Announcements

Project 1A is due today at 5:00
Midterm 1 is next Friday
In this room ... arrive on time
Cover material in 1\textsuperscript{st} 9 Lectures + Labs
Bring only Photo ID and a pencil/pen

\textbf{Tip of the day:} The most useful habit for successful computing is that of being perfectly accurate
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 -- it’s 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
Reproducibility

First step: verify the error is reproducible

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

* 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

- Empty Database
- Mailing Label Pgm
- Mailing Label File
- No Labels Printing
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
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>
</head>
<body bgcolor='808080' font color='white' face='helvetica'>

<h1>FIT100: Bringing Light to Computer Users</h1>
<h2>Winter 2006</h2>
<img src='fitFig.gif' width=315 height=2>
<table border=2>
<tr><th>Sec</th><td>TA</td></tr>
<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>Sheun</td></tr>
<tr><td>AE</td><td>Shaun</td></tr>
<tr><td>AF</td><td>Veneta</td></tr>
</table>
<p>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.
</p>
</body>
</html>
```
Debugging Demo

FIT100: Bringing Light to Computer Users

Winter 2006

<table>
<thead>
<tr>
<th>Sec</th>
<th>TA</th>
</tr>
</thead>
<tbody>
<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>Venita</td>
</tr>
</tbody>
</table>

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!
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