CSE 403
Software Engineering
Spring 2023

#23: Debugging
## Logistics

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<thead>
<tr>
<th>Date</th>
<th>Activity</th>
<th>Notes</th>
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<tbody>
<tr>
<td>05/15</td>
<td>L: Code Review</td>
<td>SLIDES/REC</td>
</tr>
<tr>
<td>05/16</td>
<td>T: R2</td>
<td>DUE: R2!!!</td>
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<td>Release Peer-Review</td>
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<td>(RPR)</td>
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<td>05/18</td>
<td>P: RPR</td>
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Debugging: What?
A bug is an **error of flaw** in a program or system that produces incorrect or **unexpected results**.

Debugging is the process to **identify** and **resolve** bugs.
Debugging: A process

6 STAGES OF DEBUGGING

1. That can't happen
2. That doesn't happen on my machine
3. That shouldn't happen
4. Why does that happen?
5. Oh I see
6. How did that ever work?
Debugging: A process

Nah! I got this!

```
Console.log('I passed HERE!')
System.out.println('I am so smart!')
```

```
Console.log('Value: ${my_account}')
```
Debugging: A process (a suggestion)

0. Identify & Document
1. Understand & Document
2. Reproduce & Document
3. Investigate & Capture
4. Fix it & Document
Live Example

GET study authorization misbehaving #8

nigini commented 15 minutes ago

If study X is authorized, it can call for any valid study ID and get a 200.
The expected behavior is only to get a 200 when the call is for ID=X.
The problem is less of an issue because it is always retrieving the study X content, not any unauthorized content!

https://github.com/nigini/SWEng/pulls
0. Identify & Document

Step 1: What the heck?

Step 2: This is broken, yall! (i.e., issue report)

Step 3: Feel like a hero!
1. Understanding (& improve documentation)

How is the program failing?

What are the assumptions to justify this error?

**What inputs or conditions are causing the error?**
*(focus of next in-class activity!)*

Is this an error in our understanding?

Is this really a bug in the code?
2. Reproduce (& improve documentation)

Can one replicate the bug?

Can I rule out other issues? (i.e., config, code synch, etc.)

Can I pinpoint a version of the code?

Can I refine the assumptions and conditions?
3. Investigate & Capture

What are my hypotheses about what is wrong?

What are the components involved in this?

Can I narrow down to a Class, method, line?

How can I test my hypothesis?
(print vs debugger vs tests)

How can I capture the but?
(create an automated way/test to trap this damn bug in the future!)
4. Fix it!

Have I really trapped the bug?

What change will fix the bug?

Remember TDD?
- Trap with a test (red bar)
- Change the code
- Test pass!!!
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**Delta Debugging**: finding a minimal set of conditions that expose the bug in complex cases. [VIDEO]
Debugging…

STEP BY STEP DEBUGGING

STEP OVER
STEP INTO
STEP OVER

MANY STEPS LATER
STEP OVER
STEP INTO
STEP OVER

SHOULD HAVE STOPPED
STEP OVER

I AM GOING TO KILL YOU!

Questions, please!