Discussion 1

As described on pages 198-199 of the textbook, the greedy algorithm for making \( n \) cents change with a set of coins with pre-defined denominations tries to use the smallest number of coins overall:

At each step we choose the coin of the largest denomination possible to add to the pile of change without exceeding \( n \) cents.

1. Use the greedy algorithm to make change using quarters, dimes, and pennies (but no nickels) for 69 cents. Is this the best way to make change using these coins? (cf. Rosen 3.1 Exercise 55)

2. Show that if there were a coin worth 12 cents, the greedy algorithm using quarters, 12-cent coins, dimes, nickels, and pennies would not always produce change using the fewest coins possible. (cf. Rosen 3.1 Exercise 56)
3. In class, we discussed the Russian Peasant Multiplication algorithm; here it is represented in pseudocode.

```
procedure RPM(m : real number; n : positive integer)
  1. total := 0
  2. a := m
  3. b := n
  4. while b > 1
  5.   if (b mod 2 = 1) then total := total + a
  6.   a := 2 \cdot a
  7.   b := b div 2
  8. return total + a
```

Trace through this algorithm on input \( m = 142 \), \( n = 17 \). Record the values of all variables during this trace. How does your trace compare to the example we worked through in class that followed the English-language description of RPM?