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LEC 02 - Testing With Purpose

A beginners way of testing functions:

1. Write function calls in console
2. Read results and judge correctness

Disadvantages:
- Lengthy
- Slow

Unit Tests:

- With doctests, thorough and complete testing would make docstrings too long
- UnitTest was briefly reviewed in CSC108
- "Unit" → one function (usually)
- Written in a separate file, enabling a thorough set of tests without impacting code readability

Key Technical Tools:
- Assertion (Python: `assert`)
- Test case (Python: a function whose name begins with `test_`)

Pytest:

- Simplifies writing small tests
  - Not as much code to write compared to unittest
- Expects tests to be in separate files that begin with `test_` of end with `_test`
- Not in the standard library
- Expected to know how to use pytest
  - Use documentation
  - Practice examples

Testing Domain:

- There are infinitely many test cases, but cases can be grouped together by common properties
- Testing specific properties allows you to reasonably assume that similar cases also work

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Choosing Test Properties:

- There are many possible properties to test
- Decide which properties to test based on what a function or method does
- Knowing how a function accomplishes a task can also influence property choices
    - Ex. if a method divides a list in half, try odd and even list sizes

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Testing Categories:

Size (list, dictionary):
- Empty collection
- 1 item collection
- Smallest interesting case
- Collection with several items

Boundary:
- Look at behaviour of function near thresholds

Dichotomy (Opposites):
- Empty / full
- Vowel / Non-Vowel
- Positive / Negative

Choosing input properties:

- We need to decide which properties are relevant
- Decide based on knowing what a function / method does
- Knowing how a function does something can influence what test cases we chose

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Property Tests:

- Generating random inputs is easy, however it is time-consuming to check each result manually
- Describing properties of desired inputs and checking for these properties on a huge number of random inputs is much easier
    - Ex. Instead of a specific input: `[1, 2, 3]`, we specify a category of input such as list of integers
    - Ex. Instead of a specific output: `42`, we specify a property of the output such as returns an element of the list, or None

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- Known as Hypothesis testing

Other Notes on Testing:

- Designing test cases before writing code is a best practice
- Testing is part of the test-driven development
- When you test code, your goal is to try to break the code

Fixing Bugs:

- Beginners Often:
    - Try some typical changes such as changing `>` to `>=`
    - Adding print statements
- A rarely done but better strategy is tracing the code on paper
    - Helps you visualize and fully understand the code
- A professional strategy is to use a debugger and use what you learn to hypothesize a fix
- Having a thorough set of test cases is beneficial for finding and fixing bugs
    - Called a “test suite”

Professionalism:

- We have learned about 2 different practices that are expected of any professional
    - Test-driven development
    - Using a debugger to find and fix bugs
- Professionalism is a theme we will revisit
- These skills will be honed throughout the course