How to develop a program

CSE 160

University of Washington
Program development methodology:
**English first, then Python**

1. Define the problem
2. Decide upon an algorithm
3. Translate it into code

Try to do these steps in order
Program development methodology: English first, then Python

1. Define the problem
   A. Write an English description of the input and output for the whole program. (Do not give details about how you will compute the output.)
   B. Create test cases for the whole program
      • Input and expected output

2. Decide upon an algorithm

3. Translate it into code

Try to do these steps in order
Program development methodology: English first, then Python

1. Define the problem

2. Decide upon an algorithm
   A. Implement it in English
      • Write the recipe or step-by-step instructions
   B. Test it using paper and pencil
      • Use small but not trivial test cases
      • Play computer, animating the algorithm
      • Be introspective
        – Notice what you really do
        – May be more or less than what you wrote down
        – Make the algorithm more precise

3. Translate it into code

Try to do these steps in order
Program development methodology: English first, then Python

1. Define the problem
2. Decide upon an algorithm
3. **Translate it into code**
   A. Implement it in Python
      • Decompose it into logical units (functions)
      • For each function:
         – Name it (important and difficult!)
         – Write its documentation string (its specification)
         – Write tests
         – Write its code
         – Test the function
   B. Test the whole program

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Try to do these steps in order

– It’s OK (even common) to back up to a previous step when you notice a problem
– You are incrementally learning about the problem, the algorithm, and the code
– “Iterative development”
The *Wishful Thinking* approach to implementing a function

- If you are not sure how to implement one part of your function, define a **helper function** that does that task
  - “I wish I knew how to do task X”
  - Give it a name and assume that it works
  - Go ahead and complete the implementation of your function, *using* the helper function (and assuming it works)
  - Later, implement the **helper function**
  - The helper function should have a simpler/smaller task

- Can you test the original function?
  - Yes, by using a **stub** for the **helper function**
  - Often a lookup table: works for only 5 inputs, crashes otherwise, or maybe just returns the same value every time
ThinkPython 3.12 Why functions?

It may not be clear why it is worth the trouble to divide a program into functions. There are several reasons:

• Creating a new function gives you an opportunity to name a group of statements, which makes your program easier to read and debug.

• Functions can make a program smaller by eliminating repetitive code. Later, if you make a change, you only have to make it in one place.

• Dividing a long program into functions allows you to debug the parts one at a time and then assemble them into a working whole.

• Well-designed functions are often useful for many programs. Once you write and debug one, you can reuse it.