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.

```c++
// 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
```

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

// Make sure the change is valid
if (change < 0) {
    cout << "The customer still owes money." << endl;
    return; // stop execution
}

// calculate the coins to return to the customer.
dollars = change / ONE_DOLLAR; // calculates # of dollars
change = change % ONE_DOLLAR; // removes the dollars returned
quarters = change / ONE_QUARTER; // calculates # of quarters
change = change % ONE_QUARTER; // removes the quarters returned
dimes = change / ONE_DIME; // calculates # of dimes
change = change % ONE_DIME; // removes the dimes returned
nickels = change / ONE_NICKEL; // calculates # of nickels
change = change % ONE_NICKEL; // removes the nickels returned
pennies = change / ONE_PENNY; // calculates # of pennies
change = change % ONE_PENNY; // removes the pennies returned

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

---

## Trace Table

<table>
<thead>
<tr>
<th>Statement</th>
<th>change</th>
<th>dollars</th>
<th>quarters</th>
<th>dimes</th>
<th>nickels</th>
<th>pennies</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>