Knapsack Algorithm using Dynamic Programming

Mahesh Bharadwaj K - 185001089

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Program

Chosen arrays is used to store if an item is chosen or not for the optimal solution

```
import numpy as np

n = int(input())

Weights = [-1]
Values = [-1]

for i in range(n):
    ip = input().split(' ')
    Weights.append(int(ip[0]))
    Values.append(int(ip[1]))

W = int(input())

l = [[ -1 for i in range(W+1)] for j in range(n+1)]
chosen = np.array([False for i in range(n+1)])
array = np.array(l)

for i in range(n+1):
    for j in range(W+1):
        if i == 0 or j == 0:
            array[i][j] = 0

def knapsack(i,j):
    global array
    global Weights
    global Values
    global chosen

    value = 0
    if array[i][j] < 0:
        if j < Weights[i]:
            array[i][j] = knapsack(i-1,j)
        else:
            array[i][j] = knapsack(i-1,j)
            chosen[i] = False
            if Values[i] + knapsack(i-1,j-Weights[i]) > array[i][j]:
                array[i][j] = Values[i] + knapsack(i-1,j-Weights[i])
                chosen[i] = True
    return array[i][j]

print('Max Value: ',knapsack(n,W))
print(chosen[1:])
```

Output

In each of the files:

- **First Line:** Number of Items
- **Next 'n' Lines:** Weights and Value of each of the 'n' Items
- **Last Line:** Capacity of the knapsack

PPT Question

```
cat ip
```

```
4
2 12
1 10
3 20
2 15
5
```

```
$python3 Knapsack.py < ip
```

```
Max Value:  37
[ True  True False  True]
```

Test Data

This input was obtained from the internet
Link to Data[Refer P08]

```
cat ip2
```

```
24
382745 825594
799601 1677009
909247 1676628
729069 1523970
467902 943972
44328 97426
34610 69666
698150 1296457
823460 1679693
903959 1902996
853665 1844992
551830 1049289
610856 1252836
670702 1319836
488960 953277
951111 2067538
323046 675367
446298 853655
931161 1826027
31385 65731
496951 901489
264724 577243
224916 466257
169684 369261
6404180
```

```
$python3 Knapsack.py < ip2

Max Value:  13549094
[ True  True False  True  True  True  True False False  True  True False
 False False False  True  True False False  True False  True  True  True]
```