Day 15 and 16:

Task 1: Knapsack Problem

Write a function int Knapsack(int W, int[] weights, int[] values) in C# that determines the maximum value of items that can fit into a knapsack with a capacity W. The function should handle up to 100 items. Find the optimal way to fill the knapsack with the given items to achieve the maximum total value. You must consider that you cannot break items, but have to include them whole.

```
package com.wipro.dyanmicprog;

import java.util.ArrayList;
import java.util.Collections;
import java.util.List;

public class KanapsackProblem01 {


public static void main(String[] args) {

        int capacity =8;
        int[] values= {1,2,5,6};
        int[] weights = {2,3,4,5};
        int n = values.length;

        int maxValue= knapsack(capacity,weights,values, n);
```

```
            System.out.println("Maximum value that can be obtained :"+
maxValue);

        }

        private static int knapsack(int capacity, int[] weights, int[] profits, int n) {
            int[][] t =new int[n+1][capacity+1];

            for(int rownum =0 ;rownum<=n; rownum++) {
                for(int colnum =0; colnum <=capacity ; colnum++) {
                    if(rownum ==0 || colnum ==0) {
                        t[rownum][colnum] =0;
                    }else if(weights[rownum-1] <= colnum) {
                        t[rownum][colnum] =  Math.max(t[rownum-
1][colnum], profits[rownum -1] +
                                                t[rownum -1][colnum -
weights[rownum-1]]);

                    }else {
                        t[rownum][colnum] = t[rownum-1][colnum];
                    }
                }
            }

            List<Integer> itemsIncluded  =
findItemsIncluded(t,weights,profits,n,capacity);
            System.out.println("Items included in the knapsack :" +
itemsIncluded);
```

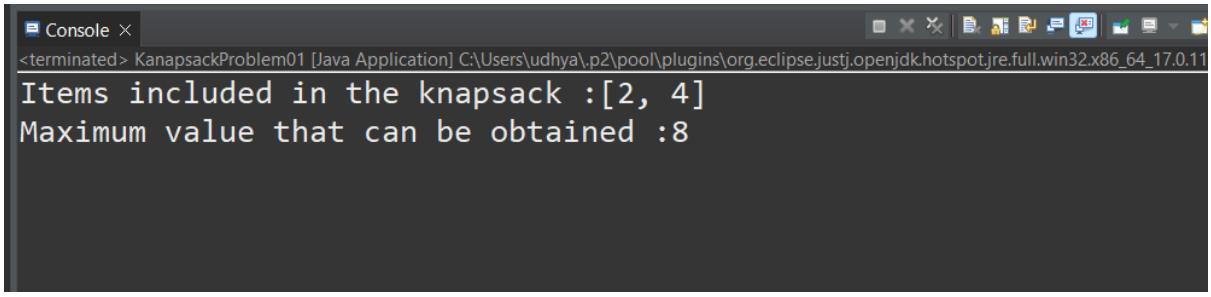
```
        return t[n][capacity];
    }

    private static List<Integer> findItemsIncluded(int[][] t, int[] weights, int[]
profits, int n, int capacity) {

        List<Integer> itemsIncluded = new ArrayList<>();
        int currentWeight = capacity;
        for (int i = n; i > 0; i--) {
            if (t[i][currentWeight] != t[i-1][currentWeight]) {
                itemsIncluded.add(i);
                currentWeight -= weights[i-1];
            }
        }
        Collections.reverse(itemsIncluded);
        return itemsIncluded;
    }

}
```

OUTPUT:



Task 2: Longest Common Subsequence

Implement int LCS(string text1, string text2) to find the length of the longest common subsequence between two strings.

```
package com.wipro.dyanmicprog;


public class LongestCommonSubsequence {


        private static int[][] dp;


    public static void main(String[] args) {
        String str1 = "babbab";
        String str2 = "abaaba";


        int length = longestCommonSubsequence(str1, str2);
        System.out.println("Length of the common substr :" + length);
        String lcs = getLongestCommonSubsequence(str1, str2, length);
        System.out.println("Longest common subsequence: " + lcs);
    }


    private static int longestCommonSubsequence(String str1, String str2) {
        int m = str1.length();
        int n = str2.length();
        dp = new int[m + 1][n + 1];


        for (int i = 0; i <= m; i++) {
            for (int j = 0; j <= n; j++) {
```

```
            if (i == 0 || j == 0) {
                dp[i][j] = 0;
            } else if (str1.charAt(i - 1) == str2.charAt(j - 1)) {
                dp[i][j] = 1 + dp[i - 1][j - 1];
            } else {
                dp[i][j] = Math.max(dp[i - 1][j], dp[i][j - 1]);
            }
        }
    }
    return dp[m][n];
  }

  private static String getLongestCommonSubsequence(String str1, String str2,
int length) {
    int m = str1.length();
    int n = str2.length();

    char[] lcs = new char[length];
    int index = length - 1;

    int i = m, j = n;
    while (i > 0 && j > 0) {
        if (str1.charAt(i - 1) == str2.charAt(j - 1)) {
            lcs[index--] = str1.charAt(i - 1);
            i--;
            j--;
        } else if (dp[i - 1][j] > dp[i][j - 1]) {
```

```
            i--;
        } else {
            j--;
        }
    }
    return String.valueOf(lcs);
}
```

OUTPUT: