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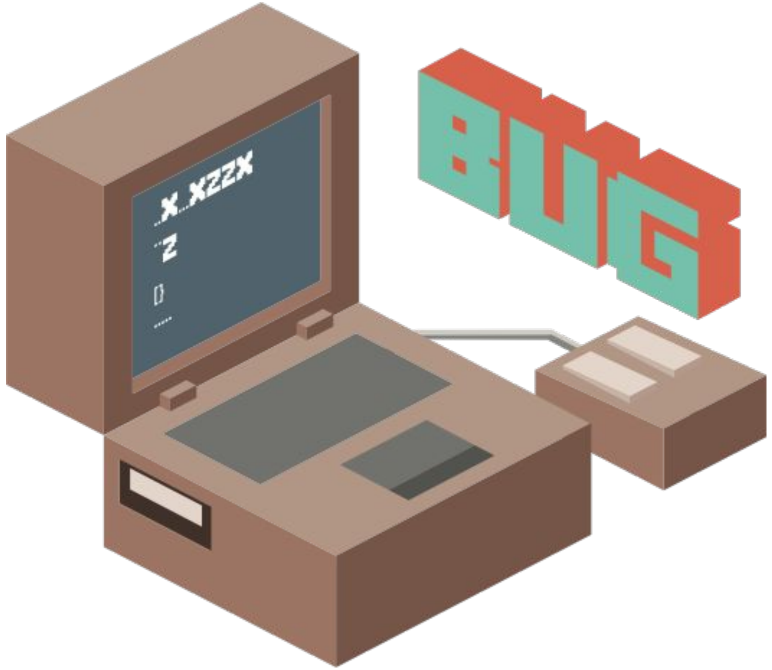
Debugging 2: Techniques

SPD 2.3

Agenda

- Learning Outcomes
- **Activity 1**: What is Debugging?
- Teacher Talk
- **Interactive Debugging Demo**
- Break
- **Activity 2**: Stepping Through



Learning Outcomes

By the end of today, you should be able to…

1. Compare and contrast the **pros and cons** of **different debugging techniques**.
2. **Use breakpoints** to debug code.
3. Apply debugging techniques in a project of their own.

Warm-Up: Read & Discuss

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"Once a problem is described in sufficient detail, its solution is obvious."

- https://wiki.c2.com/?RubberDucking

Read & Discuss (10 minutes)

Read this article on the psychology of "rubber duck debugging". Then, in a group of 3, answer the following questions:

- Have you used "rubber duck debugging" before? Was it useful?
- According to the article, how could you make your "rubber duck debugging" more useful in the future?

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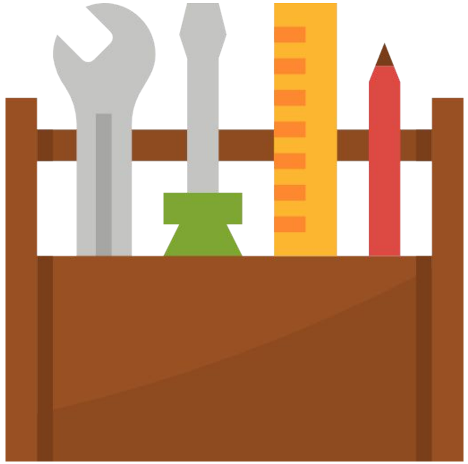
Techniques

Advanced Techniques

It's important to have some techniques in your toolbox that enable you to solve your own problems. We'll go over a few:

- Trace Backward
- Trace Forward
- Divide and Conquer



Trace Backward

To **trace backward**, figure out which line of code is producing the error. Then, **work backwards one line at a time** until you find the source of the bad data.

Use this technique when...

- The **error is thrown from a known location**
- You **understand the program well enough** to know what it's supposed to be doing

Trace Forward

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To **trace forward**, start at the beginning of your program. Then, **work forwards one line at a time** and **verify that your mental model matches the result**, using a debugger or log statements.

Use this technique when...

- The **problem line isn’t known**
- You **can't narrow down the problem** to one specific area of the code

Divide and Conquer

To **divide and conquer**:

- **Identify different code sections** that could have caused the error
- Use **breakpoints or log statements at the boundaries** to test which area is the problem
- **Focus your efforts** on that area using Trace Forward or Trace Backward

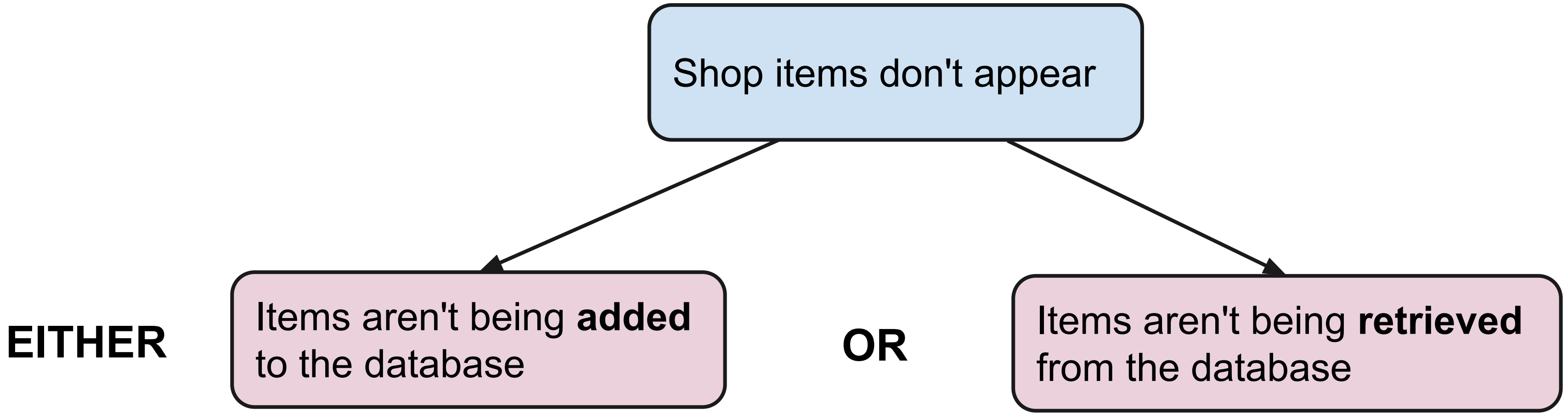
Use this technique when...

- There are **multiple areas where the error could have come from**

Divide and Conquer - Example

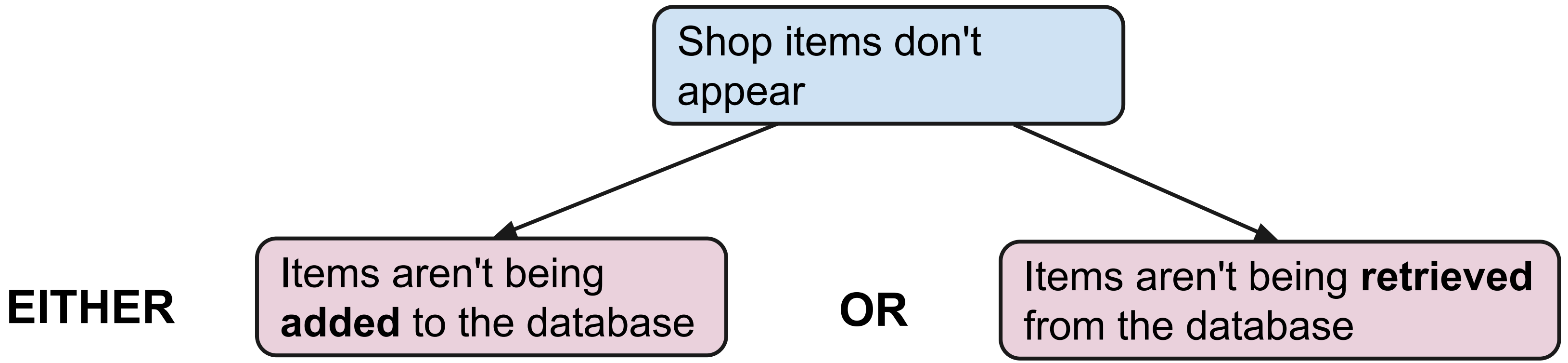
Scenario: You are writing a website for an online store. You are connecting to a database that will hold the items.

Bug: When the store owner adds a new item, it doesn't appear on the website.


Shop items don't appear
EITHER
Items aren't being **added** to the database
OR
Items aren't being **retrieved** from the database

Divide and Conquer - Example

How do we know **which of these scenarios** is causing the bug??


Shop items don't appear
EITHER
Items aren't being **added** to the database
OR
Items aren't being **retrieved** from the database

We need to **check the boundary conditions** for each of the scenarios.

In this case, we could **query the database** directly to see if the data is there.

Choose a Technique

Which technique would you use for the following scenarios?

- Your sort algorithm gives the wrong result, but there are no errors thrown.

  Trace Forward

- You make an API call to retrieve some data, but the data is not being displayed properly.

  Divide and Conquer

- When running your code, you get a NullPointerException. The stack trace doesn't immediately tell you the cause of the error.

  Trace Backward

Choose and Apply a Technique

50 minutes

Work with a partner!

For each problem in the starter code, **choose and apply a technique** that would work best for identifying and fixing the error:

- **Trace Backward**: If there is a specific line number causing the error
- **Trace Forward**: If you aren't sure which line is causing the error
- **Divide and Conquer**: If there are multiple areas which may have caused the error

It's ok to **change your mind** or **use more than one strategy**!

Break - 10 min

Credits & Additional Resources

- Deck adapted from **Debugging Effectively** (2019)