Course Name: DAA Lab **Course Code: 21ITH-311/21CSH-311**

Experiment 2.3

Aim: *Develop a program and analyze complexity to implement 0-1 Knapsack using Dynamic*

Objectives: *To implement 0-1 Knapsack using Dynamic Programming*

Input/Apparatus Used: *VS CODE*

Procedure/Algorithm:

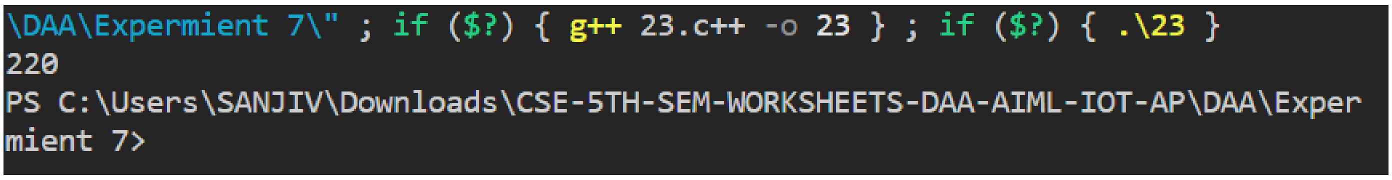
- *Dynamic Programming Approach: The solution is based on dynamic programming to solve the 0-1 Knapsack problem.*
- *DP Table: Create a DP table with columns representing all possible weights from 1 to the maximum capacity 'W' and rows representing the weights that can be kept.*
- *DP State: The state DP[i][j] represents the maximum value for a weight of 'j' considering all values from '1' to 'ith'.*
- *Two Possibilities: When considering weight 'wi' (weight in the 'ith' row), two possibilities exist:*
- *Fill 'wi' in the Column: If the weight 'wi' can be accommodated in the current column (if the weight is less than or equal to 'j'), the value in DP[i][j] can be updated as wi + DP[i-1][j-wi].*
- *Do Not Fill 'wi' in the Column: If 'wi' cannot be added to the current column, then the value remains the same as DP[i-1][j].*
- *Maximum Value: Take the maximum of these two possibilities to update the current state DP[i][j].*
- *Visualization Example: A visualization example is provided with weight elements, weight values, and capacity, where the DP table is filled step by step, considering these principles.*

Code:

```
#include <iostream>
using namespace std;

int max(int a, int b) {
    return (a > b) ? a : b;
}

int knapSack(int W, int wt[], int val[], int n) {
    int i, w;
    int K[n + 1][W + 1];

    for (i = 0; i <= n; i++) {
        for (w = 0; w <= W; w++) {
            if (i == 0 || w == 0)
                K[i][w] = 0;
            else if (wt[i - 1] <= w)
                K[i][w] = max(val[i - 1] + K[i - 1][w - wt[i - 1]], K[i - 1][w]);
            else
                K[i][w] = K[i - 1][w];
        }
    }

    return K[n][W];
}

int main() {
    int val[] = {60, 100, 120};
    int wt[] = {10, 20, 30};
    int W = 50;
    int n = sizeof(val) / sizeof(val[0]);
```

```
        cout << knapSack(W, wt, val, n) << endl;
        return 0;
    }
```

Observations/Outcome :



```
\DAA\Expermient 7\" ; if ($?) { g++ 23.c++ -o 23 } ; if ($?) { .\23 }
220
PS C:\Users\SANJIV\Downloads\CSE-5TH-SEM-WORKSHEETS-DAA-AIML-IOT-AP\DAA\Exper
mient 7>
```

Time Complexity:

- *Time Complexity: O(nW) where n is the number of items and W is the capacity of knapsack.,*