

# Debugging

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# Overview

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What not to do

What to do

- Always write readable code

- Get your program to compile

- Verify that your program works

Aside on error handling

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- ▶ When you have written a program, it will have errors
  - ▶ It ll do something, but not what you expected
  - ▶ How do you find out what it actually does?
  - ▶ How do you correct it?
  - ▶ This process is called **debugging**

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# What not to do

- ▶ `while (program doesn't appear to work)`

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# What not to do

- ▶ while (program doesn't appear to work)
  - ▶ randomly look at the program for something
  - ▶ change it to ``look better''
- ▶ Key question: how would I know if the program actually worked correctly?

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  - ▶ Break code into small `functions`



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  - ▶ Break code into small `functions`
  - ▶ Avoid complicated code sequences

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  - ▶ Break code into small `functions`
  - ▶ Avoid complicated code sequences
  - ▶ Use library facilities

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# Get your program to compile

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- ▶ `std::cout << "Hello, " << name << '\n';`

- ▶ Is every block terminated?

- ▶ 

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if (a > 0) {  
    /* do something */  
else {  
    /* do something else */  
}
```

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- ▶ Is every set of parentheses matched?
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if (a  
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```
- ▶ The compiler generally reports these kinds of errors “late”
  - ▶ It doesn't know you didn't mean to close “it” later



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```
int count;  
/* do something */  
++Count;
```
  - ▶ 

```
char ch;  
/* do something */  
Cin >> c;
```

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    - ▶ `int count;`  
`/* do something */`  
`++Count;`
    - ▶ `char ch;`  
`/* do something */`  
`Cin >> c;`
- ▶ Did you terminate each expression statement with a semi-colon?
  - ▶ `x = sqrt(y) + 2`

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  - ▶ If there isn't enough output to help, add a few debug output statements
    - ▶ `std::cerr << ``x == ' ' << x << `` , y == ' ' << y << std::endl;`



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  - ▶ Pretend you're the computer executing the program
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  - ▶ If there isn't enough output to help, add a few debug output statements
    - ▶ `std::cerr << ``x == ' ' << x << `` , y == ' ' << y << std::endl;`
- ▶ See what the program specifies, not what you think it should say!

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- ▶ Design these checks so that some can be left in the program even after you believe it to be correct
- ▶ It's almost always better for a program to stop than to give wrong results

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  - ▶ Did you handle the empty case correctly?
    - ▶ No input provided?
    - ▶ No elements in the container?
  - ▶ Did you open your files correctly?
  - ▶ Did you actually read that input?
    - ▶ Did you actually write that output?

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    - ▶ Work forward through the code from a place you know is right
    - ▶ Work backwards from some bad output
  - ▶ Once you’ve found the “the bug” carefully consider if fixing it solves the *whole* problem

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  - ▶ There is basically just one way things can work right
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  - ▶ If you break your own code, that's your own problem
  - ▶ If your code is used by your friends, uncaught errors can cause you to lose friends
  - ▶ If your code is used by strangers, uncaught errors can cause serious grief

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