- **Knapsack Problem**

Given N items where each item has some weight and profit associated with it and also given a bag with capacity W, [i.e., the bag can hold at most W weight in it]. The task is to put the items into the bag such that the sum of profits associated with them is the maximum possible.

Note: The constraint here is we can either put an item completely into the bag or cannot put it at all [It is not possible to put a part of an item into the bag].

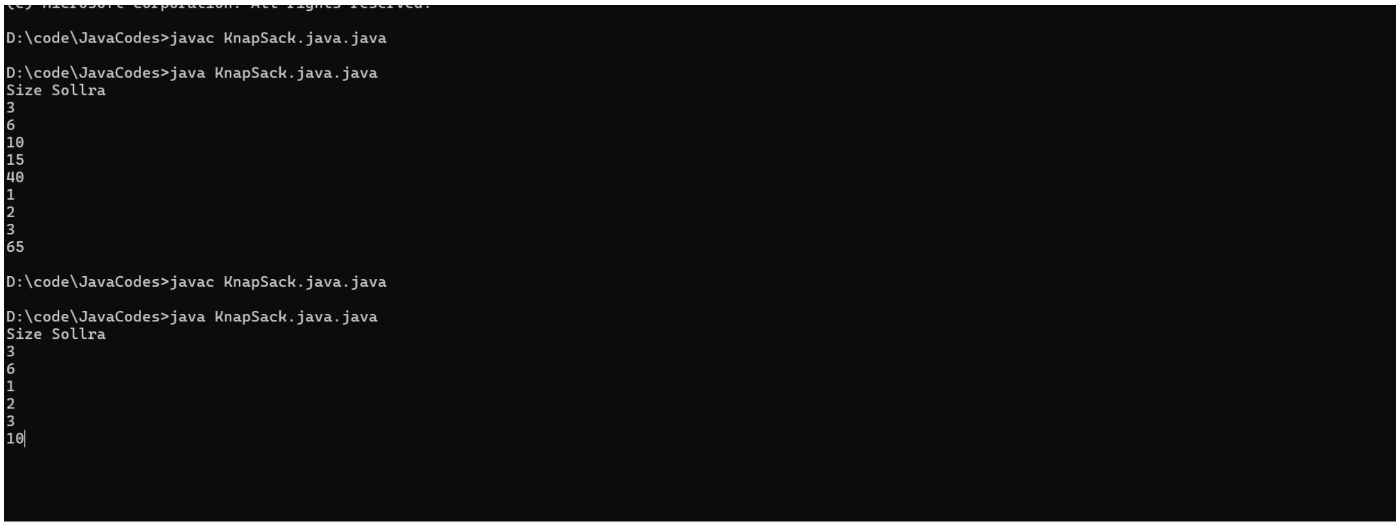
```
import java.util.*;
class KnapSack{
    public static void main(String[] args){
            Scanner sc=new Scanner(System.in);
            System.out.println("Size Sollra");
            int n=sc.nextInt();
            int weight=sc.nextInt();

            int[] prof=new int[n];
            int[] val=new int[n];
            for(int i=0;i<n;i++){
                    prof[i]=sc.nextInt();
            }
            for(int i=0;i<n;i++){
                    val[i]=sc.nextInt();
            }
            System.out.println(helper(n,weight,prof,val));



    }
    public static int helper(int n,int cap,int[] prof,int[] wt){
            int[][] pri=new int[n+1][cap+1];
            for(int i=0;i<n+1;i++){
                    for(int j=0;j<cap+1;j++){
                            if(i==0 || j==0) pri[i][j]=0;
                            else if(wt[i-1]<=j){
                                    pri[i][j]=Math.max(prof[i-1]+pri[i-1][j-wt[i-1]],pri[i-
1][j]);
                            }
                            else pri[i][j]=pri[i-1][j];
                    }
            }
            return pri[n][cap];
    }
}
```

Output:



```
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D:\code\JavaCodes>javac KnapSack.java.java

D:\code\JavaCodes>java KnapSack.java.java
Size Sollra
3
6
10
15
40
1
2
3
65

D:\code\JavaCodes>javac KnapSack.java.java

D:\code\JavaCodes>java KnapSack.java.java
Size Sollra
3
6
1
2
3
10
```

Time Complexity: O(n);

Space Complexity: O(n);

- Given a sorted array and a value **x**, the floor of x is the largest element in the array smaller than or equal to x. Write efficient functions to find the floor of x.

Input: arr[] = {1, 2, 8, 10, 10, 12, 19}, x = 20

Output: 6

Explanation: 19 is the largest element in

arr[] smaller than 20

Input : arr[] = {1, 2, 8, 10, 10, 12, 19}, x = 0

Output : -1

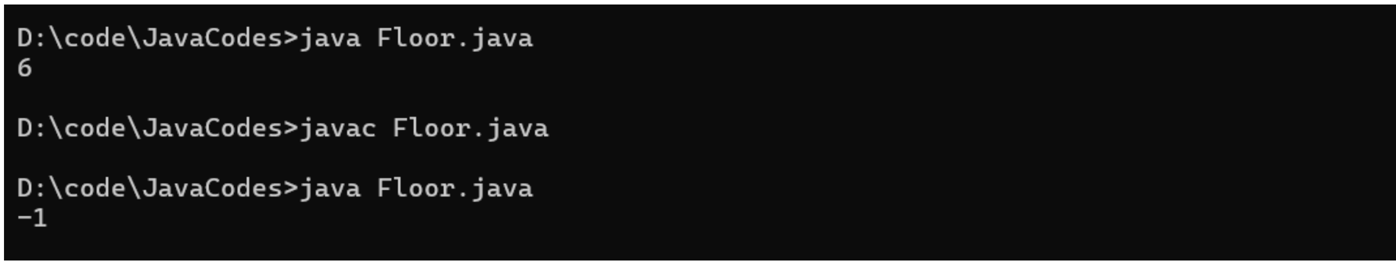
Explanation: Since floor doesn’t exist, output is -1.

Code:

class Solution {

```
    public static int Floor(int[] arr, int k) {
        int n=arr.length;
       int l=0;
       int r=n-1;
       int ind=-1;
       while(l<=r){
           int mid=l+(r-l)/2;
           if(arr[mid]==k) return mid;
           else if(arr[mid]<k){
               ind=mid;
               l=mid+1;
           }
           else  r=mid-1;
       }
       return ind;
    }
      public static void main(String[] ars){
                 int k=0;
                 int arr[] = {1, 2, 8, 10, 11, 12, 19};
                 System.out.println(Floor(arr,k));
      }
}
```

Output:



```
D:\code\JavaCodes>java Floor.java
6

D:\code\JavaCodes>javac Floor.java

D:\code\JavaCodes>java Floor.java
-1
```

- **Check equal arrays**

Given two arrays, **arr1** and **arr2** of equal length **N**, the task is to determine if the given arrays are equal or not. Two arrays are considered equal if:

- Both arrays contain the same set of elements.
- The arrangements (or permutations) of elements may be different.
- If there are repeated elements, the counts of each element must be the same in both arrays.

Input: arr1[] = {1, 2, 5, 4, 0}, arr2[] = {2, 4, 5, 0, 1}

Output: Yes

Input: arr1[] = {1, 2, 5, 4, 0, 2, 1}, arr2[] = {2, 4, 5, 0, 1, 1, 2}

Output: Yes

Input: arr1[] = {1, 7, 1}, arr2[] = {7, 7, 1}

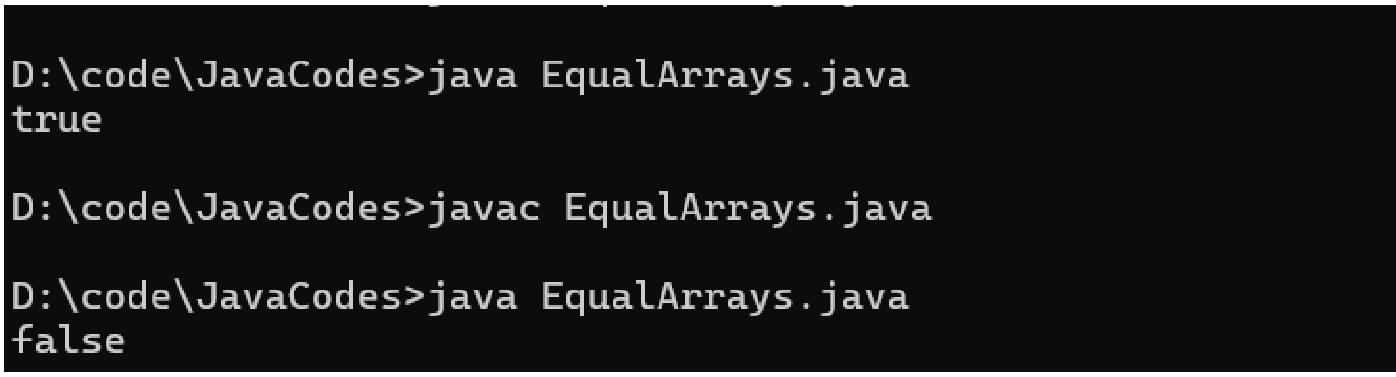
Output: No

Code:

```
import java.util.*;

class EqualArrays{
    public static boolean check(int[] arr1, int[] arr2) {
        // Your code here
        if(arr1.length!=arr2.length) return false;
        HashMap<Integer,Integer> hp=new HashMap<>();
        for(int i:arr1){
            hp.put(i,hp.getOrDefault(i,0)+1);
        }
        for(int i:arr2){
            if(!hp.containsKey(i)) return false;
            hp.put(i,hp.get(i)-1);
            if(hp.get(i)==0) hp.remove(i);
        }
        return hp.isEmpty();

    }
    public static void main(String[] args){
       int arr1[] = {1, 7, 1};
      int arr2[] = {7, 7, 1};
      System.out.println(check(arr1,arr2));
    }
}
```


```
D:\code\JavaCodes>java EqualArrays.java
true

D:\code\JavaCodes>javac EqualArrays.java

D:\code\JavaCodes>java EqualArrays.java
false
```

Time Complexity:O(n)

Space Complexity: O(n);

4. Palindrome Linked List

Given a singly linked list. The task is to check if the given linked list is palindrome or not.

Examples:

Input: head: 1->2->1->1->2->1

Output: true

Explanation: The given linked list is 1->2->1->1->2->1 , which is a palindrome and Hence, the output is true.

Input: head: 1->2->3->4

Output: false

Explanation: The given linked list is 1->2->3->4, which is not a palindrome and Hence, the output is false.

Code:

```
import java.util.*;

public class Main {

    public static void main(String... argv) {

      Scanner scan = new Scanner(System.in);

                  System.out.println("Enter the Size of the LinkedList :");

      int n = scan.nextInt();

      System.out.println("Enter the head of the LinkedList :");

      int h = scan.nextInt();

      Node head = new Node(h);

      Node temp = head;

      System.out.println("Enter the rem node val :");

      for(int i=1;i<n;i++){

         int num = scan.nextInt();

         Node node = new Node(num);

         temp.next = node;

         temp = temp.next;

      }

      Node mid = middle(head);

      Node secondHead = reverse(mid);

      boolean polin = true;

      while(head!=null && secondHead!=null){

                  if(head.val != secondHead.val){

                     polin = false;

                     break;
```

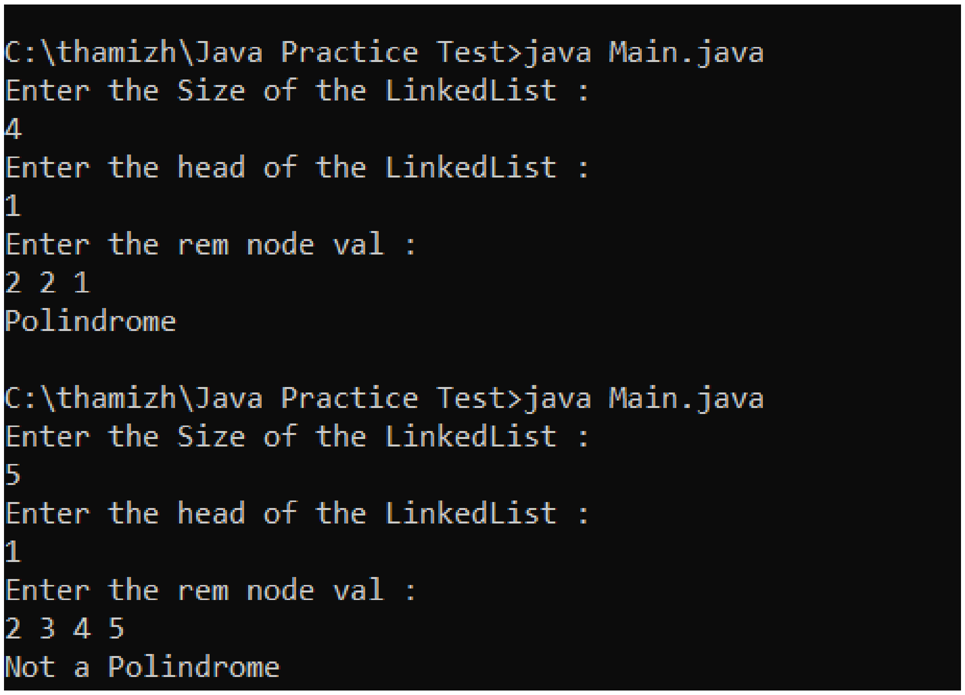
```
            }
            head = head.next;
            secondHead = secondHead.next;
  }
  if(polin){
     System.out.println("Polindrome");
  }else{
     System.out.println("Not a Polindrome");
  }

}
public static Node middle(Node head){
  Node fast = head;
  Node slow = head;
  while(fast != null && fast.next != null){
    fast = fast.next.next;
    slow = slow.next;
  }
  return slow;
}
public static Node reverse(Node head){
  Node prev = null;
  Node temp = head;
  while(temp!=null){
     Node front = temp.next;
     temp.next = prev;
```

```
          prev = temp;
          temp = front;
      }
      return prev;
    }
}

public class Node{
    int val;
    Node next;
    public Node(int val){
      this.val = val;
      next = null;
    }
}
```

Output:



```
C:\thamizh\Java Practice Test>java Main.java
Enter the Size of the LinkedList :
4
Enter the head of the LinkedList :
1
Enter the rem node val :
2 2 1
Polindrome

C:\thamizh\Java Practice Test>java Main.java
Enter the Size of the LinkedList :
5
Enter the head of the LinkedList :
1
Enter the rem node val :
2 3 4 5
Not a Polindrome
```

5. Balanced Tree Check

Given a binary tree, find if it is height balanced or not. A tree is height balanced if difference between heights of left and right subtrees is not more than one for all nodes of tree.

Examples:

Input:

```
    1
  /
 2
  \
   3
```

Output: 0

Explanation: The max difference in height of left subtree and right subtree is 2, which is greater than 1. Hence unbalanced

Code:

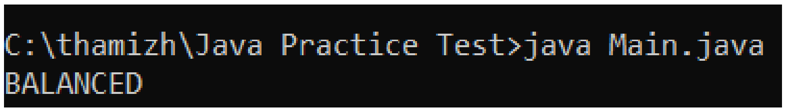
```
import java.util.*;
public class Main {
   public static void main(String... argv) {
          TreeNode root = new TreeNode(1);
      TreeNode node2 = new TreeNode(2);
      TreeNode node3 = new TreeNode(3);
      TreeNode node4 = new TreeNode(4);
      TreeNode node5 = new TreeNode(5);
          TreeNode node6 = new TreeNode(6);
      TreeNode node7 = new TreeNode(7);
      root.left = node2;
      root.right = node3;
      node2.left = node4;
      node3.right = node5;
          node5.left = node6;
          node5.right = node7;
```

```
            if(helper(root)!=-1){
               System.out.println("BALANCED");
            }else{
               System.out.println("NOT BALANCED");
            }
    }
    public static int helper(TreeNode root){
      if(root==null) return 0;
            int left = helper(root.left);
            int right = helper(root.right);
            if(left==-1 || right==-1) return -1;
        if(Math.abs(left-right)==-1) return -1;
        return Math.max(left,right)+1;
    }
}


class TreeNode {
    int val;
    TreeNode left;
    TreeNode right;

    TreeNode(int val) {
        this.val = val;
        left = null;
        right = null;
    }
}
```

Output:



```
C:\thamizh\Java Practice Test>java Main.java
BALANCED
```

6. TRIPLET SUM :

Given an array **arr[]** of size **n** and an integer **sum**. Find if there's a triplet in the array which sums up to the given integer **sum**.

Examples:

Input: *arr = {12, 3, 4, 1, 6, 9}, sum = 24;*
Output: *12, 3, 9*

Explanation: *There is a triplet (12, 3 and 9) present in the array whose sum is 24.*

Input: *arr = {1, 2, 3, 4, 5}, sum = 9*
Output: *5, 3, 1*

Explanation: *There is a triplet (5, 3 and 1) present in the array whose sum is 9.*

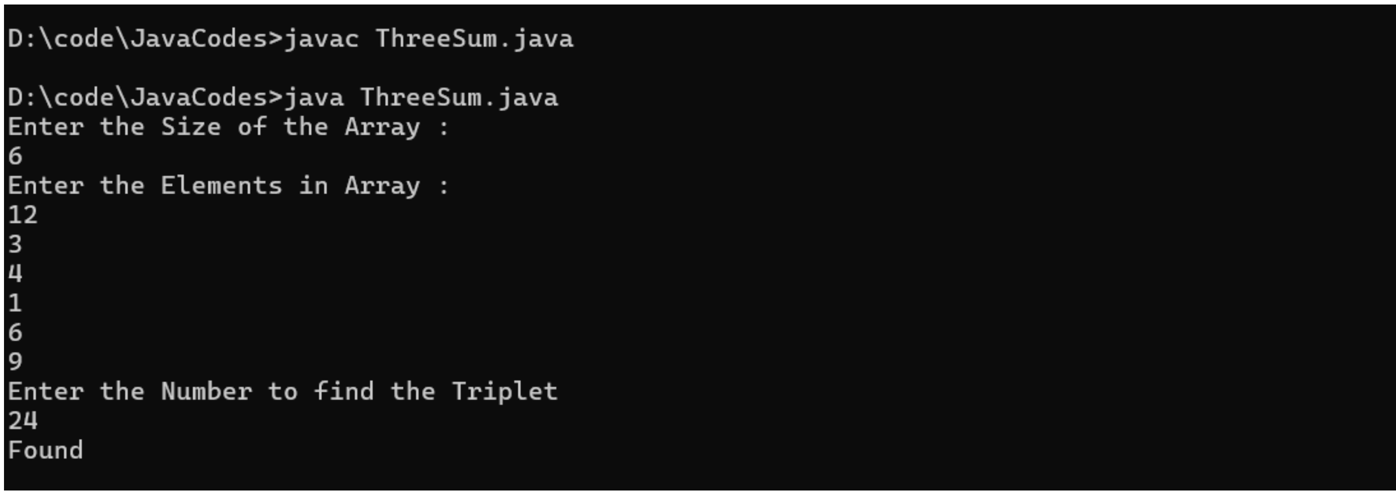
Code:

```
import java.util.*;
public class Main {
    public static void main(String... argv) {
      Scanner scan = new Scanner(System.in);
```

```
            System.out.println("Enter the Size of the Array :");
int n = scan.nextInt();
int[] arr = new int[n];
System.out.println("Enter the Elements in Array :");
for(int i=0;i<n;i++){
   arr[i] = scan.nextInt();
}
System.out.println("Enter the Number to find the Triplet ");
int x = scan.nextInt();
Arrays.sort(arr);
boolean found = false;
 for (int i = 0; i < n - 2; i++) {
     int l = i + 1;
     int r = n - 1;
     while (l < r) {
         int sum = arr[i] + arr[l] + arr[r];
         if (sum == x) {
             found = true;
               break;
         } else if (sum < x) {
             l++;
         } else {
             r--;
         }
     }
 }
```

```
        if(found){
          System.out.println("EXIST");
        }else{
          System.out.println("NOT EXIST");
        }
    }
}
```

Output:



```
D:\code\JavaCodes>javac ThreeSum.java

D:\code\JavaCodes>java ThreeSum.java
Enter the Size of the Array :
6
Enter the Elements in Array :
12
3
4
1
6
9
Enter the Number to find the Triplet
24
Found
```