Subject Name: OPERATION RESEARCH

Subject Number: MA30014

ASSIGNMENT 1

Use the graphical method to solve each of the following LP problems.

1. A wheat and barley farmer has 168 hectare of ploughed land, and a capital of ₹2000. It costs ₹14 to sow one hectare wheat and ₹10 to sow one hectare of barley. Suppose that his profit is ₹80 per hectare of wheat and ₹55 per hectare of barley. Find the optimal number of hectares of wheat and barley that must be ploughed in order to maximize profit? What is the maximum profit?

2. A company manufactures two electrical products: air conditioners and large fans. The assembly process for each is similar in that both require a certain amount of wiring and drilling. Each air conditioner takes 3 hours of wiring and 2 hours of drilling. Each fan must go through 2 hours of wiring and 1 hour of drilling. During the next production period, 240 hours of wiring time are available and up to 140 hours of drilling time may be used. Each air conditioner sold yields a profit of ₹25. Each fan assembled may be sold for a profit of ₹15. Formulate and solve this linear programming mix situation to find the best combination of air conditioners and fans that yields the highest profit.

3. A manufacturer of lightweight mountain tents makes a standard model and an expedition model for national distribution. Each standard tent requires 1 labour hour from the cutting department and 3 labour hours from the assembly department. Each expedition tent requires 2 labour hours from the cutting department and 4 labour hours from the assembly department. The maximum labour hours available per day in the cutting department and the assembly department are 32 and 84 respectively. If the company makes a profit of ₹50 on each standard tent and ₹80 on each expedition tent, use the graphical method to determine how many tents of each type should be manufactured each day to maximize the total daily profit?

4. A manufacturing plant makes two types of inflatable boats, a two-person boat and a four-person boat. Each two-person boat requires 0.9 labour hours from the cutting department and 0.8 labour hours from the assembly department. Each four-person boat requires 1.8 labour hours from the cutting department and 1.2 labour hours from the assembly department. The maximum labour hours available per month in the cutting department and the assembly department are 864 and 672 respectively. The company makes a profit of ₹25 on each two-person boat and ₹40 on each four-person boat. Use the graphical method to find the maximum profit.

5. LESCO Engineering produces chairs and tables. Each table takes four hours of labour from the carpentry department and two hours of labour from the finishing department. Each chair requires three hours of carpentry and one hour of finishing. During the current week, 240 hours of carpentry time are available and 100 hours of finishing time. Each table produced gives a profit of ₹70 and each chair a profit of ₹50. How many chairs and tables should be made in order to maximize profit?

6. A company manufactures two products X and Y. Each product has to be processed in three departments: welding, assembly and painting. Each unit of X spends 2 hours in the welding department, 3 hours in assembly and 1 hour in painting. The corresponding times for a unit of Y are 3,2 and 1 respectively. The man-hours available in a month are 1500 for the welding department, 1500 in assembly and 550 in painting. The contribution to profits and fixed overheads are ₹100 for product X and ₹120 for product Y. Formulate the appropriate linear programming problem and solve it graphically to obtain the optimal solution for the maximum contribution.

7. Suppose a manufacturer of printed circuits has a stock of 200 resistors, 120 transistors and 150 capacitors and is required to produce two types of circuits.
   Type A requires 20 resistors, 10 transistors and 10 capacitors.
   Type B requires 10 resistors, 20 transistors and 30 capacitors.
   If the profit on type A circuits is ₹5 and that on type B circuits is ₹12, how many of each circuit should be produced in order to maximize profit?

8. A small company builds two types of garden chairs.
   Type A requires 2 hours of machine time and 5 hours of craftsman time.
   Type B requires 3 hours of machine time and 5 hours of craftsman time.
   Each day there are 30 hours of machine time available and 60 hours of craftsman time. The profit on each type A chair is ₹60 and on each type B chair is ₹84. Formulate the appropriate linear programming problem and solve it graphically to obtain the optimal solution that maximizes profit.

9. Namboard produces two gift packages of fruit. Package A contains 20 peaches, 15 apples and 10 pears. Package B contains 10 peaches, 30 apples and 12 pears. Namboard has 40000 peaches, 60000 apples and 27000 pears available for packaging. The profit on package A is ₹2.00 and the profit on B is ₹2.50. Assuming that all fruit packaged can be sold, what number of packages of types A and B should be prepared to maximize the profit?

10. A factory manufactures two products, each requiring the use of three machines. The first machine can be used at most 70 hours; the second machine at most 40 hours; and the third machine at most 90 hours. The first product requires 2 hours on Machine 1, 1 hour on Machine 2, and 1 hour on Machine 3; the second product requires 1 hour each on machines 1 and 2 and 3 hours on Machine 3. If the profit is ₹40 per unit for the first product and ₹60 per unit for the second product, how many units of each product should be manufactured to maximize profit?

NOTE: Please submit the assignment in **loose sheets** on **18th of January'19 (Friday)** in **Room N-353** of the Mathematics Department between **2pm-6pm**.