

# Tracing, debugging, and standard loops

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Trace the following program, writing down and updating the values of each variable and the final output. (Assume the boilerplate is present and correct.)

```
vector<int> nums = { 3, 2, 0, 1, 0, 7 };
int result = 0;
for (int num : nums)
{
    if (num > 0)
    {
        result += 1;
    }
    else
    {
        result = 0;
    }
}
cout << result << endl;
```

From performing the trace (or reading the code), describe what you think the program is meant to do.

Using what you learned from performing the trace, can you explain why it's broken, and how to fix it?

Trace the following program, assuming that the user types "Test!!" as input. (Hint: Remember that char values are just numbers, internally, and you don't need to know what they are other than A through Z are assigned consecutive numbers... and upper and lowercase are different.)

```
string word;
cin >> word;
int countA = 0;
int countB = 0;
for (char ch : word)
{
    if (ch < 'A')
    {
        countA += 1;
    }
    else if (ch > 'Z')
    {
        countA += 1;
    }
    else
    {
        countB += 1;
    }
}
cout << countA << " " << countB << endl;
```

Using what you learned from performing the trace, how would you describe what the program does?

Trace the following program, writing down and updating the values of each variable and the final output.

```
vector<double> numbers = { -1.5, 4.5, -3.0, 6.0 };
double result = 0.0;
for (double num : numbers)
{
    if (num < result)
    {
        result = num;
    }
}
cout << result << endl;
```

Identify, based on your tracing of the program, what the apparent intent of the program is.

Now trace the same program except with the following init for `numbers`:

```
vector<double> numbers = { 1.5, 4.5, 3.0, 6.0 };
```

Show, using your trace, what the bug in the program is.

Propose a fix for the bug, and demonstrate its correctness with a trace of your corrected version: