

## Linear Programming Problems

1. A small workshop is manufacturing three products. The basic time data, m/c capacity and profit contribution are given below:

| Machine     | M/c Hours required per unit |           |           | Machine Hrs Available per week |
|-------------|-----------------------------|-----------|-----------|--------------------------------|
|             | Product A                   | Product B | Product C |                                |
| M/c I       | 1                           | 2         | 3         | 150                            |
| M/c II      | 2                           | 3         | 4         | 240                            |
| Profit/Unit | 5                           | 12        | 15        |                                |

Assume that there are no sales constraint. Formulate a L.P Problem. Determine the no. of units to be manufactured per week of each product to maximize the profit using simplex method.

2. A production manager wants to determine the quantity to be produced per month of products A and B manufactured by his firm. The data on resources required and availability of resources are available is given below:

| Resources            | Requirement |           | Capacity Available Per month |
|----------------------|-------------|-----------|------------------------------|
|                      | Product A   | Product B |                              |
| Raw material (Kg.)   | 60          | 120       | 12000                        |
| Machining Hrs/Pieces | 8           | 5         | 600                          |
| Assembly Hrs/piece   | 3           | 4         | 500                          |

The contribution per piece of A is Rs. 30 and that of B is Rs. 40. the objective of Production manager is to maximize the contribution. Formulate it as L.P. Problem and Solve.

3. X company has three department assembly, painting and packaging. With a capacity of making three different types of almarihas. Almarihas of types I requires 1 hr of assembly, 40 minutes of painting and 20 minutes of packaging time respectively. Similarly almarihas of type II need 80 minutes, 20 minutes and 1 hr respectively. The last type requires 40 minutes each of assembly, painting and packing time.

Total time available at assembly, painting and packaging are 600, 400 and 800 hrs. respectively. Formulate as LPP to maximize the profit.

The unit profit type I, type II & type III are Rs. 40, Rs. 80 and Rs. 60 respectively.

4. A farmer has 1000 acres of land on which he can grow tomatoes, raddish and soyabean . Each acre of tomatoes cost Rs. 100 for preparation requires 7 mandays of week and yields a profit of Rs. 30. the corresponding figures for raddish and soyabean are Rs. 120, 10 mandays Rs. 40 and Rs. 70, 8 mandays, Rs. 20 respectively.

If the farmer has Rs. 1,00,0000/- and can count 8000 mandays of work how many acres should be allocated each crop to maximize the profit.

- 5 A firm manufactures 4 products A, B, C and D each of which requires two resources P and Q. The following data gives the requirement of resources availability and profitability of each product. Find out optimal product mix to maximize the product. Find out optimal product mix to maximize the product.

| Product       | Requirement (Hrs/Unit) |      | Contribution (Rs/Unit) |
|---------------|------------------------|------|------------------------|
|               | P                      | Q    |                        |
| A             | 9                      | 2    | 28                     |
| B             | 17                     | 2    | 36                     |
| C             | 12                     | 8    | 32                     |
| D             | 40                     | 80   | 160                    |
| Available Hrs | 12,000                 | 8000 |                        |

- 6 Vitamins A and B are found in foods  $F_1$  and  $F_2$ . One unit of food  $F_1$  contains 3 units of vitamin A and 4 units of vitamins B. One unit of food  $F_2$  contains 6 units of vitamin A and 3 units of vitamin B.  
One unit of food  $F_1$  and  $F_2$  cost Rs 4 and Rs 5. The minimum daily requirement of A and B is 80 and 100 respectively. Assuming that anything in excess of daily minimum requirement of vitamin A and B is not harmful. Find out the optimum mixture of food  $F_1$  and  $F_2$  at the minimum cost which meets the daily requirement of vitamins A and B. Solve the LPP by graphical Problem.
7. A hospital administrator has the following minimum daily requirement of nursing Personnel. Nurses report to the hospital ward at the beginning of each period and works for 8 consecutive hours. Hospital wants to determine minimum number of nurses to be employed so that there will be sufficient number of nursing personnel available for each period. Formulate the above problem as LPP.

| Period | Clock Time    | Min No. of daily nurses Requirement |
|--------|---------------|-------------------------------------|
| 1      | 6 am to 10 am | 60                                  |
| 2      | 10 am to 2 pm | 70                                  |
| 3      | 2 pm to 6 pm  | 60                                  |
| 4      | 6 pm to 10 pm | 50                                  |
| 5      | 10 pm to 2 am | 20                                  |
| 6      | 2 am to 6 am  | 30                                  |

Hint: Let  $x_1, x_2, x_3, x_4, x_5, x_6$  be the nurses joining the period 1,2,3,4,5 and 6 respectively .