PROBLEMS TO SOLVE
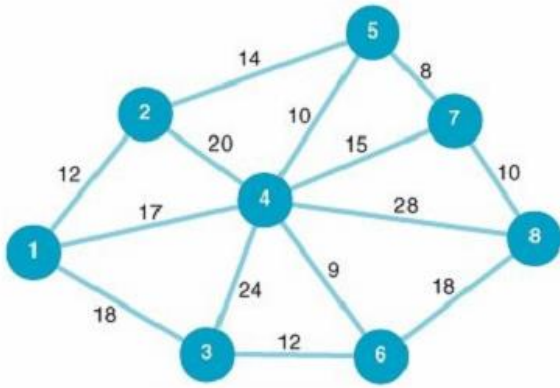
1. Hard Rock Concrete Supply makes concrete at its plant in Centerville, Virginia, and delivers it to construction sites throughout the metropolitan Washington, DC, area. The following network shows the possible routes and distances (in miles) from the concrete plant to seven construction sites.

   a. Determine the shortest route a concrete truck would take from the plant at node 1 to node 8 and the total distance for this route, using the shortest route method!
   b. Develop a minimal spanning tree!

2. Given the following network, with the indicated flow capacities along each branch, determine the maximum flow from source node 1 to destination node 7 and the flow along each branch:
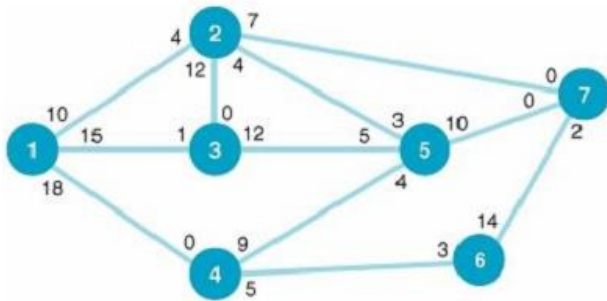
3. A farmer in the Midwest has 1,000 acres of land on which she intends to plant corn, wheat, and soybeans. Each acre of corn costs $100 for preparation, requires 7 worker-days of labor, and yields a profit of $30. An acre of wheat costs $120 to prepare, requires 10 worker-days of labor, and yields $40 profit. An acre of soybeans costs $70 to prepare, requires 8 worker-days, and yields $20 profit. The farmer has taken out a loan of $80,000 for crop preparation and has contracted with a union for 6,000 worker-days of labor. A Midwestern granary has agreed to purchase 200 acres of corn, 500 acres of wheat, and 300 acres of soybeans. The farmer has established the following goals, in order of their importance:

   1. To maintain good relations with the union, the labor contract must be honored; that is, the full 6,000 worker-days of labor contracted for must be used.
   2. Preparation costs should not exceed the loan amount so that additional loans will not have to be secured.
   3. The farmer desires a profit of at least $105,000 to remain in good financial condition.
   4. Contracting for excess labor should be avoided.
   5. The farmer would like to use as much of the available acreage as possible.
   6. The farmer would like to meet the sales agreement with the granary. However, the goal should be weighted according to the profit returned by each crop.

Formulate a goal programming model to determine the number of acres of each crop the farmer should plant to satisfy the goals in the best possible way.

4. The Livewright Medical Supplies Company has a total of 12 salespeople it wants to assign to three regions the South, the East, and the Midwest. A salesperson in the South earns $600 in profit per month for the company, a salesperson in the East earns $540, and a salesperson in the Midwest earns $375. The southern region can have a maximum assignment of 5 salespeople. The company has a total of $750 per day available for expenses for all 12 salespeople. A salesperson in the South has average expenses of $80 per day, a salesperson in the East has average expenses of $70 per day, and a salesperson in the Midwest has average daily expenses of $50. The company wants to determine the number of salespeople to assign to each region to maximize profit. Formulate an integer programming model for this problem