

Debugging

Program Tracing

Program Tracing

- Recall that an important step in program development is to walk through your algorithm.
- It's also important to execute or *trace* your C++ programs by hand.
 - To verify your program executes properly.
 - To help find logic errors.
 - To learn the programming language better.

Steps to Program Tracing

1. Label each executable statement in your program.
 - Assignment statements, output, input, if, etc.
2. Create a table with a column for each variable.
3. Create some sample input.
4. Execute each statement, recording the values for each variable.

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Program Tracing - Struble

```
// Calculate the coins to give a customer for change,  
// using the fewest number of coins. If the change is  
// less than zero, print a message saying the customer  
// still owes us.  
#include <iostream>  
#include <iomanip>  
using namespace std;  
  
void main() {  
    const int ONE_DOLLAR = 100;    // value of dollar in cents  
    const int ONE_QUARTER = 25;    // value of quarter in cents  
    const int ONE_DIME = 10;       // value of dime in cents  
    const int ONE_NICKEL = 5;      // value of nickel in cents  
    const int ONE_PENNY = 1;       // value of penny in cents  
  
    // declare the variables for storing the number of coins  
    int dollars = 0, quarters = 0, dimes = 0,  
        nickels = 0, pennies = 0;  
    int change = -1;    // the amount of change to return
```

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Program Tracing - Struble

```

1 // Prompt the user. The flush manipulator forces the screen output.
2 cout << "Enter the change to return in cents: " << flush;
  cin >> change;

  // Make sure the change is valid
3 if (change < 0) {
4     cout << "The customer still owes money." << endl;
5     return; // stop execution
6 }
  // calculate the coins to return to the customer.
7 dollars = change / ONE_DOLLAR; // calculates # of dollars
8 change = change % ONE_DOLLAR; // removes the dollars returned
9 quarters = change / ONE_QUARTER; // calculates # of quarters
10 change = change % ONE_QUARTER; // removes the quarters returned
11 dimes = change / ONE_DIME; // calculates # of dimes
12 change = change % ONE_DIME; // removes the dimes returned
13 nickels = change / ONE_NICKEL; // calculates # of nickels
14 change = change % ONE_NICKEL; // removes the nickels returned
15 pennies = change / ONE_PENNY; // calculates # of pennies
16 change = change % ONE_PENNY; // removes the pennies returned

  // print out the result
17 cout << "Return " << dollars << " dollars, "
    << quarters << " quarters, " << dimes << " dimes, "
    << nickels << " nickels, and " << pennies << " pennies."
    endl;
}

```

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Program Tracing - Struble

Trace Table

Statement	change	dollars	quarters	dimes	nickels	pennies

Statement
being
executed.

One column for
each variable.

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