Debugging and Troubleshooting

INFO/CSE 100, Spring 2005

Fluency in Information Technology

http://www.cs.washington.edu/100

Readings and References

- Reading
  - » *Fluency with Information Technology*
    - Chapter 7, To Err is Human

      "To err is human, but it takes a computer to really foul things up"

Using Computers...

- In IT, stuff goes wrong … debugging is the process of finding the error
    - » Term coined by Grace Murray Hopper
- Best solution … make no mistakes!
    - » Be accurate … get it right the 1st time
    - » Follow a process that makes it easier to get it right
    - » Computers can't make "common sense" decisions about what we really meant. They do what we say, not what we mean.
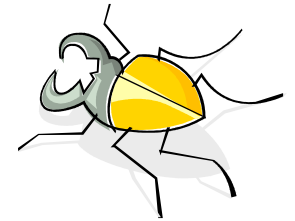
When You Debug...

Debugging is not algorithmic: no guaranteed process

- There are guidelines for debugging…

  Rather than trying things aimlessly and becoming frustrated, think of yourself as solving a mystery

  - Be objective: What are my clues? What is my hypothesis? Do I need more data?

  - Consciously 'watch' yourself debug -- its an out-of-body experience

  - When stumped, don't become frustrated, but ask, "What am I misunderstanding?"

Become Sherlock Holmes

Debugging Guidelines

- » Verify that the error is reproducible
- » Determine exactly what the actual failure is
- » Eliminate the "obvious" causes by checking
- » Divide process into working/faulty parts
- » On reaching a dead end, reassess the information you have, trying to identify the mistake you are making
- » Work through process making predictions and checking they're fulfilled

Reproducibility

- First step: verify the error is reproducible
  - » You can't find something that you can't reproduce
  - » Get out and get back in. Does it still happen?
    - Restart the application.
    - Try a different application
    - Reboot the operating system. Sometimes this is appropriate, especially for errors involving peripheral devices (printers, modems)

Getting Out and Getting Back In

Determine the Problem

- Second step: figure out what's wrong
  - » Often there is a sequence of steps following an error and propagating it … work backwards looking to see where the error first occurred

Empty Database → Mailing Label Pgm → Mailing Label File → No Labels Printing
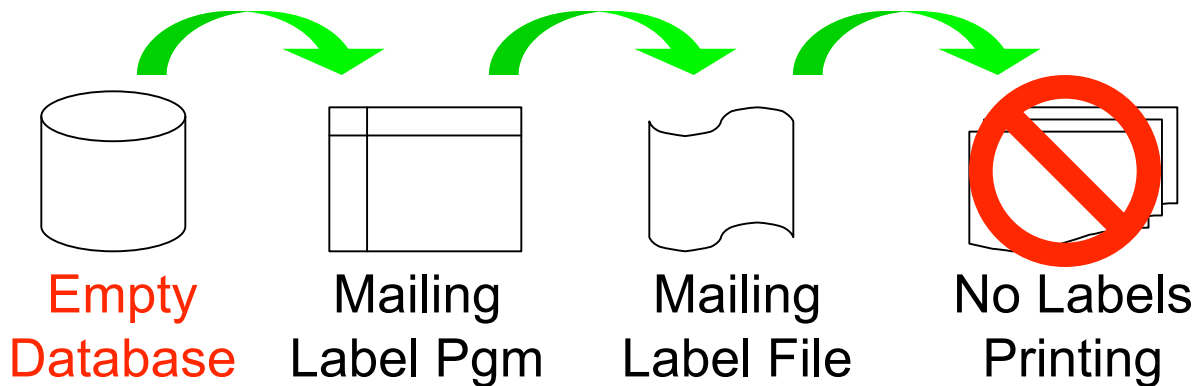
This is not a printer problem!

Eliminate the Obvious

- Third step: eliminate obvious causes

  "If the cause were obvious, the problem would have been fixed!" - Yeah, right.

  » There are standard things to check:
    - Inputs
    - Connections
    - "Permissions"
    - Physical connectivity
    - Requirements

My fan is broken, it won't turn on!
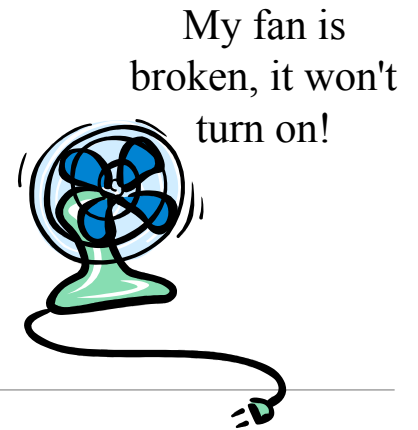
Isolate the Problem

- Try to "partition" the situation into working and non-working parts

  - Form a hypothesis of what's wrong

  - Make as few assumptions as possible

  - Take nothing for granted

The goal is to eliminate as many things from consideration as possible

At a Dead End, Reassess

- When everything seems to check out, don't get frustrated
- Instead, ask yourself "What am I overlooking or misunderstanding?"
  - » Your goal is to see the situation as it is, not as you think it should be
    - Am I assuming too much?
    - Am I misreading the clues?
    - What can I eliminate or simplify?
- Explain the situation to a friend

Make Predication/Check

- Beginning with the isolated part, step through the process, predicting the outcome and verifying it
  - » A prediction that is not fulfilled shows…
    - A possible bug
    - A possible misunderstanding
    - A chance to narrow the search

'Sleeping on it' often helps!

Summary

- Debugging is not algorithmic, but there are guidelines to follow

  » Stay calm - high blood pressure clouds your brain

  » Be organized as you investigate and fix things

  » Recognize that you may feel a little embarrassed when you finally figure out the problem.

    - If we were perfect, we would never make mistakes ...

    - A little humility is a good thing for all of us

  » Watch yourself debug -- assess how you are doing, what you need to know