

linear programming-CBSE

2 Marks Questions

- 1.** A small firm manufactures necklaces and bracelets. The total number of necklaces and bracelets that it can handle per day is at most 24. It takes one hour to make a bracelet and half an hour to make a necklace. The maximum number of hours available per day is 16. If the profit on a necklace is ₹ 100 and that on a bracelet is ₹ 300. Formulate an L.P.P. for finding how many of each should be produced daily to maximise the profit? It is being given that at least one of each must be produced.
- 2.** Two tailors *A* and *B*, earn ₹ 300 and ₹ 400 per day respectively. *A* can stitch 6 shirts and 4 pairs of trousers while *B* can stitch 10 shirts and 4 pairs of trousers per day. To find how many days should each of them work and if it is desired to produce at least 60 shirts and 32 pairs of trousers at a minimum labour cost, formulate this as an LPP.

4 Marks Questions

3. Solve the following LPP graphically:

$$\text{Minimise } Z = 5x + 10y$$

subject to the constraints

$$x + 2y \leq 120$$

$$x + y \geq 60,$$

$$x - 2y \geq 0 \text{ and } x, y \geq 0$$

4. Maximise and minimise $Z = x + 2y$ subject to the constraints

$$x + 2y \geq 100$$

$$2x - y \leq 0$$

$$2x + y \leq 200$$

$$x, y \geq 0$$

Solve the above LPP graphically.

6 Marks Questions

5. A manufacturer has employed 5 skilled men and 10 semi-skilled men and makes two models A and B of an article. The making of one item of model A requires 2 h work by a skilled man and 2 h work by a semi-skilled man. One item of model B requires 1 h by a skilled man and 3 h by a semi-skilled man. No man is expected to work more than 8 h per day. The manufacturer profit on an item of model A is ₹ 15 and on an items of model B is ₹ 10. How many of items of each models should be made per day in order to maximize daily profit? Formulate the above LPP and solve it graphically and find the maximum profit.
6. A company produces two types of goods, A and B , that require gold and silver. Each unit of type A requires 3 g of silver and 1 g of gold while that of type B requires 1 g of silver and 2 g of gold. The company can use at the most 9 g of silver and 8 g of gold. If each unit of type A brings a profit of ₹ 40 and that of type B ₹ 50, find the number of units of each type that the company should produce to maximize profit. Formulate the above LPP and solve it graphically and also find the maximum profit.
7. A factory manufactures two types of screws A and B , each type requiring the use of two machines, an automatic and a hand-operated. It takes 4 min on the automatic and 6 min on the hand-operated machines to manufacture a packet of screw ' A ' while it takes 6 min on the automatic and 3 min on the hand-operated machine to manufacture a packet of screw ' B '. Each machine is available for atmost 4 h on any day. The manufacturer can sell a packet of screw ' A ' at a profit of 70 paise and screw ' B ' at a profit of ₹ 1. Assuming that he can sell all the screws he manufactures, how many packets of each type should the factory owner produce in a day in order to maximise his profit? Formulate the above LPP and solve it graphically and find the maximum profit.
8. A manufacturer produces two products A and B . Both the products are processed on two different machines. The available capacity of first machine is 12 h and that of second machine is 9 h per day. Each unit of product A requires 3 h on both machines and each unit of product B requires 2 h on first machine and 1 h on second machine. Each unit of product A is sold at a profit of ₹ 7 and B at a profit of ₹ 4. Find the production level per day for maximum profit graphically.
9. A retired person wants to invest an amount of ₹ 50000. His broker recommends investing in two types of bonds ' A ' and ' B ' yielding 10% and 9% return respectively on the invested amount. He decides to invest at least ₹ 20000 in bond ' A ' and at least ₹ 10000 in bond ' B '. He also wants to invest at least as much in bond ' A ' as in bond ' B '. Solve this linear programming problem graphically to maximise his returns.

10. There are two types of fertilisers 'A' and 'B'. 'A' consists of 12% nitrogen and 5% phosphoric acid whereas 'B' consists of 4% nitrogen and 5% phosphoric acid. After testing the soil conditions, farmer finds that he needs at least 12 kg of nitrogen and 12 kg of phosphoric acid for his crops. If 'A' costs ₹ 10 per kg and 'B' costs ₹ 8 per kg, then graphically determine how much of each type of fertiliser should be used so that the nutrient requirements are met at a minimum cost?
11. In order to supplement daily diet, a person wishes to take X and Y tablets. The contents (in milligrams per tablet) of iron, calcium and vitamins in X and Y are given as below

Tablets	Iron	Calcium	Vitamin
X	6	3	2
Y	2	3	4

- The person needs to supplement at least 18 milligrams of iron, 21 milligrams of calcium and 16 milligrams of vitamins. The price of each tablet of X and Y is ₹ 2 and ₹ 1, respectively. How many tablets of each type should the person take in order to satisfy the above requirement at the minimum cost? Make an LPP and solve graphically.
12. A manufacturer produces nuts and bolts. It take 2 hours work on machine A and 3 hours on machine B to produce a package of nuts. It takes 3 hours on machine A and 2 hours on machine B to produce a package of bolts. He earns a profit of ₹ 24 per package on nuts and ₹ 18 per package on bolts. How many package of each should be produced each day so as to maximise his profit, if he operates his machines for at most 10 hours a day? Make an LPP and solve it graphically.
13. Find graphically, the maximum value of $Z = 2x + 5y$, subject to constraints given below

$$2x + 4y \leq 8; 3x + y \leq 6$$

$$x + y \leq 4; x \geq 0, y \geq 0.$$

14. A company manufactures three kinds of calculators: A , B and C in its two factories I and II. The company has got an order for manufacturing at least 6400 calculators of kind A , 4000 of kind B and 4800 of kind C . The daily output of factory I is of 50 calculators of kind A , 50 calculators of kind B and 30 calculators of kind C . The daily output of factory II is of 40 calculators of kind A , 20 of kind B and 40 of kind C . The cost per day to run factory I is ₹12000 and of factory II is ₹15000. How many days do the two factories have to be in operation to produce the order with the minimum cost? Formulate this problem as an LPP and solve it graphically.
15. Maximise $Z = 8x + 9y$ subject to the constraints given below
- $$2x + 3y \leq 6$$
- $$3x - 2y \leq 6$$
- $$y \leq 1$$
- $$x, y \geq 0.$$
16. One kind of cake requires 200 g of flour and 25 g of fat, another kind of cake requires 100 g of flour and 50 g of fat. Find the maximum number of cakes which can be made from 5 kg of flour and 1 kg of fat, assuming that there is no shortage of the other ingredients used in making the cakes. Make it as an LPP and solve it graphically.
17. A dealer in rural area wishes to purchase a number of sewing machines. He has only ₹ 5760 to invest and has space for atmost 20 items for storage. An electronic sewing machine cost ₹ 360 and a manually operated sewing machine ₹ 240. He can sell an electronic sewing machine at a profit of ₹ 22 and a manually operated 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 oder to maximise his profit? Make it as an LPP and solve it graphically.

18. A manufacturing company makes two types of teaching aids *A* and *B* of Mathematics for class XII. Each type of *A* requires 9 labour hours of fabricating and 1 labour hour for finishing. Each type of *B* requires 12 labour hours for fabricating and 3 labour hours for finishing. For fabricating and finishing, the maximum labour hours available per week are 180 and 30, respectively. The company makes a profit of ₹ 80 on each piece of type *A* and ₹ 120 on each piece of type *B*. How many pieces of type *A* and type *B* should be manufactured per week to get a maximum profit? Make it as an LPP and solve graphically. What is the maximum profit per week?
19. A cottage industry manufactures pedestal lamps and wooden shades, each requiring the use of a grinding/cutting machine and a sprayer. It takes 2 h on the grinding/cutting machine and 3 h on the sprayer to manufacture a pedestal lamp. It takes 1 h on the grinding/cutting machine and 2 h on the sprayer to manufacture a shade. On any day, the sprayer is available for at the most 20 h and the grinding/cutting machine for at most 12 h. The profit from the sale of a lamp is ₹ 25 and that from a shade is ₹ 15. Assuming that the manufacturer can sell all the lamps and shades that he produces, how should he schedule his daily production in order to maximise his profit? Formulate an LPP and solve it graphically.
20. A decorative item dealer deals in two items *A* and *B*. He has ₹ 15000 to invest and a space to store at the most 80 pieces. Item *A* costs him ₹ 300 and item *B* costs him ₹ 150. He can sell items *A* and *B* at respective, profits of ₹ 50 and ₹ 28. Assuming he can sell all he buys, formulate the linear programming problem in order to maximise his profit and solve it graphically.
21. A manufacturer produces nuts and bolts. It takes 1 h of work on machine *A* and 3 h on machine *B* to produce package of nuts. It takes 3 h on machine *A* and 1 h on machine *B* to produce a package of bolts. He earns a profit of ₹ 17.50 per package on nuts and ₹ 7 per package on bolts. How many packages of each should be produced each day so as to maximise his profits, if he operates his machines for at most 12 h a day? Formulate above as a Linear Programming Problem (LPP) and solve it graphically.
22. A manufacturer produces nuts and bolts. It takes 1 hour of work on machine *A* and 3 hours on machine *B* to produce a package of nuts while it takes 3 hours on machine *A* and 1 hour on machine *B* to produce a package of bolts. He earns a profit of ₹ 2.50 per package of nuts and ₹ 1.00 per package of bolts. How many packages of each type should he produce each day so as to maximise his profit, if he operates his machines for at most 12 hours a day? Formulate this problem as a linear programming problem and solve it graphically.
23. A dietician wishes to mix two types of foods in such a way that the vitamin contents of mixture contains atleast 8 units of vitamin *A* and 10 units of vitamin *C*. Food I contains 2 units per kg of vitamin *A* and 1 unit per kg of vitamin *C*, while food II contains 1 unit per kg of vitamin *A* and 2 units per kg of vitamin *C*. It costs ₹ 5 per kg to purchase food I and ₹ 7 per kg to purchase food II. Find the minimum cost of such a mixture. Formulate above as an LPP and solve it graphically.
24. A dietician wishes to mix two types of foods in such a way that the vitamin contents of the mixture contains at least 8 units of vitamin *A* and 10 units of vitamin *C*. Food I contains 2 units per kg of vitamin *A* and 1 unit per kg of vitamin *C*. Food II contains 1 unit per kg of vitamin *A* and 2 units per kg of vitamin *C*. It costs ₹ 50 per kg to purchase food I and ₹ 70 per kg to purchase food II. Formulate the problem as a linear programming problem to minimise the cost of such mixture and find the minimise cost graphically.

25. A factory makes tennis rackets and cricket bats. A tennis racket takes 1.5 h of machine time and 3 h of craftman's time in its making, while a cricket bat takes 3 h of machine time and 1 h of craftman's time. In a day, the factory has the availability of not more than 42 h of machine time and 24 h of craftman's time. If the profits on a racket and a bat are ₹ 20 and ₹ 10 respectively, then find the number of tennis rackets and cricket bats that the factory must manufacture to earn the maximum profit. Make it as an LPP and solve it graphically.
26. A merchant plans to sell two types of personal computers, a desktop model and a portable model that will cost ₹ 25000 and ₹ 40000, respectively. He estimates that the total monthly demand of computers will not exceed 250 units. Determine the 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 ₹ 70 lakh and his profit on the desktop model is ₹ 4500 and on the portable model is ₹ 5000. Make an LPP and solve it graphically.
27. A dealer deals in two items *A* and *B*. He has ₹ 15000 to invest and a space to store atmost 80 pieces. Item *A* costs him ₹ 300 and item *B* costs him ₹ 150. He can sell items *A* and *B* at profits of ₹ 40 and ₹ 25, respectively. Assuming that he can sell all that he buys, formulate the above as a linear programming problem for maximum profit and solve it graphically.
28. A small firm manufactures gold rings and chains. The total number of rings and chains manufactured per day is atmost 24. It takes 1 h to make a ring and 30 min to make a chain. The maximum number of hours available per day is 16. If the profit on a ring is ₹ 300 and that on a chain is ₹ 190, then find the number of rings and chains that should be manufactured per day so as to earn the maximum profit. Make it as an LPP and solve it graphically.
29. A library has to accommodate two different types of books on a shelf. The books are 6 cm and 4 cm thick and weight 1 kg and $1\frac{1}{2}$ kg each, respectively. The shelf is 96 cm long and atmost can support a weight of 21 kg. How should the shelf be filled with the books of two types in order to include the greatest number of books? Make it as an LPP and solve it graphically.
30. One kind of cake requires 300 g of flour and 15 g of fat, another kind of cake requires 150 g of flour and 30 g of fat. Find the maximum number of cakes which can be made from 7.5 kg of flour and 600 g of fat, assuming that there is no shortage of other ingredients used in making the cakes. Make it as an LPP and solve it graphically.