

# BHATNAGAR INTERNATIONAL SCHOOL

## WORKSHEET- Linear Programming

### Class--XII

1. A merchant plans to sell two types of personal computers- a desktop model and a portable model that will cost Rs 25000 and Rs 40000 respectively. He estimates that the total monthly demand of computers will not exceed 250 units. Determine that the total number of units of each type of computers which the merchant should stock to get maximum profit if he does not want to invest more than Rs 70000 lakhs and if his profit on the desktop model is Rs 4500 and on portable model Rs 5000.

2. A diet is to contain at least 80 units of vitamin A and 100 units of minerals. Two foods  $F_1$  and  $F_2$  are available. Food  $F_1$  costs Rs 4 per unit and food  $F_2$  costs Rs 6 per unit. One unit of food  $F_1$  contains 3 units of vitamin A and 4 units of minerals. One unit of food  $F_2$  contains 6 units of vitamin A and 3 units of Minerals. Formulate this as a linear programming problem. Find the minimum cost for diet that consists of a mixture of these two foods and also meets the minimal nutritional requirements.

3. A furniture firm manufactures chairs and tables, each requiring the use of 3 machines A,B and C. Production of one chair requires 2 hrs. on machine A, 1 hr on machine B and 1 hr on machine C. Each table requires 1hr. each on machine A and B and 3 hrs on machine C. The profit realized by selling one chair is rs.30 while for a table the figure is rs.60. The total time available per week on machine A is 70 hrs, on machine B is 40hrs and on machine C is 90hrs. How many chairs and tables should be made per week so as to maximize profit? Develop a mathematical formulation.

4. A lady wants to invest ₹ 12000 in saving certificates (SC) and national saving bonds (NSB). She has to invest at least ₹ 2000 in SC and at least ₹ 4000 in NSB . If the rate of interest on SC is 8 % p.a. and the rate of interest on NSB IS 10% P.A. , how much money should she invest to earn maximum yearly income? Find the maximum income.

( ₹ x in SC and ₹ Y in NSB then LPP is Max.  $Z = \frac{8x}{100} + \frac{10y}{100}$  subject to  $x \geq 2000$  ;  
 $y \geq 4000$  ;  $x+y \leq 12000$  )

5. A dealer wishes to purchase a number of fans and sewing machines. He has only ₹ .5760 to invest and has space for at most 20 items. A fan costing ₹ 360 and sewing machine ₹ 240. His expectation is that he can sell a fan at a profit of. ₹ 22 and a sewing machine at a profit of ₹ 18. Assuming that he can sell all the items that he can buy, how should he invest his money in order to maximize his profit .? Formulate it as a linear programming problem and solve it graphically.(Ans.8 fans,12 sewing machines, max. profit ₹ 392)

6. A small firm manufactures gold rings and chains. The total number of rings and chains manufacture per day is almost 24. It takes 1 hr to make a ring and 30mins to make a chain. The number of hours available per day is 16. If the profit on a ring is ₹ 300 and

that on a chain is ₹ 190, find the number of rings and chains that should be manufactured per day so as to earn the maximum profits. Make as an LPP and solve it graphically.

7. A two company manufactures two types of dolls, A and B. Market tests and available resources have indicated that the combined production level should not exceed 1200 dolls per week and the demand for dolls of type B is at most half of that for doll of type A. Further, the production level of dolls of type A can exceed three times the production of dolls of other type by at most 600 units. If the company makes profit of ₹ 12 and ₹ 16 per doll respectively on dolls A and B, how many of each should be produced weekly in order to maximize the profit?

8. A farm is engaged in breeding pigs. The pigs are fed on various products grown on the farm. In view of the need to ensure certain nutrient constituents (call them x, y and z), it is necessary to buy two additional products say A and B. One unit of product A contains 36 units of x, 3 units of y, and 20 units of z. One unit of product B contains 6 units of x, 12 units of y and 10 units of z. The minimum requirements of x, y and z is 108 units, 36 units and 100 units respectively. Product A costs ₹ 20 per unit and product B costs ₹ 40 per unit. Formulate the above as a linear programming problem to minimize the total cost, and solve the problem by using graphical method. (Let a units of product A and b be units of product B are bought. Minimize  $P = 20a + 40b$  subject to  $36a + 6b \geq 108$ ;  $3a + 12b \geq 36$ ;  $20a + 10b \geq 100$  and  $a, b \geq 0$ .)

9. A manufacture of patent medicines is preparing a production plan on medicines A and B. There are sufficient raw materials available to make 20,000 bottles of A and 40,000 bottles of B, but there are only 45,000 bottles into which either of the medicines can be put. Further, it takes 3 hours to prepare enough material to fill 1,000 bottles of A, it takes 1 hour to prepare enough material to fill 1000 bottles of B and there are 66 hours available for this operation. The profit is ₹ 8 per bottle for A and ₹ 7 per bottle for B. How Should the manufacturer schedule his production in order to maximize his profit? (let x be the Numbers of bottle of type A and y be the number of bottles of type B medicines. Maximize  $A = 8x + 7y$  Subject to the constraints  $x \leq 20,000$ ;  $y \leq 40,000$   $x + y \leq 45,000$ ;  $3x + y \leq 66,000$ ;  $x \geq 0, y \geq 0$ .)

10. Find graphically the maximum value of  $P = 4x + 9y$ , subject to the constraints  $x + 5y \leq 200$ ,  $2x + 3y \leq 134$ ,  $x \geq 0, y \geq 0$ .