

Basic Debugging

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Prerequisites

Languages - C or C++

Make

Editors - Vim, Emacs or at least Nano/Pico

Overview of topics

1. When is a bug not a bug?
2. The three types of bugs
 - ▶ Syntax Errors
 - ▶ Runtime Errors
 - ▶ Semantic Errors
3. Three general approaches
 - ▶ Tracing
 - ▶ Preemptive Testing
 - ▶ Interactive Debugging
4. Tips and Tricks
 - ▶ Warnings
 - ▶ Getting to know your debugger
 - ▶ Never leave your editor
 - ▶ Check what you type
5. Checklist

When it's your fault.

- ▶ Software faults
- ▶ Errors **cause** faults
- ▶ It pays to be pedantic
- ▶ Probability of hardware failure: Minimal

Syntax Errors

- ▶ I'm sorry Dave, I can't do that.

Runtime Errors

- ▶ The dreaded Segmentation Fault
- ▶ Corrupted data

Semantic Errors

- ▶ Legal, but not OK
- ▶ " =" vs. " == "

Interlude

- ▶ Let's find a syntax error...
- ▶ 1, 2 and 3 line errors
- ▶ Look for the earliest source of failure
- ▶ Download: <http://cecs.pdx.edu/~arik182/debug.tar>

Three general approaches

- ▶ Tracing
- ▶ Preemptive Testing
- ▶ Interactive Debugging

Tracing

- ▶ Tracing by hand is a required skill
- ▶ Tracing in a debugger is easier

Preemptive Testing

- ▶ Unit Testing
- ▶ The role of Assert

Interactive Debugging

- ▶ The Segmentation Fault is your friend
- ▶ Backtrace
- ▶ Break
- ▶ Print

Warnings

- ▶ Compile using -Wall
- ▶ All warnings must DIE.

Getting to know your debugger

- ▶ You can't really break anything
- ▶ GDB's help command

Never leave your editor

- ▶ `:make`
- ▶ `:cwin`
- ▶ `:ccl`

Check what you type

- ▶ There's no substitute for care
- ▶ Double and triple check yourself

List of common suspects (1)

- 1 Array bounds
- 2 Input data
- 3 Prototype Arguments
- 4 Code in a loop that doesn't belong
- 5 Dangling else
- 6 Division by zero
- 7 If conditions (check the test)
- 8 Stopping conditions (infinite loop)
- 9 lvalues
- 10 lvalues

List of common suspects (2)

- 11 Uninitialized variables
- 12 Semicolons
- 13 Operator precedence
- 14 Off-by-one errors in loops
- 15 Missing switch breaks
- 16 Matching parentheses
- 17 Missing return statements
- 18 "==" vs. "==="
- 19 null or garbage pointers/objects

Additional Resources

- ▶ gdb help
- ▶ vim :help
- ▶ Practical Debugging in Java, by Ann Ford Et al.
ISBN: 0131427814
- ▶ The Bug, by Ellen Ullman
ISBN: 1400032350