

## 1.vscode/g++

### 2.Methods and solution (details in comments), time complexity

```
1  #include <iostream>
2  #include <vector>
3  #include <algorithm>
4  using namespace std;
5
6  // Find max profit function
7  void max_profit(int n, int m);
8
9  // Main function declares two variables and takes input
10 // Calls function "max_profit" and passes variables as arguments
11 int main(){
12     int resources, projects;
13     cin >> projects >> resources;
14     max_profit(projects, resources);
15 }
16
17 // Allocating k resources to the current project i, represented by dp[i][k]
18 // Allocating the remaining j-k resources to the next project i+1, represented by dp[i+1][j-k]
19 // Adding these two profits together -> total maximum profit
20 // Can be obtained by allocating k resources to the current project i and j-k resources to the next project i+1
21 void max_profit(int n, int m){
22
23     // 2D vector with n rows and m+1 columns, initialized with all elements as 0
24     vector<vector<int>> dp(n, vector<int>(m+1));
25
26     // Takes input with n rows and m+1 columns
27     for(int i=0; i<n; i++){
28         for(int j=0; j<=m; j++){
29             cin >> dp[i][j];
30         }
31     }
32
33     // Iterates n-1 times
34     for(int i=0; i<n-1; i++){
35         vector<int> tmp(m+1, 0); // 1D vector with m+1 columns, initialized with all elements as 0
36
37         // Iterates m+1 times
38         for(int j=0; j<=m; j++){
39             int max_profit = 0;
40
41             // Iterates j+1 times
42             for(int k=0; k<=j; k++){
43                 // Formula calculating maximum profit : dp[i][k]+dp[i+1][j-k]
44                 // i is projects
45                 // k is resources
46                 max_profit = max(max_profit, dp[i][k]+dp[i+1][j-k]);
47                 // Assign to tmp[j]
48                 // j is remaining resources which equals to m
49                 tmp[j] = max_profit;
50             }
51         }
52         // Maximum profit is stored in the 'dp' vector
53         dp[i+1] = tmp;
54     }
55     // Print the maximum profit that can be obtained by allocating resources to different projects
56     cout << dp[n-1][m];
57 }
58
59 // The total number of iterations is (m+1)*(n-1)*(m+1)
60 // Innermost loop is nested within middle loop -> time complexity = O(n*m^2)
```