Debugging & Troubleshooting

"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
  * In most cases computers can't recover for our errors

The standard of precision for computers is perfect, which is tough for people, but try!

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 **Become Sherlock Holmes**

- **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?"**

Debugging Guidelines

1. Verify that the error is reproducible
2. Determine exactly what the problem is
3. Eliminate the "obvious" causes
4. Divide process into working/faulty parts
5. On reaching a dead end, reassess the information you have, trying to identify the mistake you are making
6. Work through process making predictions and checking they're fulfilled

Memorize?

Reproducibility

First step: verify the error is reproducible

* Transient errors are very rare, but they do happen … try again

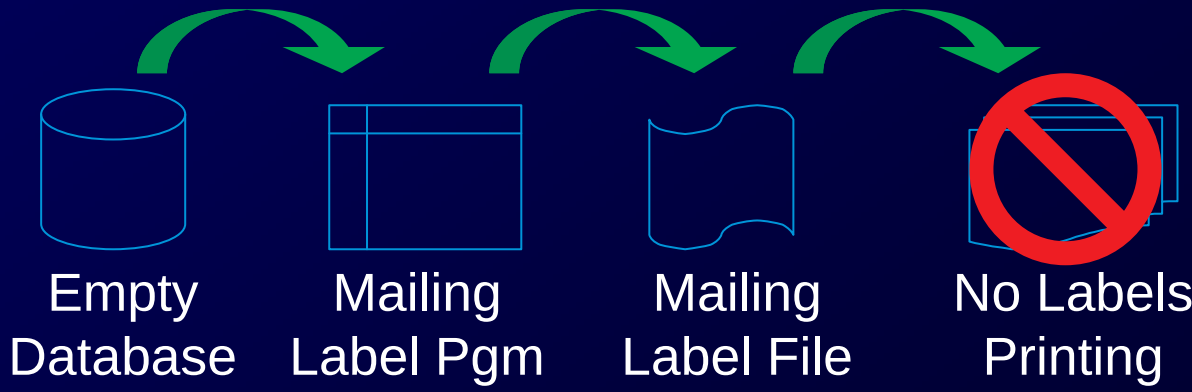
Getting Out and Getting Back In

* Rebooting the operating system is advisable, especially for errors involving peripheral devices (printers, modems)

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



Eliminate the Obvious

Third step: eliminate obvious causes

"If the cause were so obvious, the problem would have been fixed!"

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

"Working" in similar situations is usually good enough

Isolate the Problem

Fourth Step: Try to divide 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

Fifth Step: When everything seems to check out, don't get frustrated ... ask, "What am I misunderstanding?"

- Your goal is to see the situation as it is, not as you think it should be
  - **Are you assuming too much?**
  - **Are you mis-reading the clues?**

Sometimes, stepping back to the surrounding context is helpful

Make Predication/Check

Sixth: 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' may help!

A Debugging Example

After building a class web page, we find it is wrong

```
<html>
  <head> <title> Fluency Class </title> </he
  <body bgcolor='808080'><font color='white'
    <font face='helvetica'>
    <h1>FIT100: Bringing Light to Computer U
      <h2><Winter 2006</h2>
      <img src=fitFig.gif width=315 height=
      <table border=2>
        <th><td>Sec</td><td>TA</td></th>
        <tr><td>AA</td><td>Sandra</td></tr>
        <tr><td>AB</td><td>Brian</td></tr>
        <tr><td>AC</td><td>Sandra</td></tr>
        <tr><td>AD</td><td>Shaun</td></tr>
        <tr><td>AE</td><td>Shaun</td></tr>
        <tr><td>AF</td><td>Veneta</td></tr>
      </table>
      <p>Fluen
      teach st
      their li
  </body>
</html>
```

Houston, we have a problem

FIT100: Bringing Light to Computer Users

	Sec	TA
AA	Sandra	
AB	Brian	
AC	Sandra	
AD	Shaun	
AE	Shaun	
AF	Veneta	

Fluency with Information Technology is designed to teach students to use computers today and throughout their lives. It's a lot of work, but it's worth it!

Debugging Demo

FIT100: Bringing Light to Computer Users

Winter 2006

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Intended page

Summary

Debugging is not algorithmic, but there are guidelines to follow

* It probably pays to memorize them so they come to mind while debugging
* Watch yourself debug -- assess how you are doing, what you need to know
* Being accurate -- avoiding textual mistakes at all costs -- saves frustration

Notice how few letters mess up a whole page