Homework 7: Dynamic Programming

Problem 1:

Use dynamic programming in order to determine the number of ways we can arrange quarters, dimes, nickels, and pennies to make up one dollar. We make a distinction between different orders, i.e. PPNDPPNP (for a total of $1 + 1 + 5 + 10 + 1 + 1 + 10 + 1 = 30$ cents) is a different arrangement then NDPPPPNP (for a total of $5 + 10 + 1 + 1 + 1 + 1 + 10 + 1 = 30$ cents), even though the latter is only a permutation of the former. Hand in a python program using memoization.

Problem 2:

Use dynamic programming in order to determine the number of ways we can arrange quarters, dimes, nickels, and pennies to make up one dollar. However, now we make no distinction between differently ordered sequences of coins. PPNDPPNP and NSPPPPNP are just different ways to use 5 pennies, two nickels, and one dime.

Hint:

First, we generalize for any number c of cents. For problem 1 and an amount of 74 cents, we can use as the last coin a quarter (`fun(74-25)` ways), a dime (`fun(74-10)` ways), a nickel (`fun(74-5)` ways) or a penny (`fun(74-25)` ways). For problem 2 and an amount of 100 cents, we can use no quarter (100 cents with pennies, dimes, and nickels), one quarter (and 75 cents in pennies, dimes, and nickels), two quarters (and 50 cents in pennies, dimes and nickels), three quarters (and 25 cents in pennies, dimes, and nickels), and four quarters (and one way to make change for 0 cents with pennies, dimes, and nickels).