ऋते ज्ञानान्न मुक्तिः

GLA
UNIVERSITY
MATHURA
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# DESIGN AND ANALYSIS OF ALGORITHMS LAB

## (BCSC-0807)

**Made by** :- VISHAL DIXIT

**Section** :- B (62)

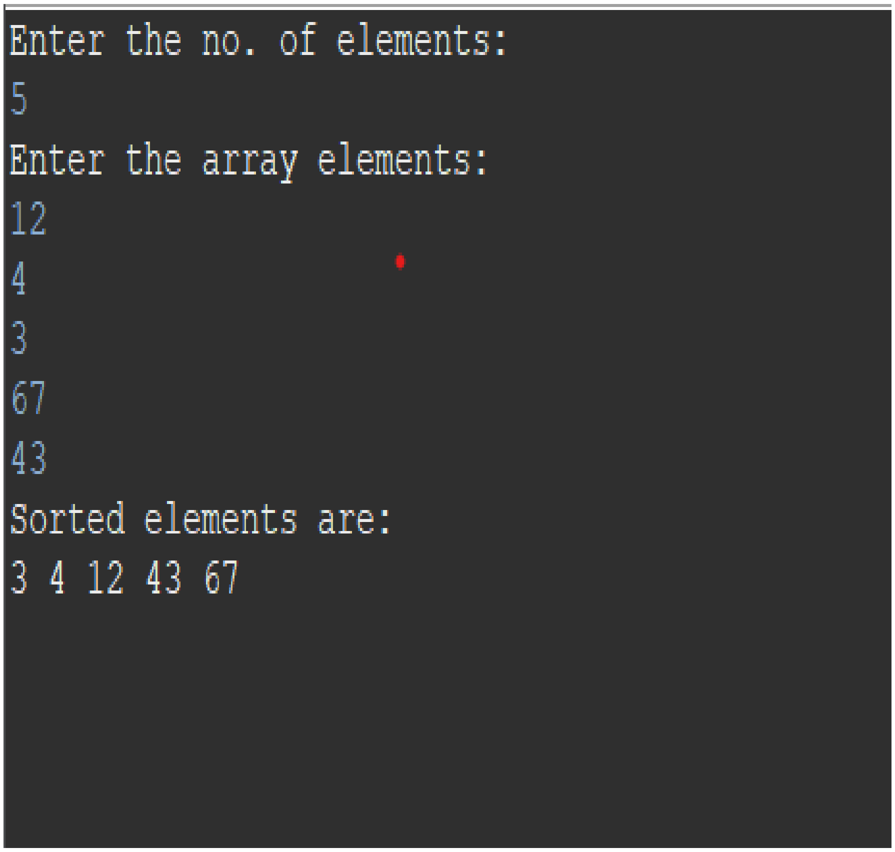
**University Roll No.** :- 201500792

**Submitted to** :- Miss. Varsha Thakur Mam

## Sortings

## (a) Selection Sort □

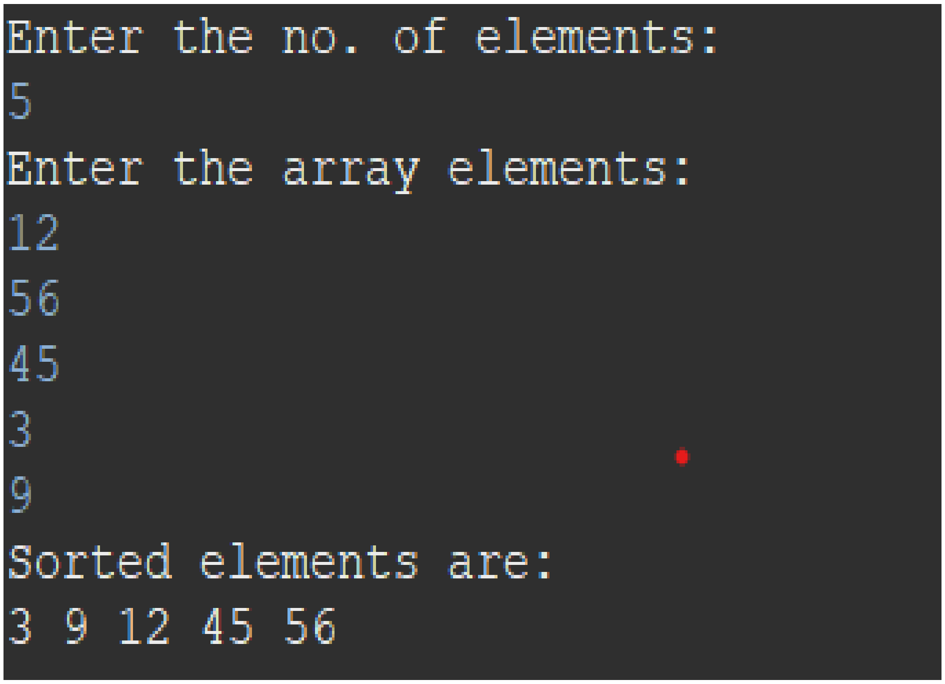
```
package com.programs.DAA_lab;
import java.util.Scanner;
public class Selection_sort {
        public static void selection_sort(int arr[]){
            int n=arr.length;
            for(int i=0;i<n;i++){
                int min=i;
                for(int j=i+1;j<n;j++){
                    if(arr[j]<arr[min]){
                        min=j;
                    }
                }
                int temp=arr[min];
                arr[min]=arr[i];
                arr[i]=temp;
            }
        }
        public static void main(String[] args) {
                  Scanner sc = new Scanner(System.in);
                  System.out.println("Enter the no. of elements: ");
            int n=sc.nextInt();
                  System.out.println("Enter the array elements: ");
            int arr[]=new int[n];
            for(int i=0;i<n;i++){
                arr[i]=sc.nextInt();
            }
            selection_sort(arr);
                  System.out.println("Sorted elements are: ");
            for(int i=0;i<n;i++){
                System.out.print(arr[i]+" ");
        }
    }
}
```



```
Enter the no. of elements:
5
Enter the array elements:
12
4
3
67
43
Sorted elements are:
3 4 12 43 67
```

### (b) Bubble Sort :-

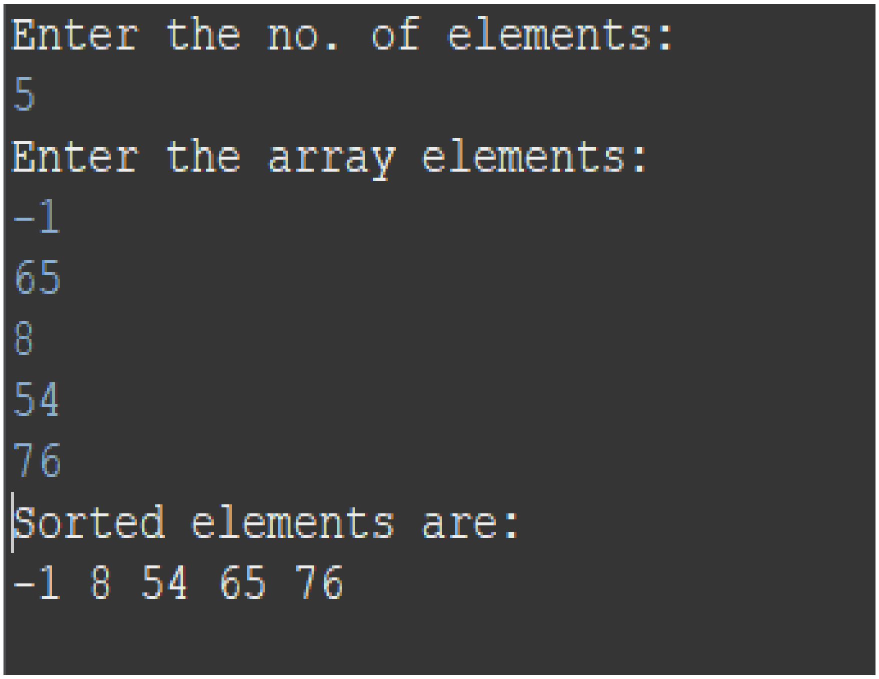
```
package com.programs.DAA_lab;
import java.util.*;
class Bubble_sort{
        public static void bubble_sort(int arr[]){
            int n=arr.length;
            for(int i=0;i<n-1;i++){
                for(int j=0;j<n-1;j++){
                    if(arr[j]>arr[j+1]){
                        int temp=arr[j];
                        arr[j]=arr[j+1];
                        arr[j+1]=temp;
                    }
                }
            }
        }
    public static void main(String args[]){
        Scanner sc = new Scanner(System.in);
        System.out.println("Enter the no. of elements: ");
            int n=sc.nextInt();
            System.out.println("Enter the array elements: ");
            int arr[]=new int[n];
            for(int i=0;i<n;i++){
                arr[i]=sc.nextInt();
            }
            bubble_sort(arr);
            System.out.println("Sorted elements are: ");
            for(int i=0;i<n;i++){
                System.out.print(arr[i]+" ");
            }
    }
}
```



```
Enter the no. of elements:
5
Enter the array elements:
12
56
45
3
9
Sorted elements are:
3 9 12 45 56
```

### c) Insertion: -

```
package com.programs.DAA_lab;
import java.util.Scanner;
public class Insertion_sort {
        public static void insertion_sort(int arr[]){
           int n=arr.length;
           int key, j;
           for(int i=1;i<n;i++){
              key=arr[i];
               j=i-1;
              while(j>=0 && arr[j]>key)
              {
                 arr[j+1]=arr[j];
                 j=j-1;
              }
              arr[j+1]=key;
           }
        }
        public static void main(String[] args) {
                Scanner sc = new Scanner(System.in);
                System.out.println("Enter the no. of elements: ");
           int n=sc.nextInt();
           System.out.println("Enter the array elements: ");
           int arr[]=new int[n];
           for(int i=0;i<n;i++){
              arr[i]=sc.nextInt();
           }
           insertion_sort(arr);
           System.out.println("Sorted elements are: ");
           for(int i=0;i<n;i++){
              System.out.print(arr[i]+" ");
           }

        }
}
```

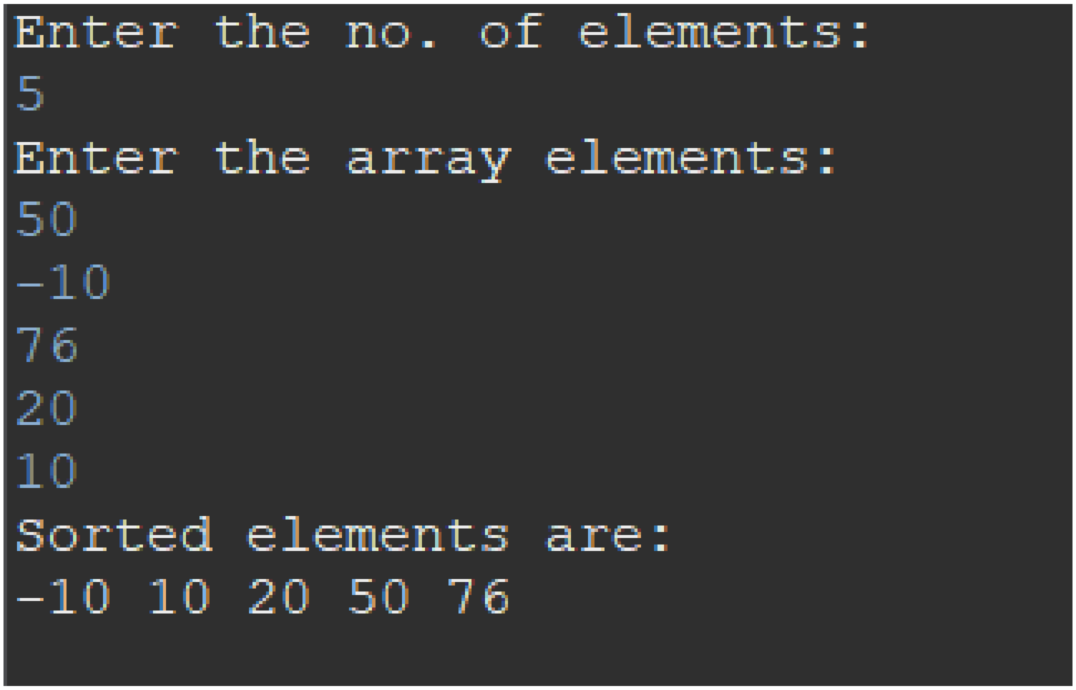


```
Enter the no. of elements:
5
Enter the array elements:
-1
65
8
54
76
Sorted elements are:
-1 8 54 65 76
```

**d) Quick Sort: -**

```
package com.programs.DAA_lab;
import java.util.*;
public class Quick_sort{
        public static void quicksort(int arr[], int si, int ei){
            if(si<ei){
                int q=partition(arr,si,ei);
                quicksort(arr,si,q-1);
                quicksort(arr,q+1,ei);
            }
        }
        public static int partition(int arr[], int si, int ei){
            int pivot=arr[ei];
            int j=si;
            for(int i=si;i<=ei-1;i++){
                if(arr[i]<=pivot){
                    int temp=arr[i];
                    arr[i]=arr[j];
                    arr[j]=temp;
                    j++;
                }
            }
            int temp=arr[j];
            arr[j]=arr[ei];
            arr[ei]=temp;
            return j;
        }

        public static void main(String[] args) {
            Scanner sc = new Scanner(System.in);
            System.out.println("Enter the no. of elements: ");
            int n=sc.nextInt();
            System.out.println("Enter the array elements: ");
            int arr[]=new int[n];
            for(int i=0;i<n;i++){
                arr[i]=sc.nextInt();
            }
            quicksort(arr,0,n-1);
            System.out.println("Sorted elements are: ");
            for(int i=0;i<n;i++){
                System.out.print(arr[i]+" ");
```

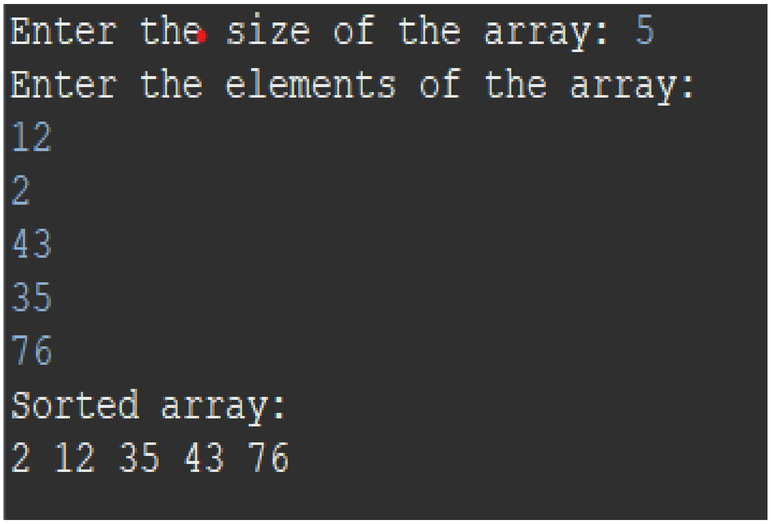
```
      }

    }
}
```



```
Enter the no. of elements:
5
Enter the array elements:
50
-10
76
20
10
Sorted elements are:
-10 10 20 50 76
```

### e) Merge Sort: -

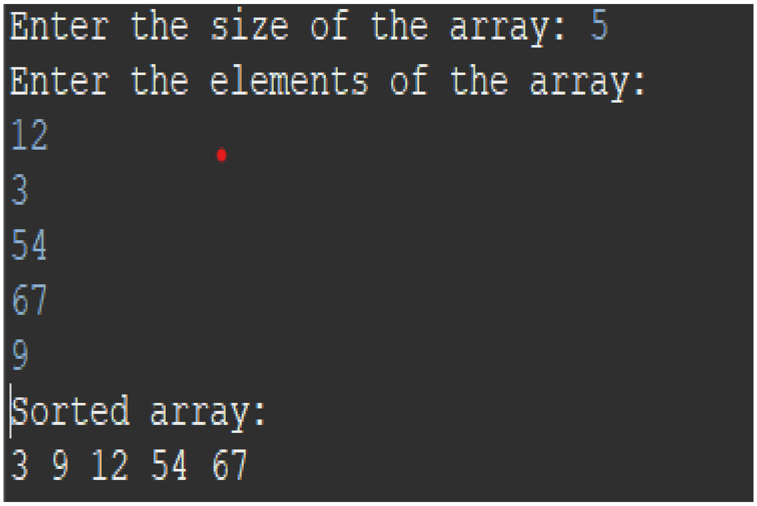
```
package com.programs.DAA_lab;
import java.util.*;
public class Merge_Sort {
  public static void main(String[] args) {
    Scanner sc = new Scanner(System.in);
    System.out.print("Enter the size of the array: ");
    int n = sc.nextInt();
    int[] arr = new int[n];
    System.out.println("Enter the elements of the array:");
    for (int i = 0; i < n; i++) {
      arr[i] = sc.nextInt();
    }
    Merge_Sort ms = new Merge_Sort();
    ms.sort(arr, 0, n - 1);
    System.out.println("Sorted array:");
    for (int i = 0; i < n; i++) {
      System.out.print(arr[i] + " ");
    }
  }
  public void sort(int[] arr, int l, int r) {
    if (l < r) {
      int m = (l + r) / 2;
      sort(arr, l, m);
      sort(arr, m + 1, r);
      merge(arr, l, m, r);
    }
  }
  public void merge(int[] arr, int l, int m, int r) {
    int n1 = m - l + 1;
    int n2 = r - m;
    int[] L = new int[n1];
    int[] R = new int[n2];
    for (int i = 0; i < n1; i++) {
      L[i] = arr[l + i];
    }
    for (int j = 0; j < n2; j++) {
      R[j] = arr[m + 1 + j];
    }
    int i = 0, j = 0, k = l;
    while (i < n1 && j < n2) {
      if (L[i] <= R[j]) {
        arr[k] = L[i];
        i++;
      } else {
        arr[k] = R[j];
        j++;
      }
      k++;
    }

    while (i < n1) {
      arr[k] = L[i];
      i++;
      k++;
    }

    while (j < n2) {
      arr[k] = R[j];
      j++;
      k++;
    }
  }
}
```



```
Enter the size of the array: 5
Enter the elements of the array:
12
2
43
35
76
Sorted array:
2 12 35 43 76
```

### f) Heap Sort:-

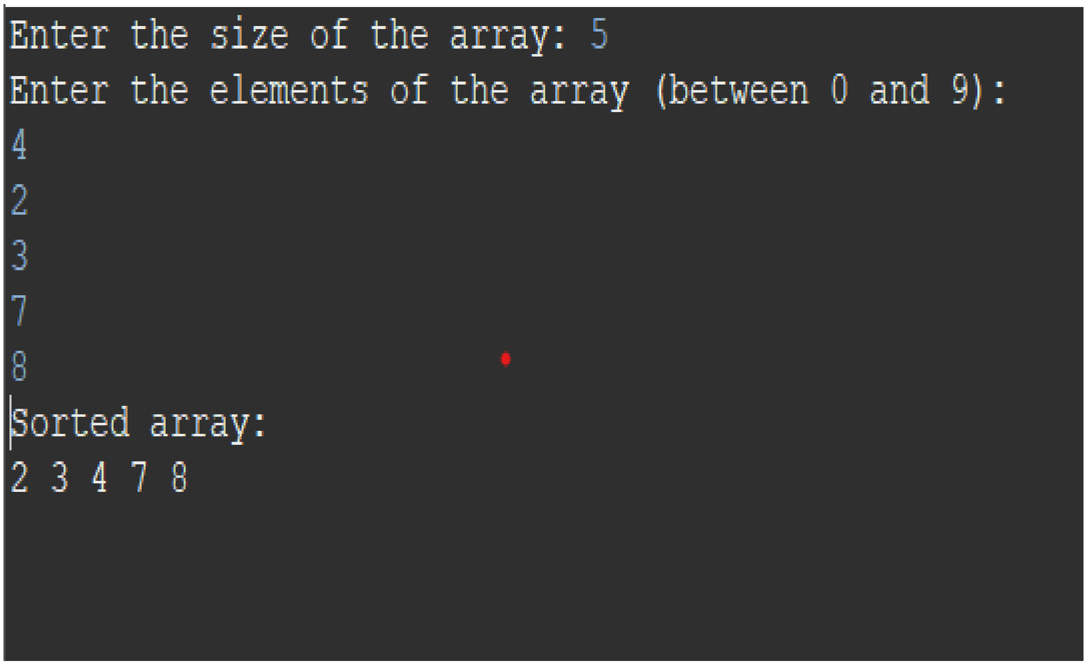
```
package com.programs.DAA_lab;

import java.util.Scanner;
public class HeapSort {
  public static void main(String[] args) {
    Scanner scanner = new Scanner(System.in);
    System.out.print("Enter the size of the array: ");
    int n = scanner.nextInt();
    int[] arr = new int[n];
    System.out.println("Enter the elements of the array:");
    for (int i = 0; i < n; i++) {
      arr[i] = scanner.nextInt();
    }
    HeapSort hs = new HeapSort();
    hs.sort(arr);
    System.out.println("Sorted array:");
    for (int i = 0; i < n; i++) {
      System.out.print(arr[i] + " ");
    }
  }
  public void sort(int[] arr) {
    int n = arr.length;

    // Build max heap
    for (int i = n / 2 - 1; i >= 0; i--) {
      heapify(arr, n, i);
    }

    // Heap sort
    for (int i = n - 1; i >= 0; i--) {
      int temp = arr[0];
      arr[0] = arr[i];
      arr[i] = temp;

      heapify(arr, i, 0);
    }
  }

  public void heapify(int[] arr, int n, int i) {
    int largest = i;
    int left = 2 * i + 1;
    int right = 2 * i + 2;

    if (left < n && arr[left] > arr[largest]) {
      largest = left;
    }

    if (right < n && arr[right] > arr[largest]) {
      largest = right;
    }

    if (largest != i) {
      int temp = arr[i];
      arr[i] = arr[largest];
      arr[largest] = temp;

      heapify(arr, n, largest);
    }
  }
}
```



```
Enter the size of the array: 5
Enter the elements of the array:
12
3
54
67
9
Sorted array:
3 9 12 54 67
```

### g) Counting Sort:-

```
package com.programs.DAA_lab;

import java.util.Scanner;
public class CountingSort {
  public static void main(String[] args) {
    Scanner scanner = new Scanner(System.in);
    System.out.print("Enter the size of the array: ");
    int n = scanner.nextInt();

    int[] arr = new int[n];
    System.out.println("Enter the elements of the array (between 0 and 9):");

    for (int i = 0; i < n; i++) {
      arr[i] = scanner.nextInt();
    }
    CountingSort cs = new CountingSort();
    cs.sort(arr);
    System.out.println("Sorted array:");
    for (int i = 0; i < n; i++) {
      System.out.print(arr[i] + " ");
    }
  }
  public void sort(int[] arr) {
    int n = arr.length;
    int[] count = new int[10];
    int[] output = new int[n];
    // Count the occurrences of each element
    for (int i = 0; i < n; i++) {
      count[arr[i]]++;
    }
    // Modify count to show the cumulative sum
    for (int i = 1; i < 10; i++) {
      count[i] += count[i - 1];
    }
    // Build the output array
    for (int i = n - 1; i >= 0; i--) {
      output[count[arr[i]] - 1] = arr[i];
      count[arr[i]]--;
    }
    // Copy the output array to the input array
    for (int i = 0; i < n; i++) {
      arr[i] = output[i];
    }
  }
}
```

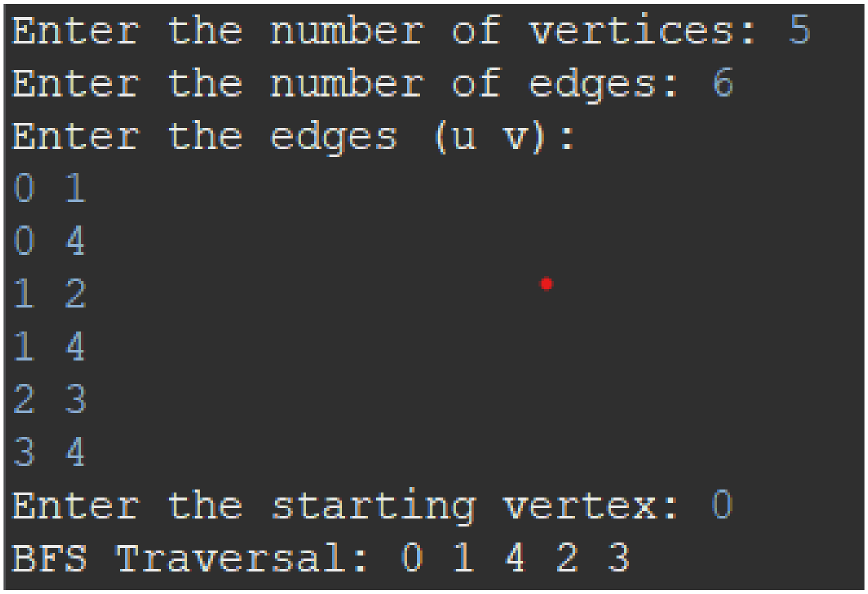


```
Enter the size of the array: 5
Enter the elements of the array (between 0 and 9):
4
2
3
7
8
Sorted array:
2 3 4 7 8
```

# Implementation of BFS and DFS

## 1) BFS: -

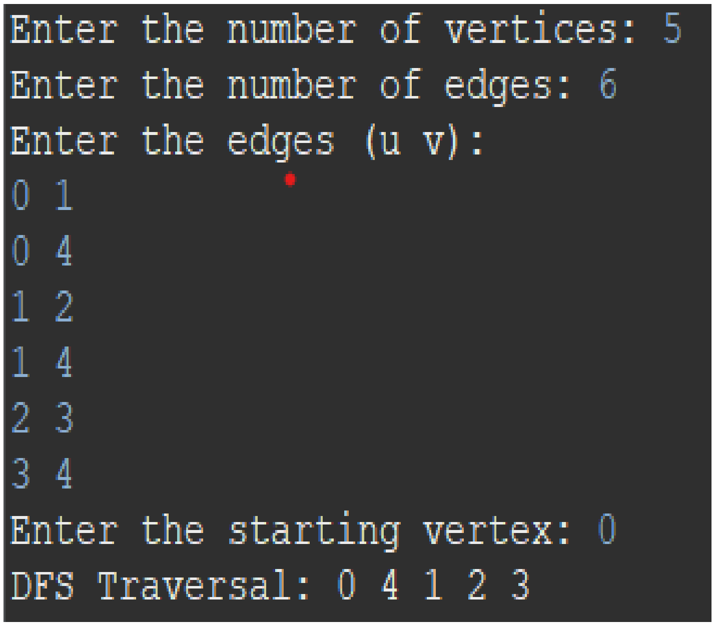
```
package com.programs.DAA_lab;

import java.util.*;
public class BFS {
  private int V;
  private LinkedList<Integer>[] adj;
  public BFS(int v) {
    V = v;
    adj = new LinkedList[V];
    for (int i = 0; i < V; i++) {
      adj[i] = new LinkedList<Integer>();
    }
  }

  public void addEdge(int v, int w) {
    adj[v].add(w);
  }
  public void bfs(int s) {
    boolean[] visited = new boolean[V];
    Queue<Integer> queue = new LinkedList<Integer>();
    visited[s] = true;
    queue.add(s);

    while (queue.size() != 0) {
      s = queue.poll();
      System.out.print(s + " ");

      for (int i = 0; i < adj[s].size(); i++) {
        int n = adj[s].get(i);
        if (!visited[n]) {
          visited[n] = true;
          queue.add(n);
        }
      }
    }
  }
  public static void main(String[] args) {
    Scanner scanner = new Scanner(System.in);
    System.out.print("Enter the number of vertices: ");
    int v = scanner.nextInt();
    BFS g = new BFS(v);
    System.out.print("Enter the number of edges: ");
    int e = scanner.nextInt();
    System.out.println("Enter the edges (u v):");
    for (int i = 0; i < e; i++) {
      int u = scanner.nextInt();
      int w = scanner.nextInt();
      g.addEdge(u, w);
    }
    System.out.print("Enter the starting vertex: ");
    int s = scanner.nextInt();
    System.out.print("BFS Traversal: ");
    g.bfs(s);
  }
}
```



```
Enter the number of vertices: 5
Enter the number of edges: 6
Enter the edges (u v):
0 1
0 4
1 2
1 4
2 3
3 4
Enter the starting vertex: 0
BFS Traversal: 0 1 4 2 3
```

## 2) DFS:-

```
package com.programs.DAA_lab;

import java.util.*;

public class DFS {
  private int V;
  private LinkedList<Integer>[] adj;
  public DFS(int v) {
    V = v;
    adj = new LinkedList[V];
    for (int i = 0; i < V; i++) {
      adj[i] = new LinkedList<Integer>();
    }
  }

  public void addEdge(int v, int w) {
    adj[v].add(w);
  }

  public void dfs(int s) {
    boolean[] visited = new boolean[V];
    Stack<Integer> st = new Stack<>();
    visited[s] = true;
    st.push(s);

    while (st.size() != 0) {
      s = st.pop();
      System.out.print(s + " ");

      for (int i = 0; i < adj[s].size(); i++) {
        int n = adj[s].get(i);
        if (!visited[n]) {
          visited[n] = true;
          st.add(n);
        }
      }
    }
  }

  public static void main(String[] args) {
    Scanner scanner = new Scanner(System.in);
    System.out.print("Enter the number of vertices: ");
    int v = scanner.nextInt();
    DFS g = new DFS(v);

    System.out.print("Enter the number of edges: ");
    int e = scanner.nextInt();
    System.out.println("Enter the edges (u v):");
    for (int i = 0; i < e; i++) {
      int u = scanner.nextInt();
      int w = scanner.nextInt();
      g.addEdge(u, w);
    }

    System.out.print("Enter the starting vertex: ");
    int s = scanner.nextInt();
    System.out.print("DFS Traversal: ");
    g.dfs(s);
  }
}
```

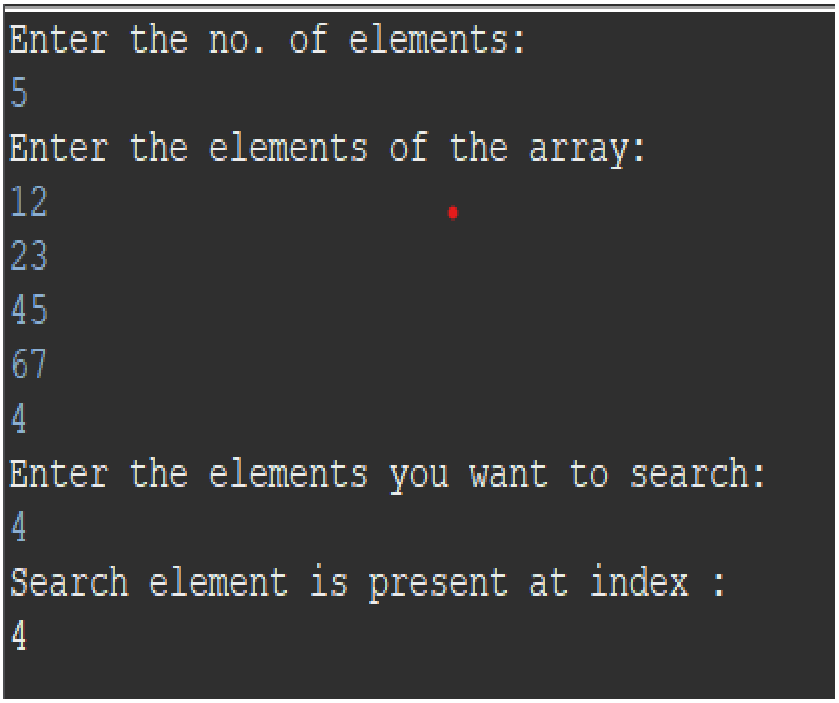


```
Enter the number of vertices: 5
Enter the number of edges: 6
Enter the edges (u v):
0 1
0 4
1 2
1 4
2 3
3 4
Enter the starting vertex: 0
DFS Traversal: 0 4 1 2 3
```

# Searching

## 1). Linear Searching:-

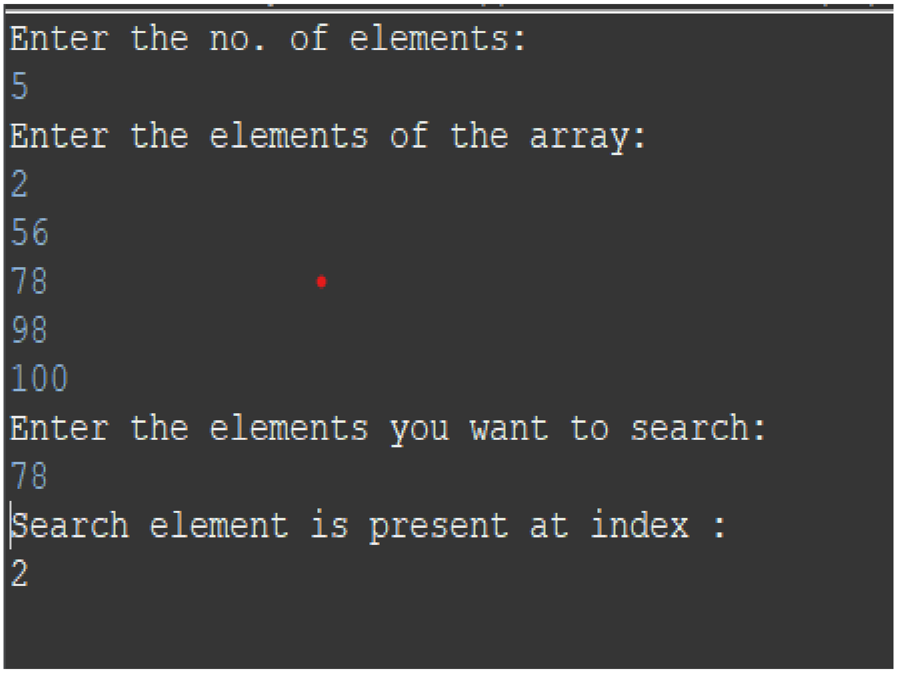
```
 package com.programs;

import java.util.*;
public class Linear_Search {

    public static void main(String[] args) {
        Scanner sc = new Scanner(System.in);
        System.out.println("Enter the no. of elements: ");
        int n = sc.nextInt();
        System.out.println("Enter the elements of the array:");
        int arr[] = new int[n];
        for(int i=0;i<n;i++) {
            arr[i]=sc.nextInt();
        }
        System.out.println("Enter the elements you want to search:");
        int item = sc.nextInt();
        System.out.println("Search element is present at index :");
        System.out.println(search(arr, item));

    }

    public static int search(int[] arr, int item) {
        for (int i = 0; i < arr.length; i++) {
            if (arr[i] == item) {
                return i;
            }

        }
        return -1;

    }

}
```



```
Enter the no. of elements:
5
Enter the elements of the array:
12
23
45
67
4
Enter the elements you want to search:
4
Search element is present at index :
4
```

### (c) Binary Search:-

```
package com.programs;
import java.util.Scanner;
public class Binary_search {
    public static void main(String[] args) {
        Scanner sc = new Scanner(System.in);
        System.out.println("Enter the no. of elements: ");
        int n=sc.nextInt();
        System.out.println("Enter the elements of the array:");
        int arr[]=new int[n];
        for(int i=0;i<n;i++) {
            arr[i]=sc.nextInt();
        }
        System.out.println("Enter the elements you want to search:");
        int item=sc.nextInt();
        System.out.println("Search element is present at index :");
        System.out.println(Search(arr, item));
    }
    public static int Search(int[] arr, int item) {
        int si = 0;
        int ei = arr.length - 1;
        while (si <= ei) {
            int mid = (si + ei) / 2;
            if (arr[mid] == item) {
                return mid;
            } else if (arr[mid] > item) {
                ei = mid - 1;
            } else {
                si = mid + 1;
            }
        }
        return -1;
    }
}
```

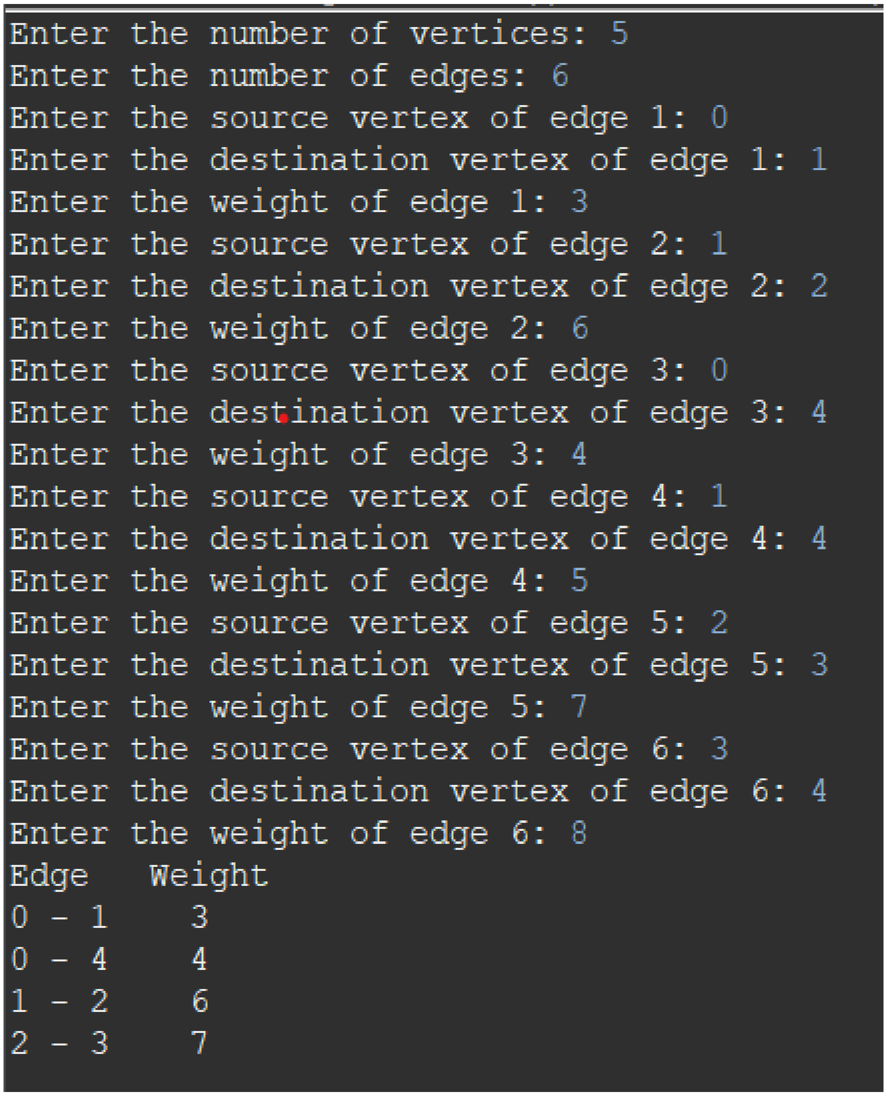


```
Enter the no. of elements:
5
Enter the elements of the array:
2
56
78
98
100
Enter the elements you want to search:
78
Search element is present at index :
2
```

# Minimum Spanning Tree

## 1) Kruskal Algorithm: -

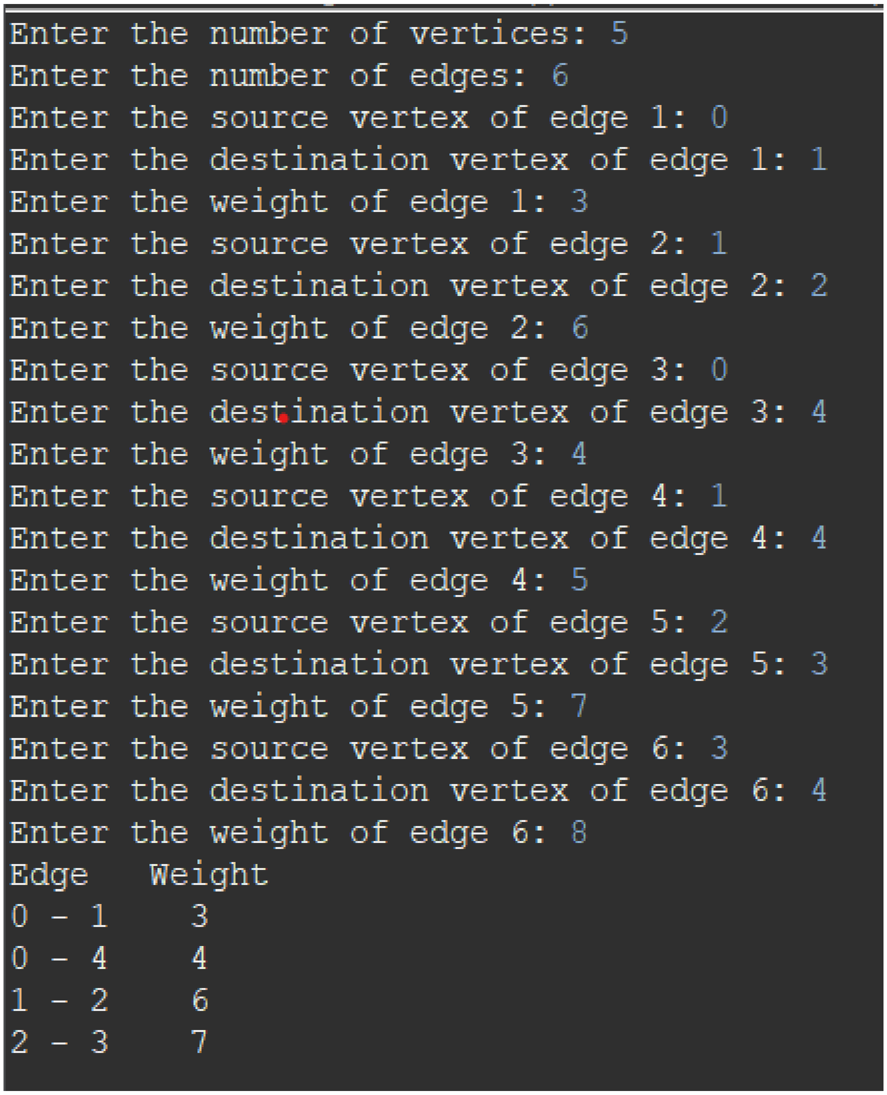
```
package com.programs.DAA_lab;

import java.util.*;
public class KruskalAlgorithm {
    private static class Edge implements Comparable<Edge> {
        int src, dest, weight;
        public Edge(int s, int d, int w) {
            src = s;
            dest = d;
            weight = w;
        }

        @Override
        public int compareTo(Edge other) {
            return weight - other.weight;
        }
    }

    private static int[] parent;
    public static void main(String[] args) {
        Scanner sc = new Scanner(System.in);
        System.out.print("Enter the number of vertices: ");
        int V = sc.nextInt();
        System.out.print("Enter the number of edges: ");
        int E = sc.nextInt();
        Edge[] edges = new Edge[E];
        for (int i = 0; i < E; i++) {
            System.out.print("Enter the source vertex of edge " + (i+1) + ": ");
            int u = sc.nextInt();
            System.out.print("Enter the destination vertex of edge " + (i+1) + ": ");
            int v = sc.nextInt();
            System.out.print("Enter the weight of edge " + (i+1) + ": ");
            int w = sc.nextInt();
            edges[i] = new Edge(u, v, w);
        }
        kruskalMST(edges, V);
    }
    private static int find(int i) {
        if (parent[i] == i) {
            return i;
        }
        return find(parent[i]);
    }
    private static void union(int i, int j) {
        int rootI = find(i);
        int rootJ = find(j);
        parent[rootI] = rootJ;
    }
    private static void kruskalMST(Edge[] edges, int V) {
        Arrays.sort(edges);
        parent = new int[V];
        for (int i = 0; i < V; i++) {
            parent[i] = i;
        }
        Edge[] result = new Edge[V-1];
        int e = 0;
        int i = 0;
        while (e < V-1) {
            Edge nextEdge = edges[i++];
            int srcParent = find(nextEdge.src);
            int destParent = find(nextEdge.dest);

            if (srcParent != destParent) {
                result[e++] = nextEdge;
                union(srcParent, destParent);
            }
        }
        printMST(result, V);
    }

    private static void printMST(Edge[] result, int V) {
        System.out.println("Edge   Weight");
        for (int i = 0; i < V-1; i++) {
            System.out.println(result[i].src + " - " + result[i].dest + "    " + result[i].weight);
        }
    }
}
```



```
Enter the number of vertices: 5
Enter the number of edges: 6
Enter the source vertex of edge 1: 0
Enter the destination vertex of edge 1: 1
Enter the weight of edge 1: 3
Enter the source vertex of edge 2: 1
Enter the destination vertex of edge 2: 2
Enter the weight of edge 2: 6
Enter the source vertex of edge 3: 0
Enter the destination vertex of edge 3: 4
Enter the weight of edge 3: 4
Enter the source vertex of edge 4: 1
Enter the destination vertex of edge 4: 4
Enter the weight of edge 4: 5
Enter the source vertex of edge 5: 2
Enter the destination vertex of edge 5: 3
Enter the weight of edge 5: 7
Enter the source vertex of edge 6: 3
Enter the destination vertex of edge 6: 4
Enter the weight of edge 6: 8
Edge   Weight
0 - 1    3
0 - 4    4
1 - 2    6
2 - 3    7
```

## 2) Prims Algorithm

```
package com.programs.DAA_lab;
import java.util.*;

public class Prims_Algorithm {
    private static int INF = Integer.MAX_VALUE;

    public static void main(String[] args) {
        Scanner sc = new Scanner(System.in);
        System.out.print("Enter the number of vertices: ");
        int V = sc.nextInt();
        System.out.print("Enter the number of edges: ");
        int E = sc.nextInt();

        int[][] graph = new int[V][V];
        for (int i = 0; i < V; i++) {
            Arrays.fill(graph[i], INF);
        }

        for (int i = 0; i < E; i++) {
            System.out.print("Enter the source vertex of edge " + (i+1) + ": ");
            int u = sc.nextInt();
            System.out.print("Enter the destination vertex of edge " + (i+1) + ": ");
            int v = sc.nextInt();
            System.out.print("Enter the weight of edge " + (i+1) + ": ");
            int w = sc.nextInt();
            graph[u][v] = w;
            graph[v][u] = w;
        }

        primMST(graph, V);
    }

    private static void primMST(int[][] graph, int V) {
        int[] key = new int[V];
        Arrays.fill(key, INF);

        boolean[] mstSet = new boolean[V];

        int[] parent = new int[V];
        Arrays.fill(parent, -1);
        key[0] = 0;
        parent[0] = -1;

        for (int count = 0; count < V-1; count++) {
            int u = minKey(key, mstSet, V);

            mstSet[u] = true;

            for (int v = 0; v < V; v++) {
                if (graph[u][v] != 0 && !mstSet[v] && graph[u][v] < key[v]) {
                    parent[v] = u;
                    key[v] = graph[u][v];
                }
            }
        }

        printMST(parent, graph, V);
    }

    private static int minKey(int[] key, boolean[] mstSet, int V) {
        int min = INF, minIndex = -1;
        for (int v = 0; v < V; v++) {
            if (!mstSet[v] && key[v] < min) {
                min = key[v];
                minIndex = v;
            }
        }
        return minIndex;
    }

    private static void printMST(int[] parent, int[][] graph, int V) {
        System.out.println("Edge   Weight");
        for (int i = 1; i < V; i++) {
            System.out.println(parent[i] + " - " + i + "    " + graph[i][parent[i]]);
        }
    }
}
```

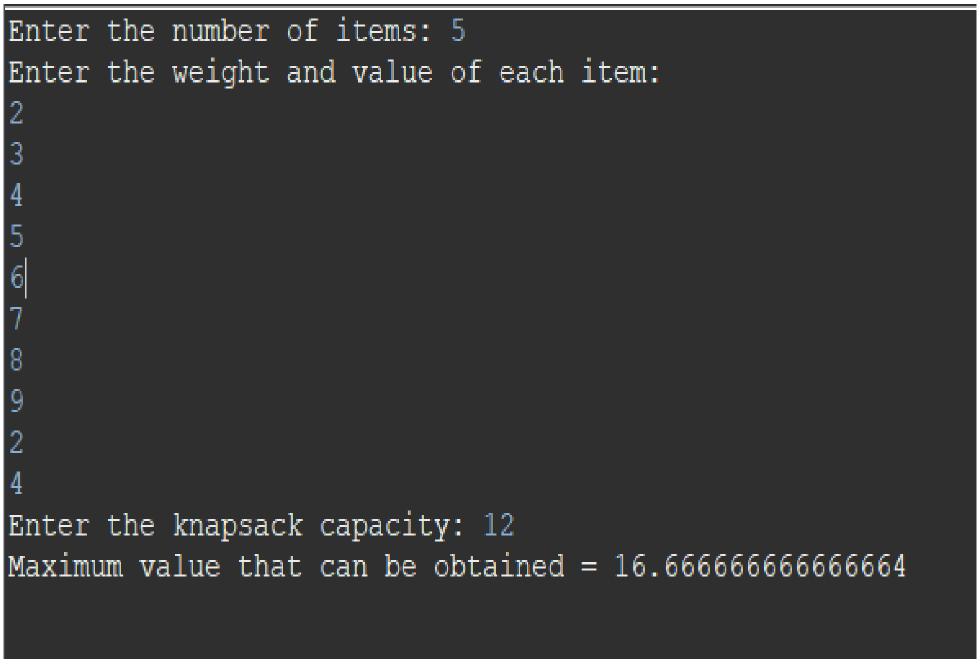


```
Enter the number of vertices: 5
Enter the number of edges: 6
Enter the source vertex of edge 1: 0
Enter the destination vertex of edge 1: 1
Enter the weight of edge 1: 3
Enter the source vertex of edge 2: 1
Enter the destination vertex of edge 2: 2
Enter the weight of edge 2: 6
Enter the source vertex of edge 3: 0
Enter the destination vertex of edge 3: 4
Enter the weight of edge 3: 4
Enter the source vertex of edge 4: 1
Enter the destination vertex of edge 4: 4
Enter the weight of edge 4: 5
Enter the source vertex of edge 5: 2
Enter the destination vertex of edge 5: 3
Enter the weight of edge 5: 7
Enter the source vertex of edge 6: 3
Enter the destination vertex of edge 6: 4
Enter the weight of edge 6: 8
Edge   Weight
0 - 1    3
0 - 4    4
1 - 2    6
2 - 3    7
```

## GREEDY ALGORITHM:-

# 1. Fractional KnapSack:

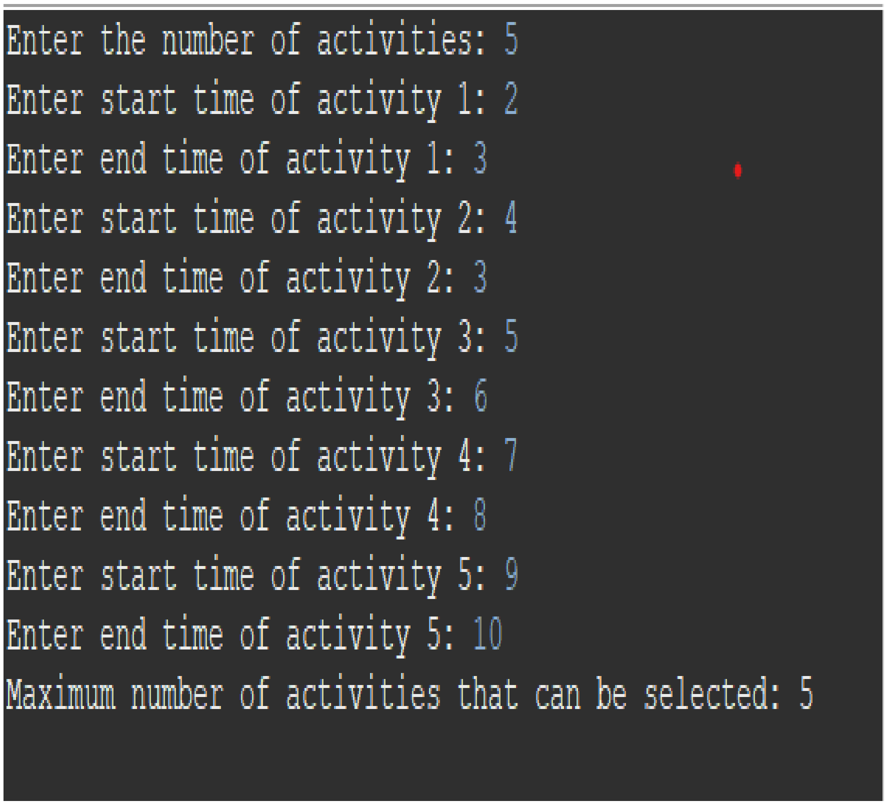
```
package com.programs.DAA_lab;

import java.util.Arrays;
import java.util.Comparator;
import java.util.Scanner;
public class FractionalKnapsack{
    public static void main(String[] args) {
        Scanner scanner = new Scanner(System.in);
        System.out.print("Enter the number of items: ");
        int n = scanner.nextInt();
        Item[] items = new Item[n];
        System.out.println("Enter the weight and value of each item:");
        for (int i = 0; i < n; i++) {
            int weight = scanner.nextInt();
            int value = scanner.nextInt();
            items[i] = new Item(weight, value);
        }
        System.out.print("Enter the knapsack capacity: ");
        int capacity = scanner.nextInt();
        double maxValue = fractionalKnapsack(items, capacity);
        System.out.println("Maximum value that can be obtained = " + maxValue);
    }

    public static double fractionalKnapsack(Item[] items, int capacity) {
        Arrays.sort(items,
Comparator.comparingDouble(Item::valuePerWeight).reversed());
        double maxValue = 0.0;
        for (Item item : items) {
            if (capacity - item.weight >= 0) {
                maxValue += item.value;
                capacity -= item.weight;
            } else {
                double fraction = ((double) capacity) / ((double) item.weight);
                maxValue += item.value * fraction;
                break;
            }
        }
        return maxValue;
    }
    static class Item {
        int weight;
        int value;
        public Item(int weight, int value) {
            this.weight = weight;
            this.value = value;
        }

        public double valuePerWeight() {
            return (double) value / (double) weight;
        }
    }
}
```



```
Enter the number of items: 5
Enter the weight and value of each item:
2
3
4
5
6
7
8
9
2
4
Enter the knapsack capacity: 12
Maximum value that can be obtained = 16.666666666666664
```

# Activity Selection

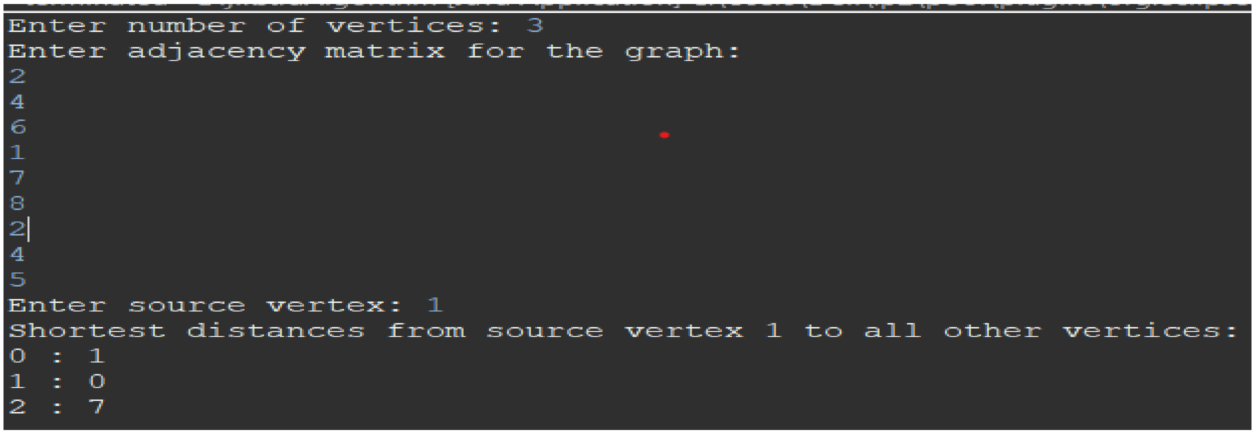
```
package com.programs.DAA_lab;
import java.util.*;
public class ActivitySelection {
    public static void main(String[] args) {
        Scanner input = new Scanner(System.in);
        System.out.print("Enter the number of activities: ");
        int n = input.nextInt();
        int[] startTimes = new int[n];
        int[] endTimes = new int[n];

        // Input the start and end times of each activity
        for (int i = 0; i < n; i++) {
            System.out.print("Enter start time of activity " + (i+1) + ": ");
            startTimes[i] = input.nextInt();
            System.out.print("Enter end time of activity " + (i+1) + ": ");
            endTimes[i] = input.nextInt();
        }
        // Sort the activities by end time in ascending order
        for (int i = 0; i < n-1; i++) {
            for (int j = i+1; j < n; j++) {
                if (endTimes[i] > endTimes[j]) {
                    int temp = endTimes[i];
                    endTimes[i] = endTimes[j];
                    endTimes[j] = temp;
                    temp = startTimes[i];
                    startTimes[i] = startTimes[j];
                    startTimes[j] = temp;
                }
            }
        }

        // Select the activities
        int selected = 1;
        int lastEnd = endTimes[0];
        for (int i = 1; i < n; i++) {
            if (startTimes[i] >= lastEnd) {
                selected++;
                lastEnd = endTimes[i];
            }
        }
        System.out.println("Maximum number of activities that can be selected: " + selected);
    }
}
```



```
Enter the number of activities: 5
Enter start time of activity 1: 2
Enter end time of activity 1: 3
Enter start time of activity 2: 4
Enter end time of activity 2: 3
Enter start time of activity 3: 5
Enter end time of activity 3: 6
Enter start time of activity 4: 7
Enter end time of activity 4: 8
Enter start time of activity 5: 9
Enter end time of activity 5: 10
Maximum number of activities that can be selected: 5
```

# Dijkstra Algorithm

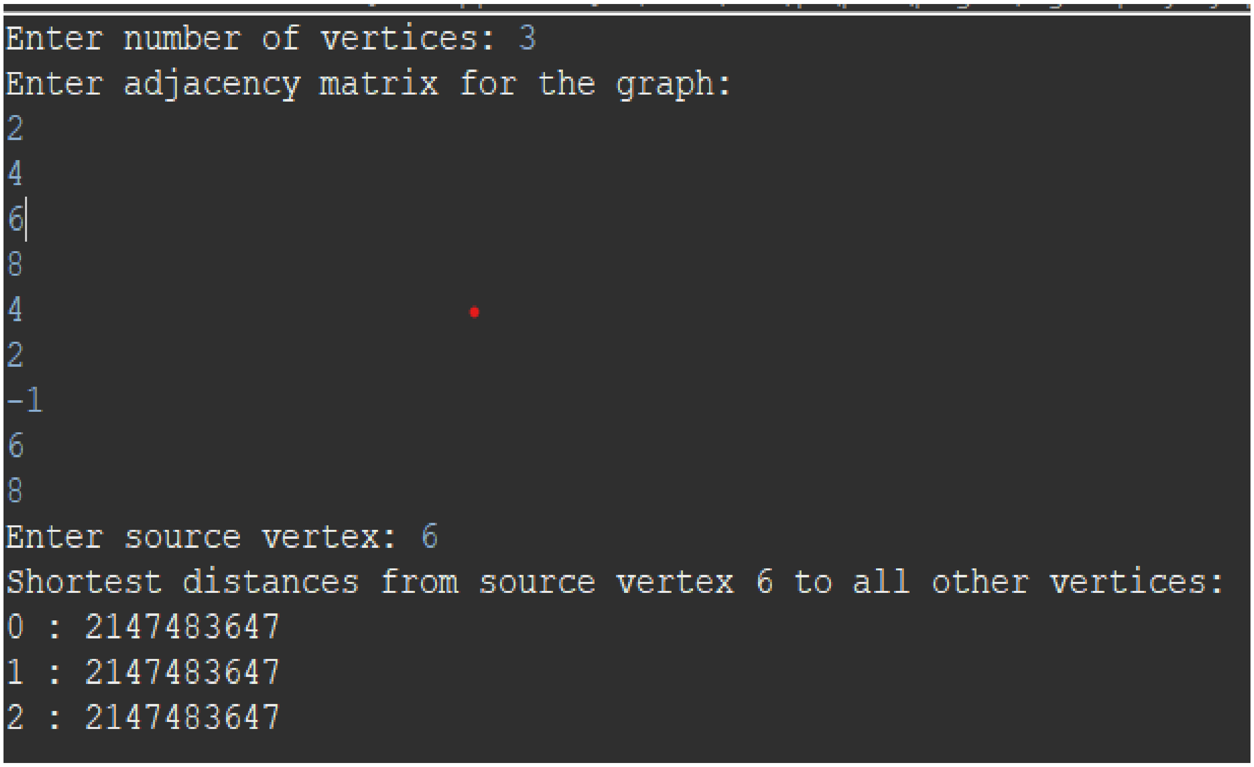
```
package com.programs.DAA_lab;

import java.util.*;

public class DijikstraAlgorithm {
    static int INF = Integer.MAX_VALUE; // infinity value for distances
    public static void main(String[] args) {
        Scanner sc = new Scanner(System.in);
        System.out.print("Enter number of vertices: ");
        int V = sc.nextInt();
        int[][] graph = new int[V][V];
        System.out.println("Enter adjacency matrix for the graph:");
        for (int i = 0; i < V; i++) {
            for (int j = 0; j < V; j++) {
                graph[i][j] = sc.nextInt();
            }
        }
        System.out.print("Enter source vertex: ");
        int source = sc.nextInt();
        dijkstra(graph, source);
    }
    public static void dijkstra(int[][] graph, int source) {
        int V = graph.length;
        boolean[] visited = new boolean[V];
        int[] distance = new int[V];

        // initialize all distances to infinity and visited array to false
        for (int i = 0; i < V; i++) {
            distance[i] = INF;
            visited[i] = false;
        }

        // distance from source vertex to itself is 0
        distance[source] = 0;

        // find shortest path for all vertices
        for (int i = 0; i < V-1; i++) {
            int minDist = INF;
            int minIndex = -1;
            // find the vertex with minimum distance that has not been visited
            for (int j = 0; j < V; j++) {
                if (!visited[j] && distance[j] < minDist) {
                    minDist = distance[j];
                    minIndex = j;
                }
            }

            // mark the vertex as visited
            visited[minIndex] = true;

            // update distance of adjacent vertices
            for (int k = 0; k < V; k++) {
                if (!visited[k] && graph[minIndex][k] != 0 && distance[minIndex] != INF
                    && distance[minIndex] + graph[minIndex][k] < distance[k]) {
                    distance[k] = distance[minIndex] + graph[minIndex][k];
                }
            }
        }

        // print the distances
        System.out.println("Shortest distances from source vertex " + source + " to all other vertices:");
        for (int i = 0; i < V; i++) {
            System.out.println(i + " : " + distance[i]);
        }
    }
}
```



```
Enter number of vertices: 3
Enter adjacency matrix for the graph:
2
4
6
1
7
8
2
4
5
Enter source vertex: 1
Shortest distances from source vertex 1 to all other vertices:
0 : 1
1 : 0
2 : 7
```

# BellmanFord Algorithm

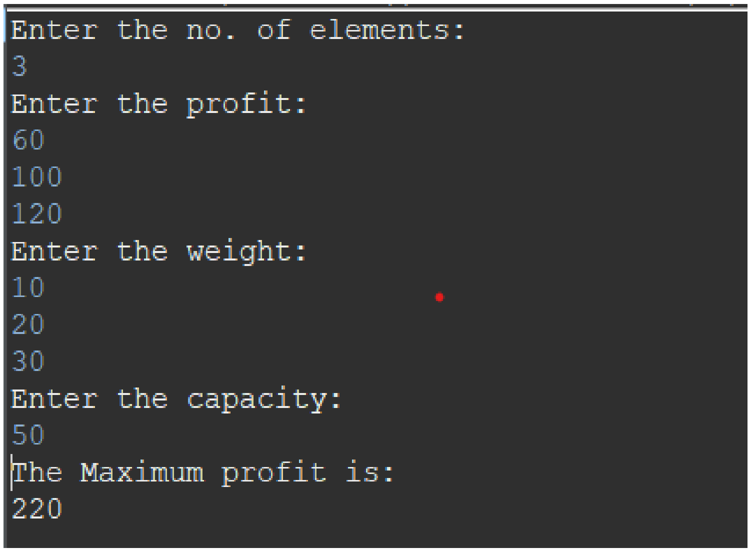
```
package com.programs.DAA_lab;

import java.util.*;

public class BellmanFord {

    static int INF = Integer.MAX_VALUE; // infinity value for distances

    public static void main(String[] args) {

        Scanner sc = new Scanner(System.in);

        System.out.print("Enter number of vertices: ");
        int V = sc.nextInt();

        int[][] graph = new int[V][V];

        System.out.println("Enter adjacency matrix for the graph:");

        for (int i = 0; i < V; i++) {
            for (int j = 0; j < V; j++) {
                graph[i][j] = sc.nextInt();
            }
        }

        System.out.print("Enter source vertex: ");
        int source = sc.nextInt();

        bellmanFord(graph, source);

    }

    public static void bellmanFord(int[][] graph, int source) {

        int V = graph.length;
        int[] distance = new int[V];

        // initialize all distances to infinity except for the source vertex which is 0
        for (int i = 0; i < V; i++) {
            if (i == source) {
                distance[i] = 0;
            } else {
                distance[i] = INF;
            }
        }

        // relax edges repeatedly
        for (int i = 0; i < V-1; i++) {
            for (int j = 0; j < V; j++) {
                for (int k = 0; k < V; k++) {
                    if (graph[j][k] != 0 && distance[j] != INF && distance[j] + graph[j][k] <
distance[k]) {
                        distance[k] = distance[j] + graph[j][k];
                    }
                }
            }
        }

        // check for negative-weight cycles
        for (int j = 0; j < V; j++) {
            for (int k = 0; k < V; k++) {
                if (graph[j][k] != 0 && distance[j] != INF && distance[j] + graph[j][k] <
distance[k]) {
                    System.out.println("Graph contains negative-weight cycle");
                    return;
                }
            }
        }

        // print the distances
        System.out.println("Shortest distances from source vertex " + source + " to all other
vertices:");
        for (int i = 0; i < V; i++) {
            System.out.println(i + " : " + distance[i]);
        }
    }
}
```



```
Enter number of vertices: 3
Enter adjacency matrix for the graph:
2
4
6
8
4
2
-1
6
8
Enter source vertex: 6
Shortest distances from source vertex 6 to all other vertices:
0 : 2147483647
1 : 2147483647
2 : 2147483647
```

# Knapsack Problem(DP)

```
import java.util.*;
public class Knap_sack {
   static int max(int a, int b) {
        return (a > b) ? a : b;
        }
   static int knapSack(int W, int wt[], int val[], int n)
   {
      if (n == 0 || W == 0) {
         return 0;
      }
      if (wt[n - 1] > W) {
         return knapSack(W, wt, val, n - 1);
      }
      else {
         return max(val[n - 1]+ knapSack(W - wt[n - 1], wt,val, n - 1),knapSack(W, wt, val,
n - 1));
      }
   }
        public static void main(String[] args) {
                Scanner sc = new Scanner (System.in);
                System.out.println("Enter the no. of elements: ");
                int n=sc.nextInt();
                System.out.println ("Enter the profit: ");
                int profit[]=new int[n];
                for(int i=0;i<n;i++) {
                        profit[i]=sc.nextInt();
                }
                System.out.println("Enter the weight: ");
                int weight[]=new int[n];
                for(int i=0;i<n;i++) {
                        weight[i]=sc.nextInt();
                }
                System.out.println("Enter the capacity: ");
                int m=sc.nextInt();
                System.out.println("The Maximum profit is: ");
                System.out.println(knapSack(m, weight, profit, n));
        }

}
```



```
Enter the no. of elements:
3
Enter the profit:
60
100
120
Enter the weight:
10
20
30
Enter the capacity:
50
The Maximum profit is:
220
```