Problem Solving and Critical Thinking

Flex your Brain Muscles

- Push ups for the brain
- Uncomfortable, but worth it
- Practice makes perfect

What We’ll Cover Today

- General steps
  - Problem solving
  - Critical thinking
- Data Science Specifics
  - Organization
  - Flowcharting
  - Problem solving checklist
- When to ask for help

General Problem Solving and Critical Thinking

Steps to Problem Solving

- Define the problem
- Set a goal – what do you want to achieve by solving the problem?
- Brainstorm possible solutions
- Rule out any bad options
- Evaluate pros and cons of options
- Identify and choose the best solution
- Use your solution
- Evaluate your solution

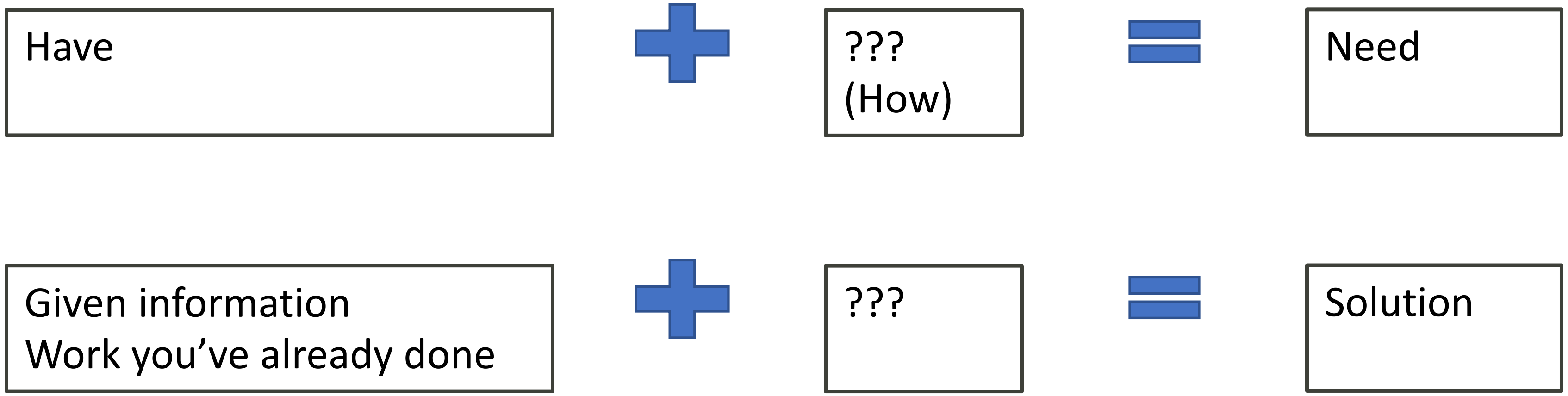
Question Everything!

- What information about this problem do you already have?
- How do you know the above information?
- What is your goal and what are you trying to discover, prove, disprove, support or criticize?
- What might you be overlooking?

- Write down / say out loud the answers
- Use someone else as a sounding board

To summarize, think through:

- What do I have?
- What do I need?
- How do I get there?



Have + ??? (How) = Need

Given information
Work you’ve already done + ??? = Solution

Problem Solving in Data Science

Code for Success

- Do the smallest, simplest piece you can at a time
- Check to ensure your code worked
- Add another piece

- This lets you pinpoint what went wrong

Organize your Code

- Make notes so you know what each step is doing for next time
- Break your work up into sections
  - Import packages/libraries
  - Data import
  - Wrangling
  - Analysis, visualization

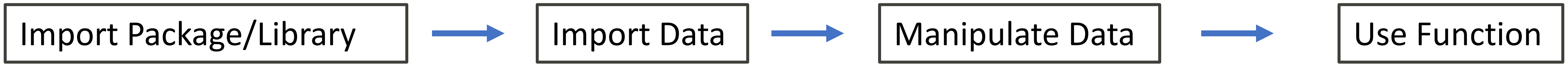
- Code linearly – everything from start to finish should go in order

- Remove code attempts that didn’t work

- Save code by module, lesson, and topic

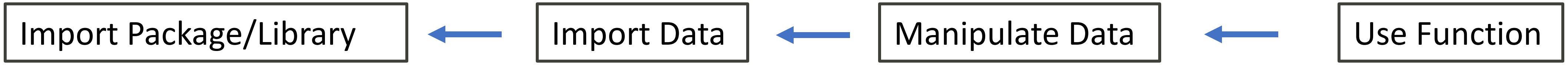
Create a Flowchart

- Visually display the problem you’re on
- Make concrete an abstract issue



Import Package/Library → Import Data → Manipulate Data → Use Function

Work Backwards



Import Package/Library ← Import Data ← Manipulate Data ← Use Function

Problem Solving Checklist

woz U

Problem Solving Checklist

1. Understand The Problem

□ Determine what the question is asking.

□ Find the error message if applicable.

2. Check Your Work

□ Check spelling and typos.

□ Check parentheses, brackets & quotes.

□ Ensure all packages/libraries are loaded.

3. Search For Answers

□ Find similar work in lessons/hands-on.

□ Look for red lines in your code.

□ Search the internet.

4. Ask A Question

□ Ask a concrete question in #datascience.

□ Include @mentors, module, lesson & page.

□ Allow time for a mentor to respond.

Example Question

@mentors Basic Statistics Lesson 7, Page 10. I do not understand how to calculate the effect size. This is what I have...

Determine What the Question is Asking

- Ask yourself:
  - What is this question asking me to do?

- Break it into the smallest parts you can

- Figure out the parts you already have

Find Similar Work in Lessons / Hands On

- Ask yourself:
  - Have I seen anything else like this in my lessons?
- Go through page by page in the lesson
- Ask yourself:
  - Have I done anything else like this in a hands-on or an example?
- Pull up homework / follow along files

Compare with Similar Things

- Place your current problem and past work side by side

- Ask yourself:
  - What should be the same?
  - What is different about the questions/problems?
  - What is the part I should change?

- Copy and paste similar code and modify

Check for Typos and Correct Spelling

- Ask yourself:
  - Have I spelled everything correctly?
  - Is my spelling consistent?
    - **Object to object**
    - **Function to function**
    - **Libraries/packages**
    - **Data**

Check Punctuation

- Ask yourself:
  - Have I closed all of the following?
    - **Parentheses ( )**
    - **Brackets [ ]**
    - **Curly brackets { }**
    - **Single quotes ‘**
    - **Double quotes “**

- Count how many open versus closed
- Determine where each open one gets closed

- R will give you a red squiggly when these are wrong

Ensure All Packages / Libraries are Loaded

- When using R, ask yourself:
  - Have you installed and loaded all the libraries you need?

- When using Python, ask yourself:
  - Have you installed and loaded all the packages you need?

Search the Internet

- Information to include in search:
    - Error message or general problem
    - Language
    - Specific packages – ggplot etc.

- Know when responses are too far over your head

- Good resources to choose:
    - Data to Fish
    - Towards Data Science
    - Geeks for Geeks
    - W3 Schools
    - R Bloggers
    - Stack Overflow*

Ask a Concrete Question

- Write out a concrete question for staff
  - “I don’t understand this concept. Does this mean X?”
  - “This part of the project does not work, and I got X error.”
  - Include screenshots or code when you can

- Being specific helps:
  - YOU better understand
  - US answer you faster and more completely

- Try problem solving for AT LEAST 10-15 minutes
  - If you’re still stuck, frustrated, or angry, then ask!

Questions?