Formulate this problem as an integer LP model to determine the unit of refrigerators and ranges that the company should produce to realize the maximum profit.