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Department of Computer Engineering
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Roll No.: 12	**Div:** A
Course: Laboratory Practice III	**Course Code:** 410246

Assignment No: 04

Problem Statement:

Write a program to solve a 0-1 Knapsack problem using dynamic programming or branch and bound strategy.

Objective:

To implement 0-1 Knapsack as well as comprehend dynamic programming strategy.

Course Outcome:

CO5: Implement an algorithm that follows one of the following algorithm design strategies: divide and conquer, greedy, dynamic programming, backtracking, branch andbound.

Overview of Fractional Knapsack:

In 0/1 Knapsack Problem,

- As the name suggests, items are indivisible here.
- We can not take the fraction of any item.
- We have to either take an item completely or leave it completely.
- It is solved using dynamic programming approach.

Time complexity:

- **Time Complexity:** O(2n).
- **Auxiliary Space :**O(1) + O(N).

Program:

```
def knapSack(W, wt, val, n):
   K = [[0 for x in range(W + 1)] for x in range(n + 1)]
   #Table in bottom up manner
   for i in range(n + 1):
      for w in range(W + 1):
         if i == 0 or w == 0:
            K[i][w] = 0
         elif 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]
#Main
val = []
wt = []
print("Enter Number of Items to be tested:")
num=int(input())
for i in range(num):
    print("Enter item value")
    v=int(input())
    print("Enter item weight")
    w=int(input())
    val.append(v)
    wt.append(w)
W = int(input("Enter Knapsack Capcity"))
n = len(val)
print("Maximum Profit: ",knapSack(W, wt, val, n))
```

Output:

```
>> %Run BinaryKnapSack.py
Enter Number of Items to be tested:
3
Enter item value
60
Enter item weight
10
Enter item value
100
Enter item weight
20
Enter item value
120
Enter item weight
30
Enter Knapsack Capcity: 50
Maximum Profit: 220
```

Conclusion:

Thus, I learnt the concept of dynamic programming strategy as well as implemented algorithm to solve 0-1 knapsack problem using this strategy.