Assignment 1
Subject: Advanced Software Engineering (Software Testing)

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Binary Search in Java

```
import java.util.*;
class BinarySearch {
   // Returns index of key if it is present in arr[l.. r], else return -1

   int binarySearch(int arr[], int l, int r, int key)
   {
      if (r >= l) {
         int middle = l + (r - l) / 2;

         // If the element is present at the middle itself
         if (arr[middle] == key)
            return middle;

         // If element is smaller than middle, then it can only be present in left subarray
         if (arr[middle] > key)
            return binarySearch(arr, l, middle - 1, key);

         // Else the element can only be present in right subarray
         return binarySearch(arr, middle + 1, r, key);
      }

      // We reach here when element is not present in array
      return -1;
   }
   public static void main(String args[])
   {
      BinarySearch ob = new BinarySearch();
      int arr[];
      Scanner sc= new Scanner(System.in);
      System.out.println("Enter the length of the array you want to search in.:");
      int length=sc.nextInt();
      arr= new int[length];
      System.out.println("Enter "+length+" elements.");
      for(int i=0;i<length;i++)
      {
         try
         {
            System.out.println("Enter element no. "+(i+1));
            arr[i]=sc.nextInt();
         }
         catch(Exception e)
         {
            System.out.println(e.getMessage());
            i--;
         }
      }
      sc.nextLine();
```

```
        System.out.println("Enter the no which you want to find in the array input by you :\n Enter Q
           to quit");

        while(true)
        {
           String a=sc.nextLine();
           if(a.equalsIgnoreCase("Q"))
           {
              System.exit(0);
           }
           else
           {
              try
              {
                 int result = ob.binarySearch(arr, 0, length - 1, Integer.parseInt(a));
                 if (result == -1)
                    System.out.println("Element not present");
                 else
                    System.out.println("Element found at index " + result);

              }

              catch(Exception e)
              {
                 System.out.println(e.getMessage());
              }
           }
        }
     }
}
```

Boundary Value Check Analaysis

1 variables so total cases= 4n+1=4*1+1=5
let sorted array used in above program–[11,25,31,49,52,66,74,89,93,100]

Range:11-100
Min value:11
Min+ value:12
Max value:100
Max- value:93
Nominal value:52

Test cases:

Test No.	Input	Outpur
1	11	Element found at index 0
2	12	Element not present
3	100	Element found at index 9
4	93	Element found at index 8
5	74	Element found at index 6

Equivalence partitioning

Pre-conditions satisfied, key element in array
Pre-conditions satisfied. Key element not in array
Pre-conditions unsatisfied, key element in array
Pre-conditions unsatisfied. Key element not in array
Input array has a single value

Binary Search – Test cases

Input array(T)	Key(key)	Output(Found, L)
19	19	true,0
19	0	false,??
19,20,23,25	19	true,0
19,16,28,30,31,51,65	65	true,6
19,20,23,25,35,38,52	20	true,2
19,20,23,25,35,38,52	23	true,2
22,38.41,53,62	53	true,3
21,23,29,33,38	25	false,??

Check Input partitions:

- Do the inputs satisfy the pre condition?
- Is the key in the array?
  Leads to at least 2x2 equivalence classes

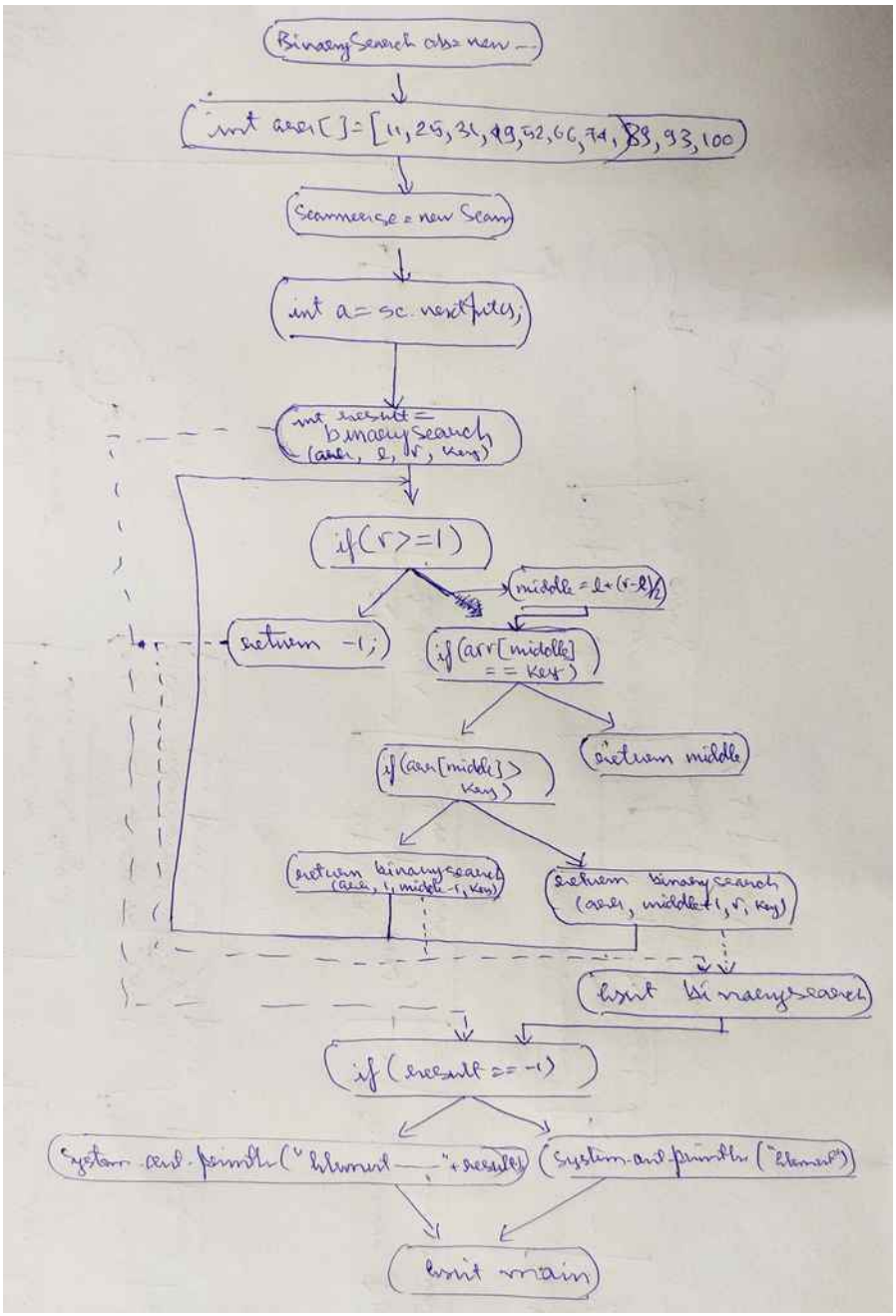
Check boundary conditions

- Is the array of length 1?
- Is the key at the start or end of the array>leads to further subdivisions
  (not all combinations make sense)

Equivalence Partitioning: Test Data

Test cases	Input	Output
Array length 0	key =27, element={}	false
Array not sorted	key =27, element={43,31,27,28}	exception
Array size 1, key in array	key =27, element={27}	true
Array size 1, key not in array	key =0, element={27}	false
Array size > 1, key is first	key =27, element={27,28,32,33}	true
Array size > 1, key is last element	key =33, element={27,28,32,33}	true
Array size > 1, key is in middle	key =20, element={27,28,32.33}	true
Array size > 1. key not in array	key =50, element={27,28,32,33}	false

Control Flow Graph:



Cyclometic Complexity

No of edges(E)=20
No of nodes(N)=18
V(G)=E-N+2
V(G)=20-18+2=4