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The Coin Change Problem

by alanl

Problem Submissions Leaderboard Discussions Editorial

You have m types of coins available in infinite quantities where the value of each coin is given in the array $C = [c_0, c_1, \ldots, c_{m-1}]$. Can you determine the number of ways of making change for n units using the given types of coins? For example, if $m = 4$, and $C = [8, 3, 1, 2]$, we can make change for $n = 3$ units in three ways: $\{1, 1, 1\}$, $\{1, 2\}$, and $\{3\}$.

Given n, m, and C, print the number of ways to make change for n units using any number of coins having the values given in C.

Input Format

The first line contains two space-separated integers describing the respective values of n and m.
The second line contains m space-separated integers describing the respective values of $c_0, c_1, \ldots c_{m-1}$ (the list of distinct coins available in infinite amounts).

Constraints

- $1 \le c_i \le 50$
- $1 \le n \le 250$
- $1 \le m \le 50$
- Each c_i is guaranteed to be distinct.

Hints

- *Solve overlapping subproblems using Dynamic Programming (DP):*
  You can solve this problem recursively but will not pass all the test cases without optimizing to eliminate the overlapping subproblems. Think of a way to store and reference previously computed solutions to avoid solving the same subproblem multiple times.
- Consider the degenerate cases:
  - How many ways can you make change for 0 cents?
  - How many ways can you make change for > 0 cents if you have no coins?
- If you're having trouble defining your solutions store, then think about it in terms of the base case $(n = 0)$.
- The answer may be larger than a 32-bit integer.

Output Format

Print a long integer denoting the number of ways we can get a sum of n from the given infinite supply of m types of coins.

Sample Input 0

```
4 3
1 2 3
```

Sample Output 0

```
4
```

Explanation 0

There are four ways to make change for $n = 4$ using coins with values given by $C = [1, 2, 3]$:

1. $\{1, 1, 1, 1\}$
2. $\{1, 1, 2\}$
3. $\{2, 2\}$
4. $\{1, 3\}$

Thus, we print 4 as our answer.

Sample Input 1

```
10 4
2 5 3 6
```

Sample Output 1

```
5
```

Explanation 1

There are five ways to make change for $n = 10$ units using coins with values given by $C = [2, 5, 3, 6]$:

1. $\{2, 2, 2, 2, 2\}$
2. $\{2, 2, 3, 3\}$
3. $\{2, 2, 6\}$
4. $\{2, 3, 5\}$
5. $\{5, 5\}$

Thus, we print 5 as our answer.

Submissions: 32854
Max Score: 60
Difficulty: Hard

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More

Current Buffer (saved locally, editable)

Java 8

```java
import java.io.*;
import java.util.*;
import java.text.*;
import java.math.*;
import java.util.regex.*;

public class Solution {

    public static void main(String[] args) {
        Scanner in = new Scanner(System.in);
        int n = in.nextInt();
        int m = in.nextInt();
        long[] c = new long[m];
        for(int c_i=0; c_i < m; c_i++){
            c[c_i] = in.nextLong();
        }
        Arrays.sort(c);

        long[][] matrix = new long[m][n + 1];

        for(int i = 0 ; i < m ; i++){
            for(int j = 0 ; j < n + 1 ; j++){
                if(j == 0){
                    matrix[i][j] = 1;
                    continue;
                }

                if(j < c[i]){

                    if(i == 0 && (j - (int)c[i]) < 0){
                        matrix[i][j] = 0;
                    }
                    else{
                        matrix[i][j] = matrix[i - 1][j];
                    }
                }
                else{
                    if(i == 0){
                        matrix[i][j] = matrix[i][j - (int)c[i]];
                    }
                    else{
                        matrix[i][j] = matrix[i][j - (int)c[i]] + matrix[i - 1][j];
                    }
                }
            }
        }

        System.out.println(matrix[m - 1][n]);

    }
}

```

Line: 51 Col: 2

Upload Code as File

□ Test against custom input

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