Data Structures (CS 1520) Lab 8 Name:_____

Objectives: You will gain experience:

- get a feel for backtrack via recursion
- writing a dynamic programming solution

Download and extract the following file to your desktop: http://www.cs.uni.edu/~fienup/cs1520s12/labs/lab8.zip

Part A: The `lab8.zip` file you downloaded and extracted contains a `coin_no_globals.py` file. It implements the recursive backtracking algorithm discussed in lecture to implement the "coin-change" problem. Given a set of coin types and an amount of change to be returned, it determines the **fewest number** of coins for this amount of change.

a) For coins in ascending order of 1 5 10 12 25 50, complete the backtrack timings:

Change Amount	Run-Time (seconds)	Number of Tree Nodes
200		
300		
320		
340		

b) For coins in descending order of 50 25 12 10 5 1, complete the backtrack timings:

Change Amount	Run-Time (seconds)	Number of Tree Nodes
340		
360		
499 (takes a while)		
500		

c) Explain why the algorithm performs better for the descending order of coins.

d) For the descending order of coins, why does 499 change solution take so much longer than the 500 change solution?

After you have completed part A, raise your hand and explain your results.

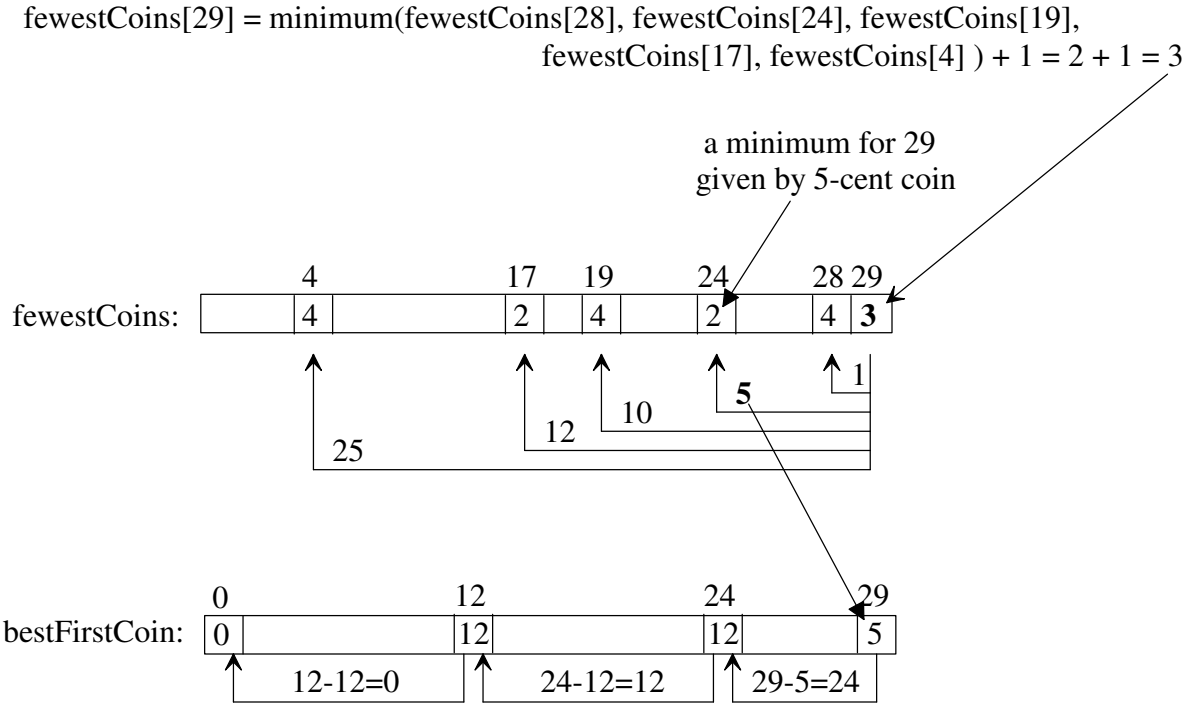
Part B. The `lab8.zip` file you downloaded and extracted contains a `coinDynPgmming.py` file. It contains a partial solution to the dynamic programming coin-change problem. Your job is to complete it.

Recall that the dynamic programming algorithm is:

I. Fills an array fewestCoins from 0 to the amount of change. An element of fewestCoins stores the fewest number of coins necessary for the amount of change corresponding to its index value.

For 29-cents using the set of coin types {1, 5, 10, 12, 25, 50}, the dynamic programming algorithm would have previously calculated the fewestCoins for the change amounts of 0, 1, 2, ..., up to 28 cents.

II. If we record the best, first coin to return for each change amount (found in the "minimum" calculation) in a list bestFirstCoin, then we can easily recover the actual coin types to return.



Extract the coins in the solution for 29-cents from bestFirstCoin[29], bestFirstCoin[24], and bestFirstCoin[12]

After you have completed dynamic programming program and debugged it, raise your hand and explain your code.