

CSCI 33500 - Spring 2016 - Homework #5 Programming Techniques

Due by email May 16th

In this homework you will implement three different algorithms to solve the change-making problem, which is defined as follows:

Given a value $N \in \mathbb{N}$ and a set $S = \{c_1, c_2, \dots, c_M\}$ of M different coin denominations (with $c_1 = 1$ and $c_i \in \mathbb{N}$): what is the smallest (in number of coins) combination of coins from S needed to produce N ?

Notes:

c_1 always equal 1 so that there is always way of producing N .

The set of coins S is not necessarily in any order, but all the denominations are distinct from each other.

Your work should consist of three different files: `greedy.cpp`, `recursive.cpp`, and `dynamic.cpp`. Each should run one instance of the algorithm, asking the user to input the value N , then the set S of denominations, followed by the answer your algorithm produces. It should look similar to this:

```
Enter the value N to produce:
32
Enter the denominations to use (1 will be added if necessary)
1 6 7 5 3
The optimal solution is: 7+7+7+7+3+1
```

- Greedy: The simplest greedy algorithm is the classic method of making change: keep subtracting the largest denomination possible from N . Keep in mind that this greedy algorithm does not always return the optimal solution.
- Recursive: If $N = 0$, then there is an obvious optimal solution: no coins. Otherwise, compare solutions that include one coin of the first denomination (not necessarily the smallest or largest) with solutions that do not include that denomination at all.
- Dynamic: The recursive solution makes many redundant calls. Use dynamic programming to optimize the algorithm.

As always, your code should be documented and contains comments for ease of understanding. There is wealth of information on this problem and its solution online. You are welcomed to do research the answers, but all the code must be your own.

How to submit

Your homework should be zipped in a single file containing your code. Name your zip `HW5_STUDENTNAME.zip`, and email it to `fg297@hunter.cuny.edu` by noon on May 16th.