DSA PRACTICE – 2

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DEPT : IT

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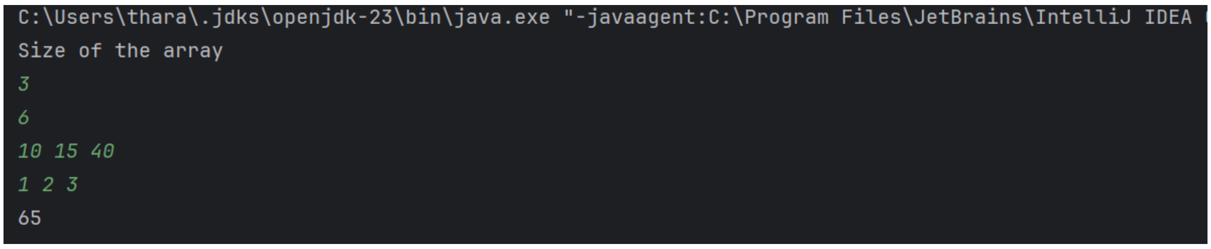
1. Knapsack Problem

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:



```
C:\Users\thara\.jdks\openjdk-23\bin\java.exe "-javaagent:C:\Program Files\JetBrains\IntelliJ IDEA
Size of the array
3
6
10 15 40
1 2 3
65
```

Time Complexity: O(n);

Space Complexity: O(n);

2. 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

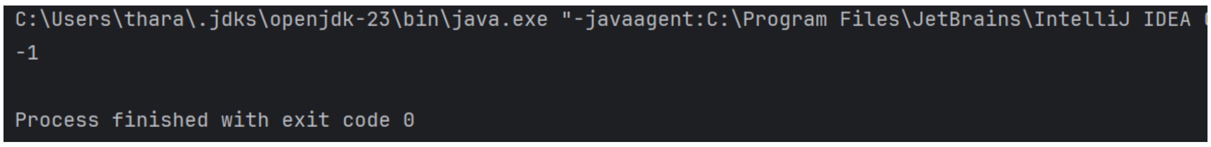
Explanation: Since floor doesn't exist, output is -1.

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, 9, 11, 17};
                System.out.println(Floor(arr,k));
     }
}
```

Output:



```
C:\Users\thara\.jdks\openjdk-23\bin\java.exe "-javaagent:C:\Program Files\JetBrains\IntelliJ IDEA
-1

Process finished with exit code 0
```

3. 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

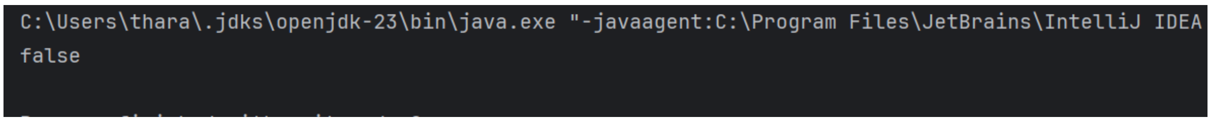
Input: arr1[] = {1, 7, 1}, arr2[] = {7, 7, 1}

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));
    }
}
```

OUTPUT:



```
C:\Users\thara\.jdks\openjdk-23\bin\java.exe "-javaagent:C:\Program Files\JetBrains\IntelliJ IDEA
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.

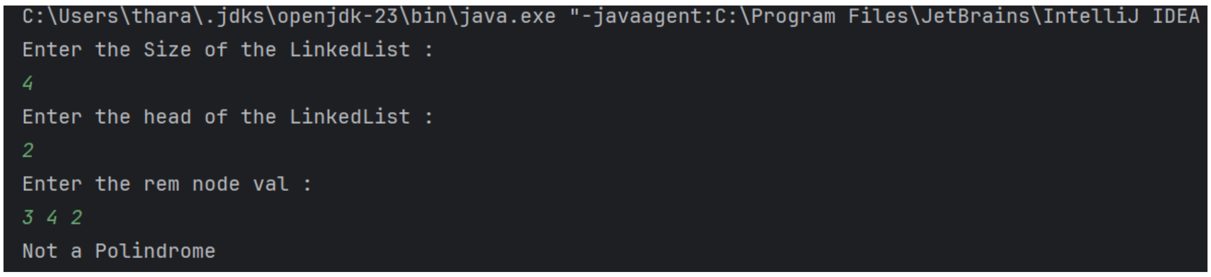
Code:

```
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:\Users\thara\.jdks\openjdk-23\bin\java.exe "-javaagent:C:\Program Files\JetBrains\IntelliJ IDEA
Enter the Size of the LinkedList :
4
Enter the head of the LinkedList :
2
Enter the rem node val :
3 4 2
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

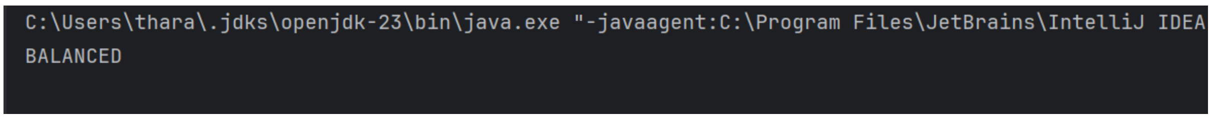
Explanation: The max difference in height of left subtree and right subtree is 2, which is greater than 1. Hence unbalanced

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:\Users\thara\.jdks\openjdk-23\bin\java.exe "-javaagent:C:\Program Files\JetBrains\IntelliJ IDEA
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.*

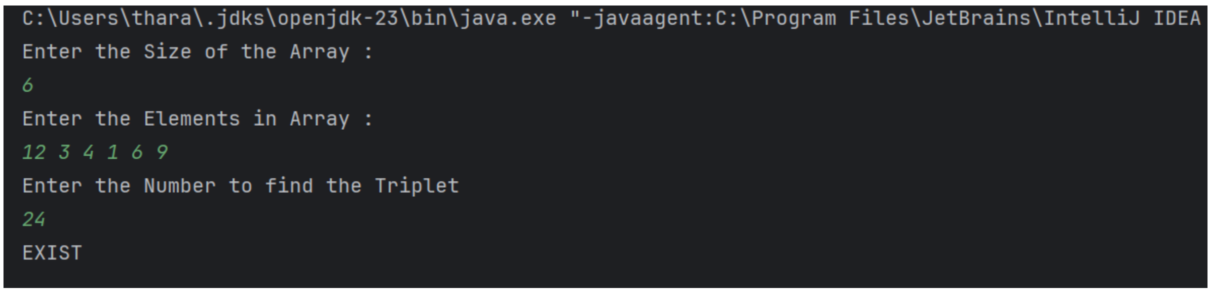
Input: *arr = {1, 2, 3, 4, 5}, sum = 9*
Output: *5, 3, 1*

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:



```
C:\Users\thara\.jdks\openjdk-23\bin\java.exe "-javaagent:C:\Program Files\JetBrains\IntelliJ IDEA
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
EXIST
```