

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** ($b \bmod 2 = 1$) **then** $total := total + a$
6. $a := 2 \cdot a$
7. $b := b \text{ div } 2$
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*?