



Experiment 2.3

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Branch: CSE

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Subject Name: Design & Analysis Algorithm Lab

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Section/Group: 607 /B

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Subject Code: 20CSP-312

1. Aim:

Code to implement 0-1 knapsack problem using dynamic programming.

2. Task to be done:

Code to implement 0-1 knapsack problem using dynamic programming.

3. Algorithm:

In the Dynamic programming we will work considering the same cases as mentioned in the recursive approach. In a $DP[i][j]$ table let's consider all the possible weights from '1' to 'W' as the columns and weights that can be kept as the rows.

The state $DP[i][j]$ will denote maximum value of 'j-weight' considering all values from '1 to ith'. So if we consider 'wi' (weight in 'ith' row) we can fill it in all columns which have 'weight values > wi'. Now two possibilities can take place:

1. Fill 'wi' in the given column.
2. Do not fill 'wi' in the given column.

Now we have to take a maximum of these two possibilities, formally if we do not fill 'ith' weight in 'jth' column then $DP[i][j]$ state will be same as $DP[i-1][j]$ but if we fill the weight, $DP[i][j]$ will be equal to the value of 'wi' + value of the column weighing 'j-wi' in the previous row. So we take the maximum of these two possibilities to fill the current state. This visualisation will make the concept clear.

4. Code:

```
#include <bits/stdc++.h>
using namespace std;
max(int a, int b){ return
(a > b) ? a : b;
} knapSack(int W, int wt[], int val[], int n){ int i, w;
vector<vector<int>> K(n + 1, vector<int>(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(){
```

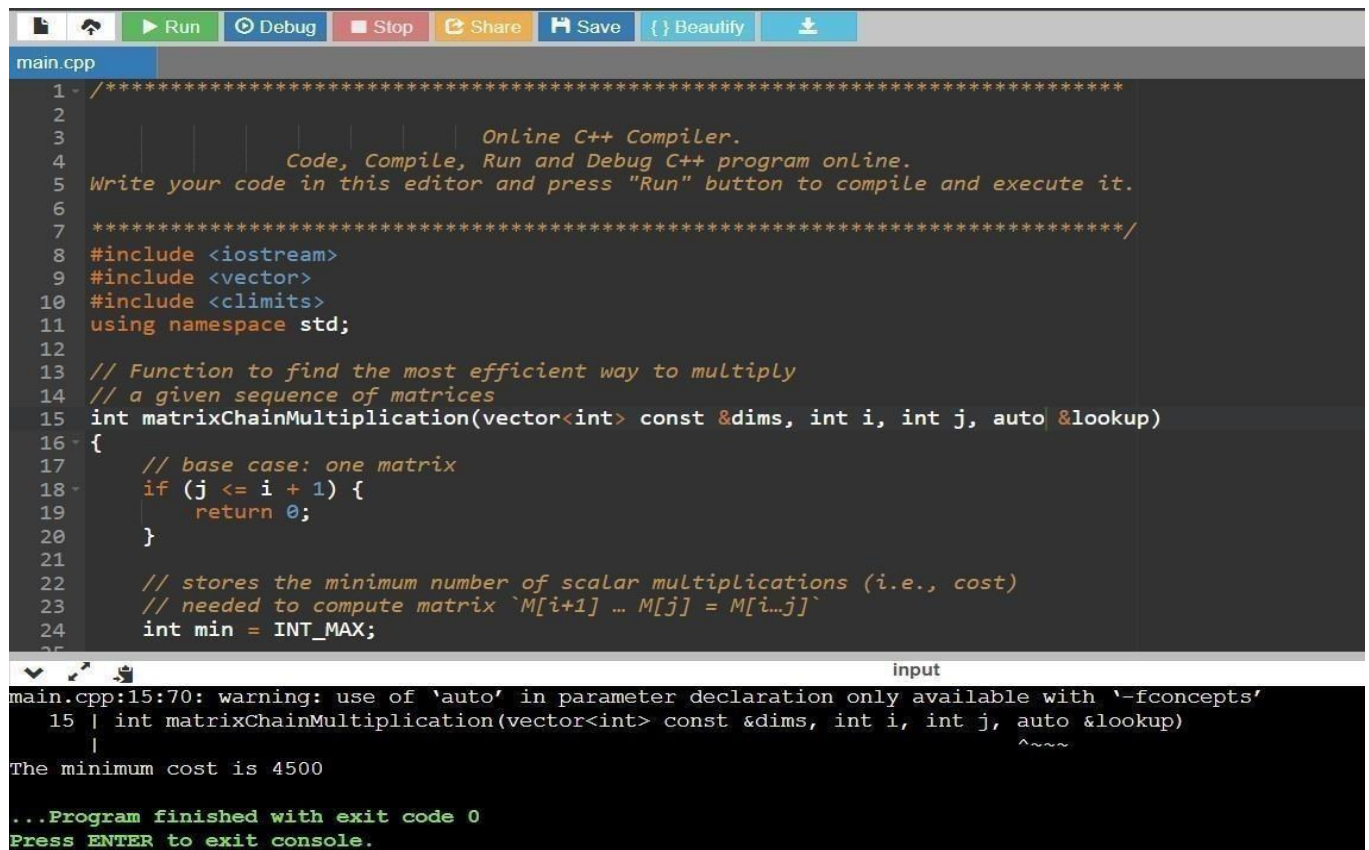
```
int val[] = { 60, 100, 120 }; int wt[] = { 10,  
20, 30 }; int W = 50; int n = sizeof(val) /  
sizeof(val[0]); cout << knapSack(W, wt,  
val, n); return 0;  
}
```

5. Complexity Analysis:

Time Complexity:

$O(N*W)$ Auxiliary Space: $O(N*W)$

6. Result:



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