**Operations Research**

1.A company makes two products (X and Y) using two machines (A and B). Each unit of X that is produced requires 50 minutes processing time on machine A and 30 minutes processing time on machine B. Each unit of Y that is produced requires 24 minutes processing time on machine A and 33 minutes processing time on machine B.

At the start of the current week there are 30 units of X and 90 units of Y in stock. Available processing time on machine A is forecast to be 40 hours and on machine B is forecast to be 35 hours.

The demand for X in the current week is forecast to be 75 units and for Y is forecast to be 95 units. Company policy is to maximise the combined sum of the units of X and the units of Y in stock at the end of the week.

* Formulate the problem of deciding how much of each product to make in the current week as a linear program.
* Solve this linear program graphically.

2.A company is involved in the production of two items (X and Y). The resources need to produce X and Y are twofold, namely machine time for automatic processing and craftsman time for hand finishing. The table below gives the number of minutes required for each item:

Machine time Craftsman time

Item X 13 20

Y 19 29

The company has 40 hours of machine time available in the next working week but only 35 hours of craftsman time. Machine time is costed at £10 per hour worked and craftsman time is costed at £2 per hour worked. Both machine and craftsman idle times incur no costs. The revenue received for each item produced (all production is sold) is £20 for X and £30 for Y. The company has a specific contract to produce 10 items of X per week for a particular customer.

* Formulate the problem of deciding how much to produce per week as a linear program.
* Solve this linear program graphically.

3.A candy manufacturer has 130 pounds of chocolate-covered cherries and 170 pounds of chocolate-covered mints in stock. He decides to sell them in the form of two different mixtures. One mixture will contain half cherries and half mints by weight and will sell for $2.00 per pound. The other mixture will contain one-third cherries and two-thirds mints by weight and will sell for $1.25 per pound. How many pounds of each mixture should the candy manufacturer prepare in order to maximize his sales revenue?

4.The Osgood County refuse department runs two recycling centers. Center 1 costs $40 to run for an eight hour day. In a typical day 140 pounds of glass and 60 pounds of aluminum are deposited at Center 1. Center 2 costs $50 for an eight-hour day, with 100 pounds of glass and 180 pounds of aluminum deposited per day. The county has a commitment to deliver at least 1540 pounds of glass and 1440 pounds of aluminum per week to encourage a recycler to open up a plant in town. How many days per week should the county open each center to minimize its cost and still meet the recycler’s needs?

5. A furniture company produces inexpensive tables and chairs. The production process for each is similar in that both require a certain number of hours of carpentry work and a certain number of labour hours in the painting department. Each table takes 4 hours of carpentry and 2 hours in the painting department. Each chair requires 3 hours of carpentry and 1 hour in the painting department. During the current production period, 240 hours of carpentry time are available and 100 hours in painting is available. Each table sold yields a profit of E7; each chair produced is sold for a E5 profit. Find the best combination of tables and chairs to manufacture in order to reach the maximum profit.

6. A small brewery produces Ale and Beer. Suppose that production is limited by scarce resources of corn, hops and barley malt. To make Ale 5kg of Corn, 4kg of hops and 35kg of malt are required. To make Beer 15kg of corn, 4 kg of hops and 20kg of malt are required. Suppose that only 480 kg of corn, 160kg of hops and 1190 kg of malt are available. If the brewery makes a profit of E13 for each kg of Ale and E23 for each kg of Beer, how much Ale and Beer should the brewer produce in order to maximize profit?

7. (Medicine) A patient in a hospital is required to have at least 84 units of drug A and 120 units of drug B each day. Each gram of substance M contains 10 units of drug A and 8 units of drug B, and each gram of substance N contains 2 units of drug A and 4 units of drug B. Now suppose that both M and N contain an undesirable drug C, 3 units per gram in M and 1 unit per gram in N. How many grams of substances M and N should be mixed to meet the minimum daily requirements at the same time minimize the intake of drug C? How many units of the undesirable drug C will be in this mixture?

8. A wheat and barley farmer has 168 hectare of ploughed land, and a capital of E2000. It costs E14 to sow one hectare wheat and E10 to sow one hectare of barley. Suppose that his profit is E80 per hectare of wheat and E55 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? [80,88], Profit E11 240

9. An 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 E25. Each fan assembled may be sold for a profit of E15. Formulate and solve this linear programming mix situation to find the best combination of air conditioners and fans that yields the highest profit. [40 air conditioners, 60 fans, profit E1900]

10. 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 E50 on each standard tent and E80 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? [E1480]

11. A manufacturing plant makes two types of inflatable boats, a two-person boat and a fourperson 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 E25 on each twoperson boat and E40 on each four-person boat. Use the graphical method to find the maximum profit. [E21 600]

12. 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 E70 and each chair a profit of E50. How many chairs and tables should be made in order to maximize profit? [40,30], P = E410

13. 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 xii overheads are E100 for product X and E120 for product Y. Formulate the appropriate linear programming problem and solve it graphically to obtain the optimal solution for the maximum contribution. [150, 400], P = 63000

14. 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 E5 and that on type B circuits is E12, how many of each circuit should be produced in order to maximize profit? [6,3], P = 66

15. 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 E60 and on each type B chair is E84. Formulate the appropriate linear programming problem and solve it graphically to obtain the optimal solution that maximizes profit. [6,6], P = 864

16. 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 40 000 peaches, 60 000 apples and 27 000 pears available for packaging. The profit on package A is E2.00 and the profit on B is E2.50. Assuming that all fruit packaged can be sold, what number of packages of types A and B should be prepared to maximize the profit? [750 type A, 1625 type B]

17. 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 1and 2 and 3 hours on Machine 3. If the profit in E40 per unit for the first product and E60 per unit for the second product, how many units of each product should be manufactured to maximize profit? [24,22, P = 2280]

18.A house wife wishes to mix together two kinds of food, I and II, in such a way that the mixture contains at least 10 units of vitamin A, 12 units of vitamin B and 8 units of vitamin C. The vitamin contents of one kg of food is given below; Vitamin A Vitamin B Vitamin C Food I 1 2 3 Food II 2 2 1 One Kg of food I costs E6 and one Kg of food II costs E10. Formulate the above problem as a linear programming problem and find the least cost of the mixture which will produce the diet. [2,4, cost = E52]

19. A chicken farmer can buy a special food mix A at 20c per Kg and special food mix B at 40c per Kg. Each Kg of mix A contains 3000 units of nutrient N1 and 1000 units of nutrient N2; each Kg of mix B contains 4000 units of nutrient N1 and 4000 units of nutrient N2. If the minimum daily requirements for the chickens collectively are 36000 units of nutrient N1 and 20000 units of nutrient N2, how many pounds of each food mix should be used each day to minimize daily food costs while meeting (or exceeding) the minimum daily nutrient requirements? What is the minimum daily cost? [8kg of mix A, 3 kg of mix B; C = E2.80 per day]

20. A farmer can buy two types of plant food, mix A and mix B. Each cubic metre of mix A contains 20 kg of phosphoric acid, 30 kg of nitrogen, and 5 kg of potash. Each cubic metre of mix B contains 10 kg of phosphoric acid, 30 kg of nitrogen and 10 kg of potash. The minimum monthly requirements are 460 kg of phosphoric acid, 960 kg of nitrogen, and 220 kg of potash. If mix A costs E30 per cubic metre and mix B costs E35 per cubic metre, how many cubic metres of each mix should the farmer blend to meet the minimum monthly requirements at a minimal cost? What is the cost? [20 m3 , 12 m3 , E1020]

21. A city council voted to conduct a study on inner city community problems. A nearby university was contacted to provide sociologists and research assistants. Allocation of time and costs per week are given in the table. How many sociologists and how many research assistants should be hired to minimize the cost and meet the weekly labour-hour requirements? What is the weekly cost? LABOUR HOURS MINIMUM LABOURResearch HOURS NEEDED Sociologist Assistant PER WEEK FIELDWORK 10 30 180 RESEARCH CENTRE 30 10 140 COSTS PER WEEK (E) 500 300

22. A laboratory technician in a medical research centre is asked to formulate a diet from two commercially packaged foods, food A and food B, for a group of animals. Each kg of food A contains 8 units of fat, 16 units of carbohydrates, and 2 units of protein. Each Kg of food B contains 4 units of fat, 32 units of carbohydrate and 8 units of protein. The minimum daily requirements are 176 units of fat, 1024 units of carbohydrate, and 384 units of protein. If xiv food A costs 5c per Kg and food B costs 5c per Kg, how many kilograms of each food should be used to meet the minimum daily requirements at the least cost? What is the cost of this amount?

23. A can of cat food, guaranteed by the manufacturer to contain at least 10 units of protein, 20 units of mineral matter, and 6 units of fat, consists of a mixture of four different ingredients. Ingredient A contains 10 units of protein, 2 units of mineral matter, and 1 2 unit of fat per 100g. Ingredient B contains 1 unit of protein, 40 units of mineral matter, and 3 units of fat per 100g. Ingredient C contains 1 unit of protein, 1 unit of mineral matter, and 6 units of fat per 100g. Ingredient D contains 5 units of protein, 10 units of mineral matter, and 3 units of fat per 100g. The cost of each ingredient is 3c, 2c, 1c, and 4c per 100g, respectively. How many grammes of each should be used to minimise the cost of the cat food, while still meeting the guaranteed composition?

24.A person requires at least 10 and 12 units of chemicals A and B respectively, for his garden. A liquid product contains 5 and 2 units of A and B respectively per bottle. A dry product contains 1 and 4 units of A and B respectively per box. If the liquid product sales for Rs. 30 per bottle, dry product sales for Rs. 40 per box. How many of each should be purchased in order to minimize the cost and meet the requirements? Formulate the L.P.P.

25. A firm manufactures two types of products A and B and sells them at a profit of Rs. 200 on type A and Rs. 300 on type B. each product is processed on two machines G and H. type A requires 1 minute of processing time on G and 2minutes on H; Type B requires 1 minute on G and 1 minute on H. the machine G is available for not more than 6 hours, 40 minutes while H is available for 10 hours during any working day. Formulate this problem as a linear programming problem.

26. A firm manufactures headache pills in two sizes A and B. size A contains 2 grains of aspirin , 5 grains of bicarbonate and 1 grain of codeine. Size B contains 1 grain of aspirin, 8 grains of bicarbonate and 6 grains of codeine. It is found by users that it requires at least 12 grains of aspirin, 74 grains of bicarbonate and 24 grains of codeine for providing immediate effect. It is required to determine the least number of pills a patient should take to get immediate relief. Formulate the problem as a LPP.

27. A carpenter produces two products chairs and tables. Processing of these products is done on two machines A and B. Chair requires 2 hours on machine A and 6 hours on machine B. A table requires 5 hours on machine A and no hours on machine There are 16 hours of time per day available on machine A and 30 hours on machine B. Assuming that the profit per chair is Rs. 20 and Rs. 35 for table. Formulate the problem as LPP in order to determine the number of chairs and tables to be produced so as to maximize the profit.

28. A manufacturer has two machines A and B. He manufactures two products P and Q on these two machines. For manufacturing product P he has to use machine A for 3 hours and machine B for 6 hours, and for manufacturing product Q he has to use machine A for 6 hours and machine B for 5 hours. On each unit of P he earns Rs. 14 and on each unit of Q he earns Rs. 10. How many units of P and Q should be manufactured to get the maximum profit? Each machine cannot be used for more than 2100 hours. Formulate as LPP.

29Vitamin A and B are found in foods F1 and F2. One unit of food F1 contains three unit of vitamin A and four unit of vitamin B. One unit of food F2 contains six unit of vitamin A and three unit of vitamin B. One unit of food F1 and F2 cost Rs 14 and Rs 20 respectively. The minimum daily requirement (for person) of vitamin A and B is of 80 and100 units. Assuming excess of vitamin is not harmful to health, formulate LPP to obtain optimum mixture of food F1 and F2 required to meet the daily demand such that the total cost is minimized.

30. An electronic company is engaged in production of two components C1 and C2 used in radio sets. The availability of different aspects and the prices are given below. Formulate as LPP to determine number of components C1 and C2 to be produced so as to maximize the profit. Resources/Constraint Components Total Availability C1 C2 Budget(Rs) 10 / unit 40 / unit 4000 Machine time 3 hr / unit 2 hr / unit 2000 hrs Assembly time 2 hr / unit 3 hr / unit 1400 hrs Profit Rs.22 Rs. 40

31. A firm can produce two types of cloth, say: A and B. Three kinds of wool are required for it, say : red, green and blue wool. One unit length of type A cloth needs 4 meters of red wool and 3 meters of green wool; whereas one unit length of type B cloth needs 3 meters of red wool, 2 meters of green wool and 5 meters of blue wool. The firm has only a stock of 10 meters of red wool, 6 meters of green wool and 15 meters of blue wool. It is assumed that the profit obtained from one unit length type A cloth is Rs. 13 and of type B cloth is Rs. 25. Formulate as LPP.

32. A company makes two type varieties, Alpha and Beta, of pens. Each Alpha pen needs twice as much labour time as a Beta pen. If only Beta pens are manufactured, the company can make 500 pens per day. The market can take only up to 150 alpha pens and 250 Beta pens per day. If alpha and Beta pens yield profits of Rs. 8 and Rs. 5 respectively per pen, determine the number of Alpha and Beta pens to be manufactured per day so as to maximize the profit. Formulate as L.P.P.

33.Solve the following LP problems graphically 1) Minimize Z = 3 x1 + 2 x2 s.t. 5 x1 + x2 ≥ 10 x1 + x2 ≥ 6 x1 + 4 x2 ≥ 12 x1 , x2 ≥ 0

34. Maximize Z = 30 x1 + 20 x2 s.t. 3 x1 + 3 x2 ≥ 40 3 x1 + x2 ≥ 40 2 x1 + 5 x2 ≥ 44 x1 , x2 ≥ 0

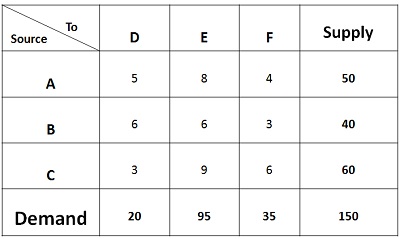
**UNIT II**

1.Luminous lamps has three factories - F1, F2, and F3 with production capacity 30, 50, and 20 units per week respectively. These units are to be shipped to four warehouses W1, W2, W3, and W4 with requirement of 20, 40, 30, and 10 units per week respectively. The transportation costs (in Rs.) per unit between factories and warehouses are given below.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Factory** | **Warehouse** | | | | **Supply** |
| **W1** | **W2** | **W3** | **W4** |
| **F1** | 1 | 2 | 1 | 4 | 30 |
| **F2** | 3 | 3 | 2 | 1 | 50 |
| **F3** | 4 | 2 | 5 | 9 | 20 |
| **Demand** | 20 | 40 | 30 | 10 |  |

Find an initial basic feasible solution of the given transportation problem using northwest corner rule.

2.Solve BY LCM



**3.** [Consider](https://www.chegg.com/homework-help/questions-and-answers/consider-following-transportation-problem-use-least-cost-method-find-initial-solution-tran-q12404017) the [following](https://www.chegg.com/homework-help/questions-and-answers/consider-following-transportation-problem-use-least-cost-method-find-initial-solution-tran-q12404017) [transportation](https://www.chegg.com/homework-help/questions-and-answers/consider-following-transportation-problem-use-least-cost-method-find-initial-solution-tran-q12404017) [problem](https://www.chegg.com/homework-help/questions-and-answers/consider-following-transportation-problem-use-least-cost-method-find-initial-solution-tran-q12404017). Use the [least](https://www.chegg.com/homework-help/questions-and-answers/consider-following-transportation-problem-use-least-cost-method-find-initial-solution-tran-q12404017) cost [method](https://www.chegg.com/homework-help/questions-and-answers/consider-following-transportation-problem-use-least-cost-method-find-initial-solution-tran-q12404017) to find [initial](https://www.chegg.com/homework-help/questions-and-answers/consider-following-transportation-problem-use-least-cost-method-find-initial-solution-tran-q12404017) [solution](https://www.chegg.com/homework-help/questions-and-answers/consider-following-transportation-problem-use-least-cost-method-find-initial-solution-tran-q12404017)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | C1 | C2 | C3 | C4 | Supply |
| S1 | 3 | 2 | 1 | 4 | 10 |
| S2 | 4 | 5 | 8 | 5 | 20 |
| S3 | 2 | 4 | 10 | 3 | 10 |
| S4 | 7 | 6 | 12 | 5 | 5 |
| Demand | 20 | 5 | 15 | 5 |  |

1. Given the following Transportation problem:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| To | A | B | C | D | Supply |
| From |  | | | | |
| 1 | 5 | 12 | 7 | 10 | 50 |
| 2 | 4 | 6 | 7 | 6 | 50 |
| 3 | 2 | 8 | 5 | 3 | 60 |
| Demand | 40 | 20 | 30 | 70 |  |

Find the initial solution by VAM method.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **5.** |  | D1 | D2 | D3 | D4 | Supply |
|  |  |  |  |  |  |  |
|  | O1 | 6 | 4 | 1 | 5 | 14 |
|  |  |  |  |  |  |  |
|  | O2 | 8 | 9 | 2 | 7 | 16 |
|  |  |  |  |  |  |  |
|  | O3 | 4 | 3 | 6 | 2 | 5 |
|  |  |  |  |  |  |  |
|  | Dem. | 6 | 10 | 15 | 4 |  |
|  |  |  |  |  |  |  |

Obtain the initial solution to above TP using northwest corner method.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **6)** |  | A | B | C | D | Supply |
|  |  |  |  |  |  |  |
|  | I | 6 | 3 | 5 | 4 | 22 |
|  |  |  |  |  |  |  |
|  | II | 5 | 9 | 2 | 7 | 15 |
|  |  |  |  |  |  |  |
|  | III | 5 | 7 | 8 | 6 | 8 |
|  |  |  |  |  |  |  |
|  | Demand | 7 | 12 | 17 | 9 |  |
|  |  |  |  |  |  |  |

Obtain the initial solution to above TP using least cost method.

7.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  | D1 | D2 | D3 | D4 | Supply |
|  |  |  |  |  |  |  |
|  | O1 | 1 | 2 | 3 | 4 | 6 |
|  |  |  |  |  |  |  |
|  | O2 | 4 | 3 | 2 | 0 | 8 |
|  |  |  |  |  |  |  |
|  | O3 | 0 | 2 | 2 | 1 | 10 |
|  |  |  |  |  |  |  |
|  | Demand | 4 | 6 | 8 | 6 |  |
|  |  |  |  |  |  |  |

Obtain the initial solution to above TP using least cost method

.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **8)** |  | A | B | C | D | Supply |
|  |  |  |  |  |  |  |
|  | I | 1 | 5 | 3 | 3 | 34 |
|  |  |  |  |  |  |  |
|  | II | 3 | 3 | 1 | 2 | 15 |
|  |  |  |  |  |  |  |
|  | III | 0 | 2 | 2 | 3 | 12 |
|  |  |  |  |  |  |  |
|  | IV | 2 | 7 | 2 | 4 | 19 |
|  |  |  |  |  |  |  |
|  | Demand | 21 | 25 | 17 | 17 |  |
|  |  |  |  |  |  |  |

Obtain the initial solution to above TP using northwest corner method

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **9)** |  | I | II | III | IV | Supply |
|  |  |  |  |  |  |  |
|  | A | 21 | 16 | 15 | 13 | 11 |
|  |  |  |  |  |  |  |
|  | B | 17 | 18 | 14 | 23 | 13 |
|  |  |  |  |  |  |  |
|  | C | 32 | 27 | 18 | 41 | 19 |
|  |  |  |  |  |  |  |
|  | Demand | 6 | 10 | 12 | 15 |  |
|  |  |  |  |  |  |  |

Obtain the initial solution to above TP using Vogel’s approximation method.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **10)** |  | D1 | D2 | D3 | D4 | Supply |
|  |  |  |  |  |  |  |
|  | O1 | 1 | 2 | 1 | 4 | 30 |
|  |  |  |  |  |  |  |
|  | O2 | 3 | 3 | 2 | 1 | 50 |
|  |  |  |  |  |  |  |
|  | O3 | 4 | 2 | 5 | 9 | 20 |
|  |  |  |  |  |  |  |
|  | Demand | 20 | 40 | 30 | 10 |  |
|  |  |  |  |  |  |  |

Obtain the initial solution to above TP using Vogel’s approximation method

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **11)** |  | I | II | III | IV | Supply |
|  |  |  |  |  |  |  |
|  | A | 2 | 3 | 11 | 7 | 6 |
|  |  |  |  |  |  |  |
|  | B | 1 | 0 | 6 | 1 | 1 |
|  |  |  |  |  |  |  |
|  | C | 5 | 8 | 15 | 10 | 10 |
|  |  |  |  |  |  |  |
|  | Demand | 7 | 5 | 3 | 2 | 17 |
|  |  |  |  |  |  |  |

Obtain the optimal solution to above TP

12) a b c Supply

I 10 9 8 8

II 10 7 10 7

III 11 9 7 9

IV 12 14 10 4

Demand 10 10 8

Obtain the initial solution to above TP using northwest corner method.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **13)** |  | Warehouses | | |  |  |
|  |  |  |  |  |  |  |
|  |  | W1 | W2 | W3 | W4 | Supply |
|  |  |  |  |  |  |  |
|  | F1 | 19 | 30 | 50 | 10 | 7 |
|  |  |  |  |  |  |  |
|  | F2 | 70 | 30 | 40 | 60 | 9 |
|  |  |  |  |  |  |  |
|  | F3 | 40 | 8 | 70 | 20 | 18 |
|  |  |  |  |  |  |  |
|  | Demand | 5 | 8 | 7 | 14 |  |
|  |  |  |  |  |  |  |
|  | Obtain the optimal solution to above TP.  14) | | | | | |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Destination | | |  | Supply |  |
|  |  |  |  |  |  |  |
| Source | I | II | III | IV |  |  |
|  |  |  |  |  |  |  |
| A | 19 | 14 | 23 | 11 | 11 |  |
|  |  |  |  |  |  |  |
| B | 15 | 16 | 12 | 21 | 13 |  |
|  |  |  |  |  |  |  |
| C | 30 | 25 | 16 | 39 | 19 |  |
|  |  |  |  |  |  |  |
| Demand | 6 | 10 | 12 | 15 |  |  |
|  |  |  |  |  |  |  |
| Obtain the optimal solution to above TP. | | | | | | |

15.What is transportation problem?

16. Write mathematical form of transportation problem.

17. What is feasible solution and non degenerate solution in transportation problem?

18. What do you mean by balanced transportation problem?

19. What is the Assignment problem?

20. Give mathematical form of assignment problem.

21. What is travelling salesman problem? Extra

22. What is the difference between Assignment Problem and Transportation Problem?

23. Write steps for North-West Corner Method.

24. Write steps for Matrix Minima Method.

25. Determine the optimum basic feasible solution to the following transportation problem.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | A | B | C | Available |
| I | 50 | 30 | 220 | 1 |
| II | 90 | 45 | 170 | 3 |
| III | 250 | 200 | 50 | 4 |
| Required | 4 | 2 | 2 |  |

Find Initial Basic Feasible Solution using VAM method.

26.Determine the optimum basic feasible solution to the following transportation problem.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | D1 | D2 | D3 | D4 | Available |
| O1 | 1 | 2 | 1 | 4 | 30 |
| O2 | 3 | 3 | 2 | 1 | 50 |
| O3 | 4 | 2 | 5 | 9 | 20 |
| Required | 20 | 40 | 30 | 10 | 100 |

Find Initial Basic Feasible Solution using Lowest cost method.

27.Determine the optimum basic feasible solution to the following transportation problem in which cell entries represent unit costs.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | To |  | Available |
|  | 2 | 7 | 4 | 5 |
| From | 3 | 3 | 1 | 8 |
|  | 5 | 4 | 7 | 7 |
|  | 1 | 6 | 2 | 14 |
| Required | 7 | 9 | 18 | 34 |

Find Initial Basic Feasible Solution using VAM.

28.Solve the transportation problem where all entries are unit costs.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | D1 | D2 | D3 | D4 | D5 | ai |
| O1 | 73 | 40 | 9 | 79 | 20 | 8 |
| O2 | 62 | 93 | 96 | 8 | 13 | 7 |
| O3 | 96 | 65 | 80 | 50 | 65 | 9 |
| O4 | 57 | 58 | 29 | 12 | 87 | 3 |
| O5 | 56 | 23 | 87 | 18 | 12 | 5 |
| bj | 6 | 8 | 10 | 4 | 4 |  |

Find Initial Basic Feasible Solution using Lowest cost method.

29.The following table gives the cost for transporting material from supply points A, B, C and to demand points E, F, G, H and J.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  |  | To |  |  |
|  | E | F | G | H | J |
| A | 8 | 10 | 12 | 17 | 15 |
| B | 15 | 13 | 18 | 11 | 9 |
| From C | 14 | 20 | 6 | 10 | 13 |
| D | 13 | 19 | 7 | 5 | 12 |

The present allocation is as follows: A to E 90, A to F 10, B to F 150, C to F 10, C to G 50, C to J 120, D to H 210, D to J 70.Check if this allocation is optimum. If not, find an optimum schedule.

**UNIT III**

1.ABC Ltd. uses EOQ logic to determine the order quantity for its various components and is planning its orders. The Annual consumption is 80,000 units, Cost to place one order is Rs. 1,200, Cost per unit is Rs. 50 and carrying cost is 6% of Unit cost. Find EOQ, No. of order per year, Ordering Cost and Carrying Cost and Total Cost of Inventory.

2.Midwest Precision Control [**Corporation**](http://www.accountancyknowledge.com/define/corporation/) is trying to decide between two alternate Order Plans for its inventory of a certain item. Irrespective of the plan to be followed, demand for the item is expected to be 1,000 units annually. Under Plan 1st, Midwest would use a teletype for ordering; order costs would be Rs. 40 per order. Inventory holding costs (carrying cost) would be Rs. 100 per unit per annum. Under Plan 2nd order costs would be Rs. 30 per order. And holding costs would 20% and unit Cost is Rs. 480. Find out EOQ and Total Inventory Cost than decide which Plan would result in the lowest total inventory cost?

3.A local TV repairs shop uses 36,000 units of a part each year (A maximum consumption of 100 units per working day). It costs Rs. 20 to place and receive an order. The shop orders in lots of 400 units. It cost Rs. 4 to carry one unit per year of inventory.

company makes bicycles. It produces 450 bicycles a month. It buys the tires for bicycles from a supplier at a cost of $20 per tire. The company’s inventory carrying cost is estimated to be 15% of cost and the ordering is $50 per order

4.The Maha Cutlery Outlet sells dinner sets. It provides you the following information:

* Maximum demand: 200 per week
* Average demand: 160 per week
* Minimum demand: 145 per week
* Maximum lead time: 2 weeks
* Average lead time: 1.5 weeks
* Minimum lead time: 1.35 weeks
* Re-order quantity per order: 500 dinner sets
* Safety stock: 184 dinner sets

 Compute [maximum level of stock](https://www.accountingformanagement.org/maximum-level-of-stock/) of Maha Cutlery Outlet using above information

5. A company manufactures wooden chairs. To manufacture one chairs the company needs 2 square feet of wood.

**Demand:**

* Maximum demand: 550 chairs per month
* Average demand: 510 chairs per month
* Minimum demand: 485 chairs per month

**Lead time of the supplies:**

* Maximum lead time: 2.5 months
* Average lead time: 2 months
* Minimum lead time: 1.75 months

**Stock levels:**

* Safety stock: 600 square feet of wood
* Re-order quantity: 496 square feet of wood
* Maximum stock level: ?Compute maximum stock level.

**UNIT IV**

1.A dispatcher presently has six taxicabs at different locations and five customers who have call for service. The mileage from each taxi’s present location to each curstomer is

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Customer | | | | | 1 | 2 | | 3 | 4 | 5 |
| Cab | | | | |  | | | | | |
| A | | | | | 7 | 2 | | 4 | 10 | 7 |
| B | | | | | 5 | 1 | | 5 | 6 | 6 |
| C | | | | | 8 | 7 | | 6 | 5 | 5 |
| D | | | | | 2 | 5 | | 2 | 4 | 5 |
| E | 3 | 3 | 5 | 8 | 4 | |
| F | 6 | 2 | 4 | 3 | 4 | |

Determine the optional assignment that will minimize the total mileage.

2.Solve the assignment Problems

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | |  |  | P |  | Q |  | R |  | S |
|  | |  |  |  |  |  |  |  |  |  |
|  | | A | 22 | | 30 | | 21 | | 15 | |
|  | |  |  |  |  |  |  |  |  |  |
|  | | B | 18 | | 33 | | 9 | | 31 | |
|  | |  |  |  |  |  |  |  |  |  |
|  | | C | 44 | | 25 | | 24 | | 21 | |
|  | |  |  |  |  |  |  |  |  |  |
|  | | D | 23 | | 30 | | 28 | | 14 | |
|  |  | I | |  | II | |  |  | III | | IV | |
|  |  |  |  |  |  |  | |  |  |  |  | |
| 1 |  | 11 | |  | 10 | | |  | 18 | | 5 | |
|  |  |  |  |  |  |  | |  |  |  |  | |
| 2 |  | 14 | |  | 13 | | |  | 12 | | 19 | |
|  |  |  |  |  |  |  |  |  |  |  |  | |
| 3 |  | 5 |  |  | 3 | |  |  | 4 | | 2 | |
|  |  |  |  |  |  |  | |  |  |  |  | |
| 4 |  | 15 | |  | 18 | | |  | 17 | | 9 | |
|  |  |  |  |  |  |  |  |  |  |  |  | |
|  |  |  |  |  | |  |  | |  |  |  | |
|  |  | P |  | Q | |  | R | |  | S |  | |
|  |  |  |  |  | |  |  |  |  |  |  | |
| A |  | 5 |  | 3 | |  | 4 |  |  | 7 |  | |
|  |  |  |  |  | |  |  |  |  |  |  | |
| B |  | 2 |  | 3 | |  | 7 |  |  | 6 |  | |
|  |  |  |  |  | |  |  |  |  |  |  | |
| C |  | 4 |  | 1 | |  | 5 |  |  | 2 |  | |
|  |  |  |  |  | |  |  |  |  |  |  | |
| D |  | 6 |  | 8 | |  | 1 |  |  | 2 |  | |
|  |  |  |  |  |  |  |  |  |  |  |  | |

**3.**Find the assignment of salesmen to various districts which will result minimum cost.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Salesman | District | |  |  |
|  |  |  |  |  |
|  | 1 | 2 | 3 | 4 |
|  |  |  |  |  |
| A | 16 | 10 | 14 | 11 |
|  |  |  |  |  |
| B | 14 | 11 | 15 | 15 |
|  |  |  |  |  |
| C | 15 | 15 | 13 | 12 |
|  |  |  |  |  |
| D | 13 | 12 | 14 | 15 |
|  |  |  |  |  |

4.Solve the following assignment problem so as to minimize the time](in days) required to complete all the task.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| person | task | |  |  |  |  |
|  |  |  |  |  |  |  |
|  | 1 |  | 2 | 3 | 4 | 5 |
|  |  |  |  |  |  |  |
| A | 6 |  | 5 | 8 | 11 | 16 |
|  |  |  |  |  |  |  |
| B | 1 |  | 13 | 16 | 1 | 10 |
|  |  |  |  |  |  |  |
| C | 16 |  | 11 | 8 | 8 | 8 |
|  |  |  |  |  |  |  |
| D | 9 |  | 14 | 12 | 10 | 16 |
|  |  |  |  |  |  |  |

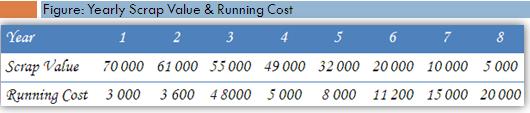
5.A department has 5 employees and five jobs are to be performed. The time each man will take to perform each job is given in the following table below. How should the job beallocated one per employee, so as to minimize the total man-hours.

Cost matrix

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Jobs | Employee | | |  |  |
|  |  |  |  |  |  |
|  | A | B | C | D | E |
|  |  |  |  |  |  |
| 1 | 9 | 3 | 10 | 13 | 4 |
|  |  |  |  |  |  |
| 2 | 9 | 17 | 13 | 20 | 5 |
|  |  |  |  |  |  |
| 3 | 5 | 14 | 8 | 11 | 6 |
|  |  |  |  |  |  |
| 4 | 11 | 13 | 9 | 12 | 3 |
|  |  |  |  |  |  |
| 5 | 12 | 8 | 14 | 16 | 7 |
|  |  |  |  |  |  |

**UNIT V**

1.A transport company purchased a motor vehicle for rupees 80000/-. The resale value of the vehicle keeps on decreasing from USD 70000/- in the fiUSDt year to USD 5000/- in the eighth year while, the running cost in maintaining the vehicle keeps on increasing with USD. 3000/- in the fiUSDt year till it goes to USD. 20000/- in the eighth year as shown in the below table. Determine the optimum replacement policy?



2.A factory has 1000 bulbs installed. Cost of individual replacement is USD. 3/- while that of group replacement USD 1/-per bulb respectively. It is decided to replace all the bulbs simultaneously at fixed interval & also to replace the individual bulbs that fail in between. Determine optimal replacement policy. Failure probabilities are as given below:

