

Tracing and debugging

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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, 7 };
int result = 1;
for (int num : nums)
{
    result = result * num;
}
cout << result << endl;
```

From performing the trace (or just reading the code), how would you describe what the program does?

Using what you learned from performing the trace, can you explain why `result` was initialised to 1?

Trace the following program, assuming that the user types “Test!!” as input. (Hint: you can use the table on p494 to help evaluate the conditions, or you can do some broader reasoning about the code.)

```
string word;
cin >> word;
int countA = 0;
int countB = 0;
for (char ch : word)
{
    if (ch < 'A')
    {
        ++ countA;
    }
    else if (ch > 'Z')
    {
        ++ countA;
    }
    else
    {
        ++ countB;
    }
}
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 = { 3.0, 4.5, -1.5, 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 = { 3.0, 4.5, 1.5, 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: