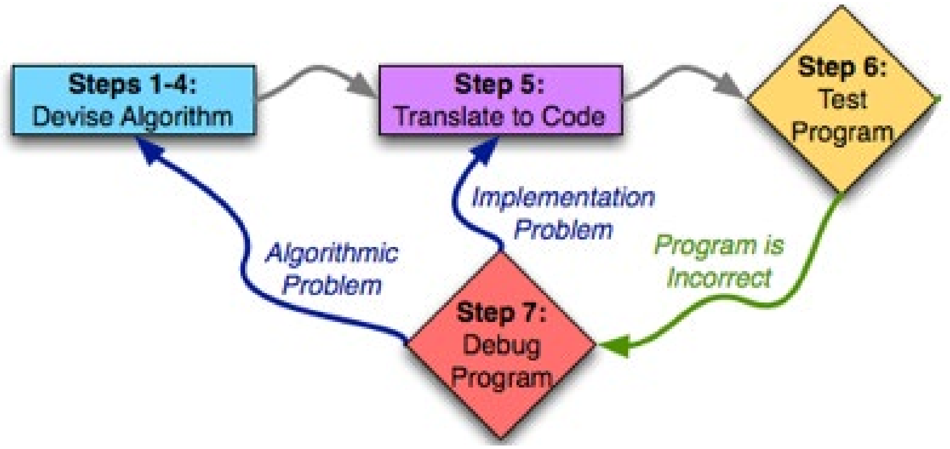
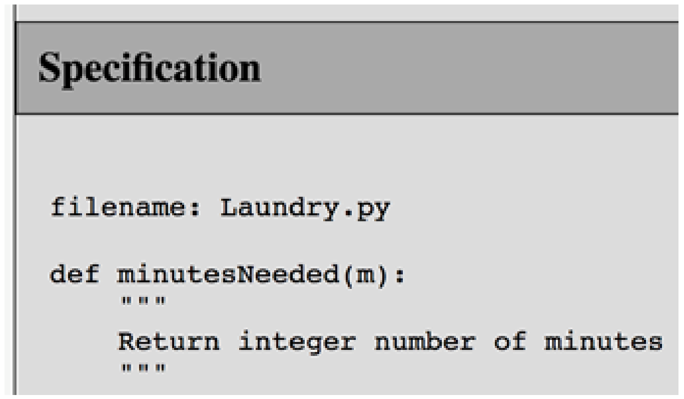
Compsci 101
7-steps, Functions, Order of Execution





Specification

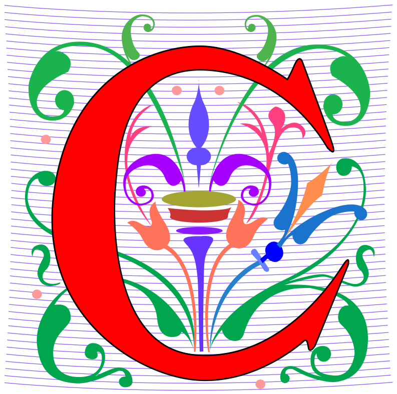
```
filename: Laundry.py

def minutesNeeded(m):
    """
    Return integer number of minutes
    """
```

Susan Rodger

January 19, 2023

C is for …

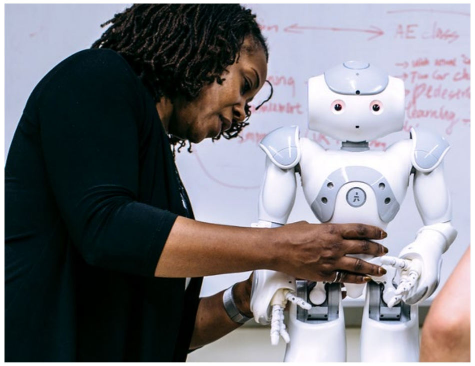


- **Computer Science and Computing**
  - It's what we do
- **Cookies**
  - Good for the web and for …
- **CSV**
  - Comma Separated Values: Data
- **ChatGPT**
  - Trained AI model to answer questions

Ayanna Howard

- **Educator, Researcher and Innovator**
- **BS Brown, MS/PhD USC, MBA Claremont**
- **Was Professor, Georgia Tech**
- **Now Dean of Engineering at Ohio State**
- **Robotics – Robots and Bias, Robots changing lives of children with disabilities, Robots beyond part of the family**
- **Top 50 U.S. Women in Tech, Forbes, 2018**

"I believe that every engineer has a responsibility to make the world a better place. We are gifted with an amazing power to take people's wishes and make them a reality."



Announcements

- **Lab 01 Friday,**
  - Complete Prelab before going to lab
- **APT-1 out today, due Thursday, January 26**
- **Assignment 0 due Today!**
  - Due to Drop/Add -> ok to turn in by Jan 26
- **Sakai quizzes on readings due 10:15am on date due**
  - Get three tries, score highest score
  - First two weeks we allow you to submit late
  - First 5 quizzes turn off, 10:15am Jan 26

- **Read Ed Discussion Every Day – You will learn things!**
- **Reminder: Ed Discussion back channel in lecture!**

PFTD

- Functions
- Order of execution
- 7 steps of programming
- APTs
- Testing and Submitting APTs

Go over answers from last WOTO

x = 8

y = 3

z = 2.0

x/y*z

x + y * y

(x+y)*z3**

a = "Duke"

b = "CoolColors"

a+a

a+3

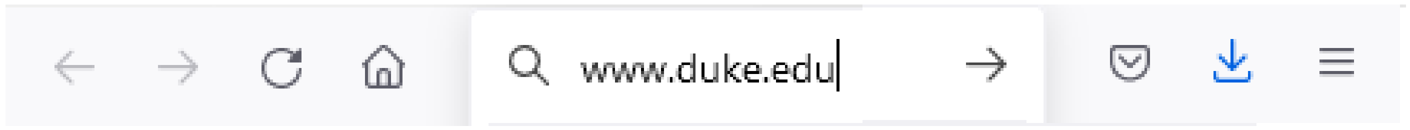
a*3

a+b

What is a Function?

- **Function has:**
  - Name
  - Maybe inputs
  - Processes or calculates something
  - Has a result

Functions in the Real World: URL in webpage

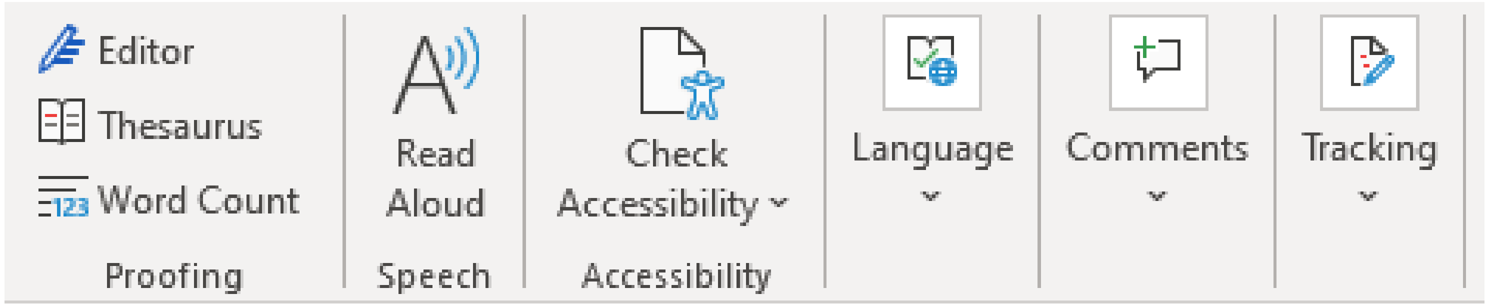

www.duke.edu

- **Function has:**
  - Name: "Search"
  - Input: www.duke.edu
  - Calculates:
  - Returns back:

Functions in the Real World: calculator

- **Function has:**
  - Name: calculator
  - Input: number(s), operator
    - Example: 25, squareroot
  - Calculates:
  - Returns back:

Functions in the Real World: Counting words in Microsoft Word



- **Function has:**
  - Name:
  - Input:
  - Calculates:
  - Returns back:

Built-in Python Function – len() already exists, you use it

- **len()** function
- **Function has:**
  - Name: len
  - Input: a string
  - Calculates: number of characters in string
  - Returns back: number

Examples:

x = len("duke")

# value of x:

y = len("computer")

Built-in Python Function – str() already exists, you use it

- **str()** function
- **Function has:**
  - Name: str
  - Input: an expression
  - Calculates: string version of expression's value
  - Returns back: string

Examples:

```
x = str(623)
# value of x:

y = len( str( 2**8) )

z = str(6 + 8.3)
```

Other Python built-in functions

- **`type(something)`**
- **`int(7.8)`**
- **`float(4)`**

- **Returns type of variable `something`**
- **Returns integer value of decimal number, e.g. 7**
- **Returns float value of integer, e.g. 4.0**

print() function

- **General function has:**
  - Name
  - Maybe inputs
  - Processes or calculates something
  - Has a result

- **print("hi cat")**
  - Name:
  - Input:

Example with lines numbered:

```
1   x = float(6)
2   print("x is", x)
3   y = print("x is", x)
4   print("y is", y)
```

Output:

Writing your own Python function

- **Format:**

```
def <nameOfFunction>(<parameters>):
    <body, or lines of code>
    return value    # optional, but likely
```

- **Example define function:**

```
def inchesToCentimeters(inches):
    centi = inches * 2.54
    return centi
```

- **Use or call function:**

```
answer = inchesToCentimeters(10.0)
print(answer)
```

Writing your own Python function

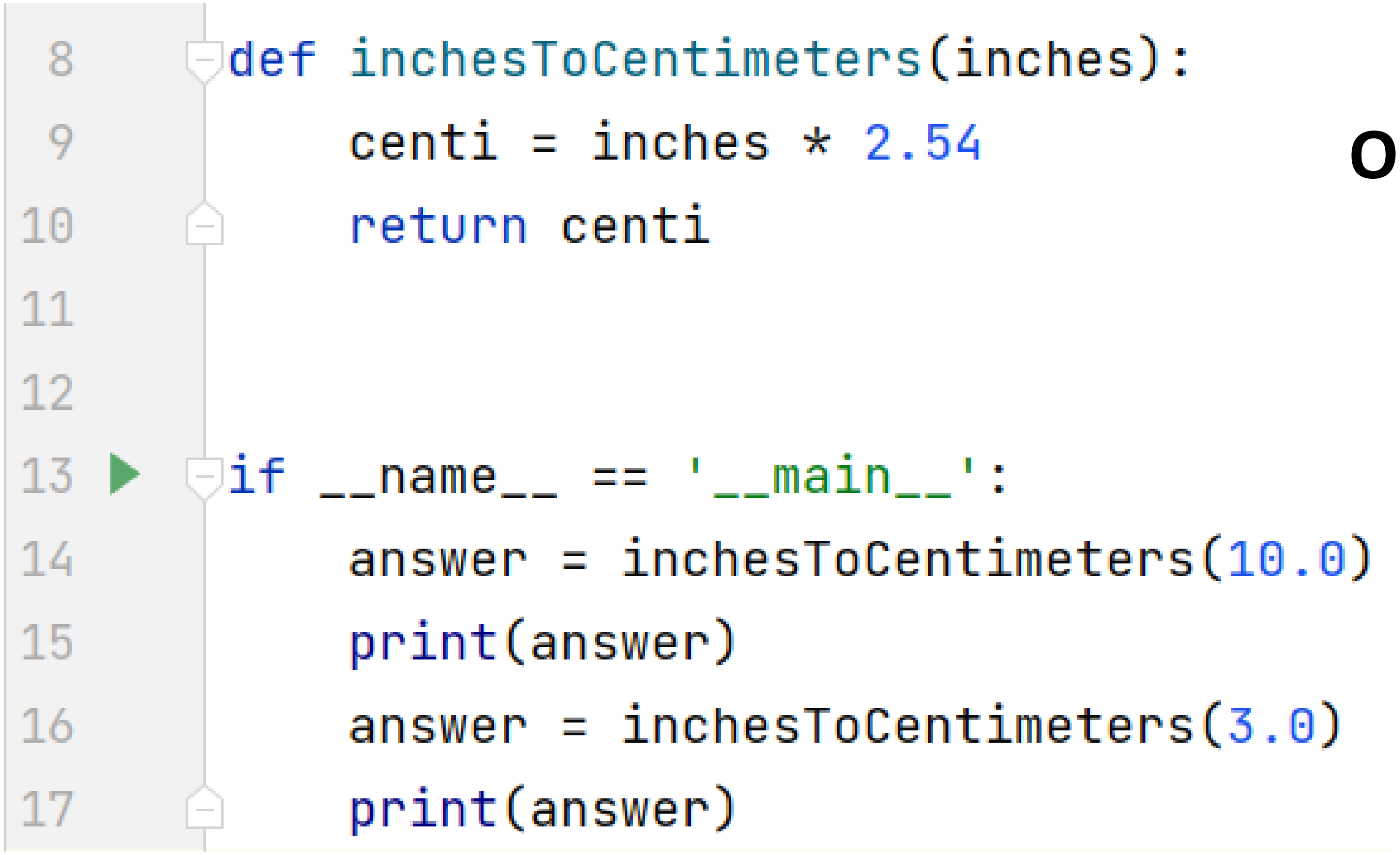
- **Parameter**
  - Variable, place holder for a value
  - In parenthesis in first line of definition of function
- **Argument**
  - Expression or value
  - In parenthesis when calling or using a function
- **Example:**

```
def inchesToCentimeters(inches):
    centi = inches * 2.54
    return centi
```

- **Use or call function:**

```
answer = inchesToCentimeters(10.0)
print(answer)
```

What happens when executes?

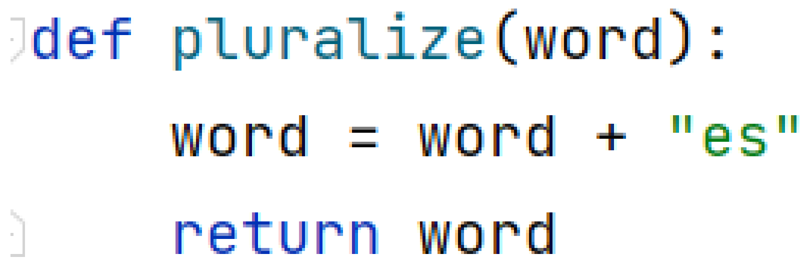


```
 8  def inchesToCentimeters(inches):
 9      centi = inches * 2.54
10      return centi
11
12
13  if __name__ == '__main__':
14      answer = inchesToCentimeters(10.0)
15      print(answer)
16      answer = inchesToCentimeters(3.0)
17      print(answer)
```

Output:

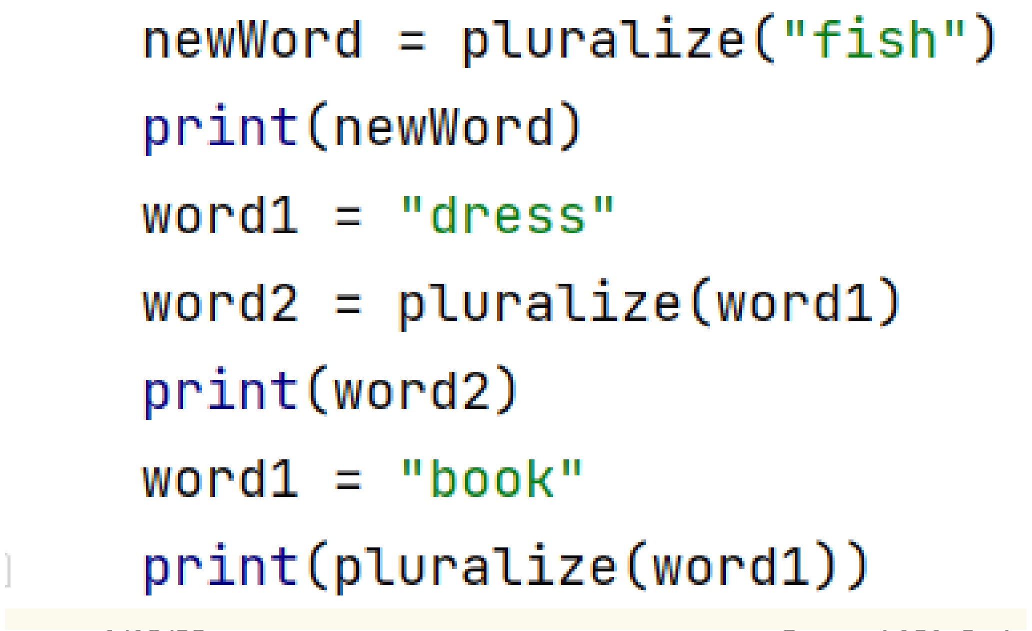
Start on line 1 of the file and move line by line
The first 7 lines are blank or are a comment, ignore.

Let’s go see this in Pycharm and add a function



```
def pluralize(word):
    word = word + "es"
    return word
```

Add this function

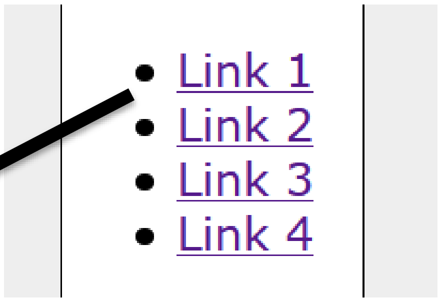


```
newWord = pluralize("fish")
print(newWord)
word1 = "dress"
word2 = pluralize(word1)
print(word2)
word1 = "book"
print(pluralize(word1))
```

Add these lines of code that call the function

WOTO – Working Together (breakout groups)

- **Given a bitly link**
  - Type it in OR click on it on the calendar page
  - http://bit.ly/101s23-0119-1
- **What you should do:**
  - Introduce yourselves
  - Each person fills out google form
  - Put in your name, email and netid
  - Discuss each question and fill out
  - Be mindful of time


- Link 1
- Link 2
- Link 3
- Link 4

WOTO: Calling Functions
http://bit.ly/101s23-0119-1

APTs in 101 and 201

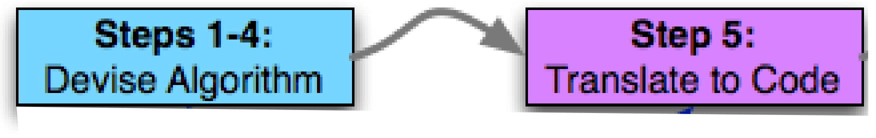
- **Algorithm Problem-solving and Testing**
  - Algorithm that's Automatically Tested
  - In use at Duke since 2003, million+ APTs solved

- **Given a problem statement**
  - Read**, think,** plan on **paper** …
  - Write a function to solve the problem
  - Submit the code for testing, debug if necessary
- **Where do you start with problem solving?**

The Seven Steps
Programming Process: High-level

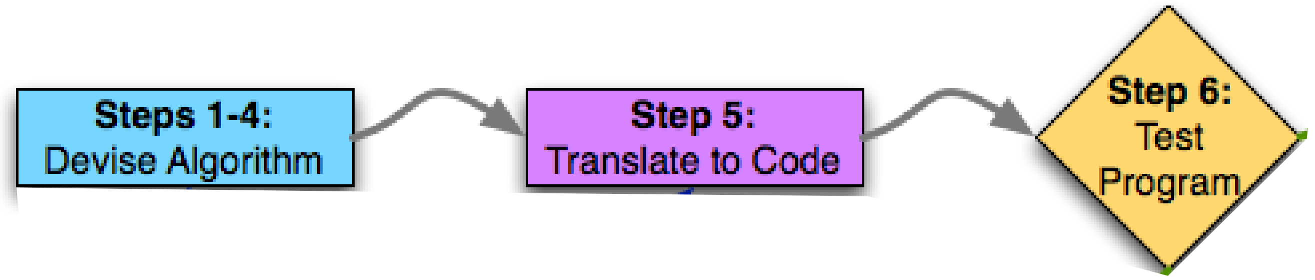
- **First part: devise the algorithm**
  - The meta-problem solving piece
  - Big/complex enough to be 4 steps (more shortly)

The Seven Steps
Programming Process: High-level



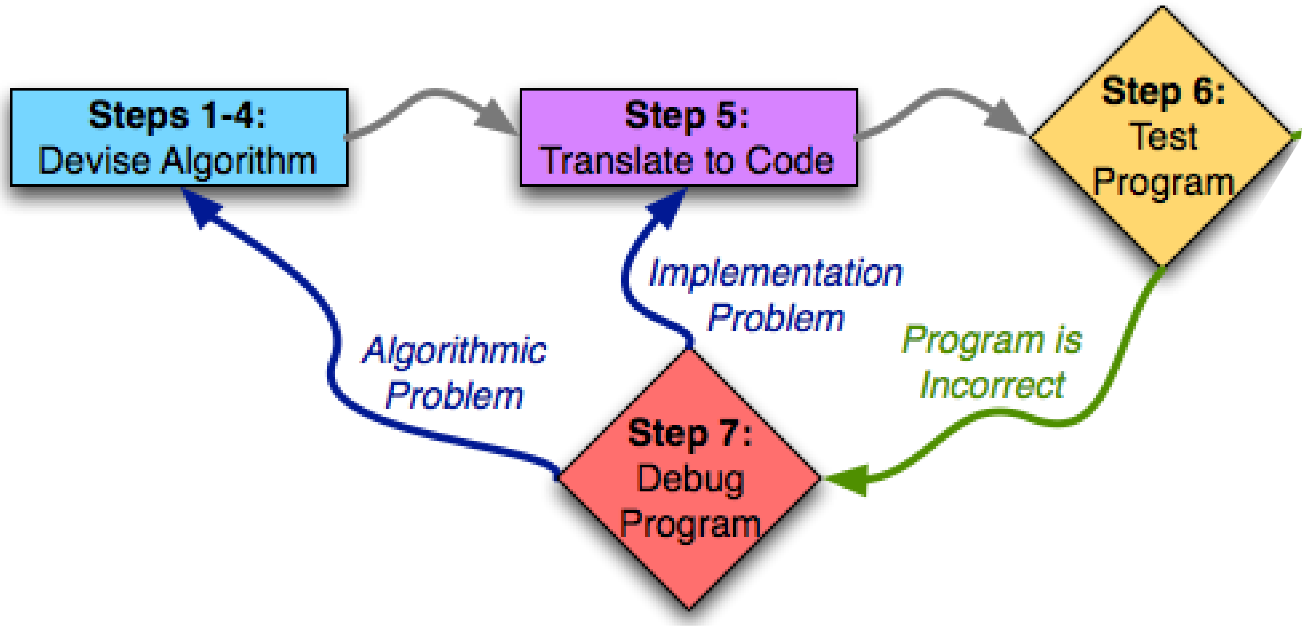
- **After devising the algorithm, translate to code**
  - Plan first, then code
  - Bridge analogy: blue prints, then construction
  - Essay analogy: outline, then prose

The Seven Steps
Programming Process: High-level



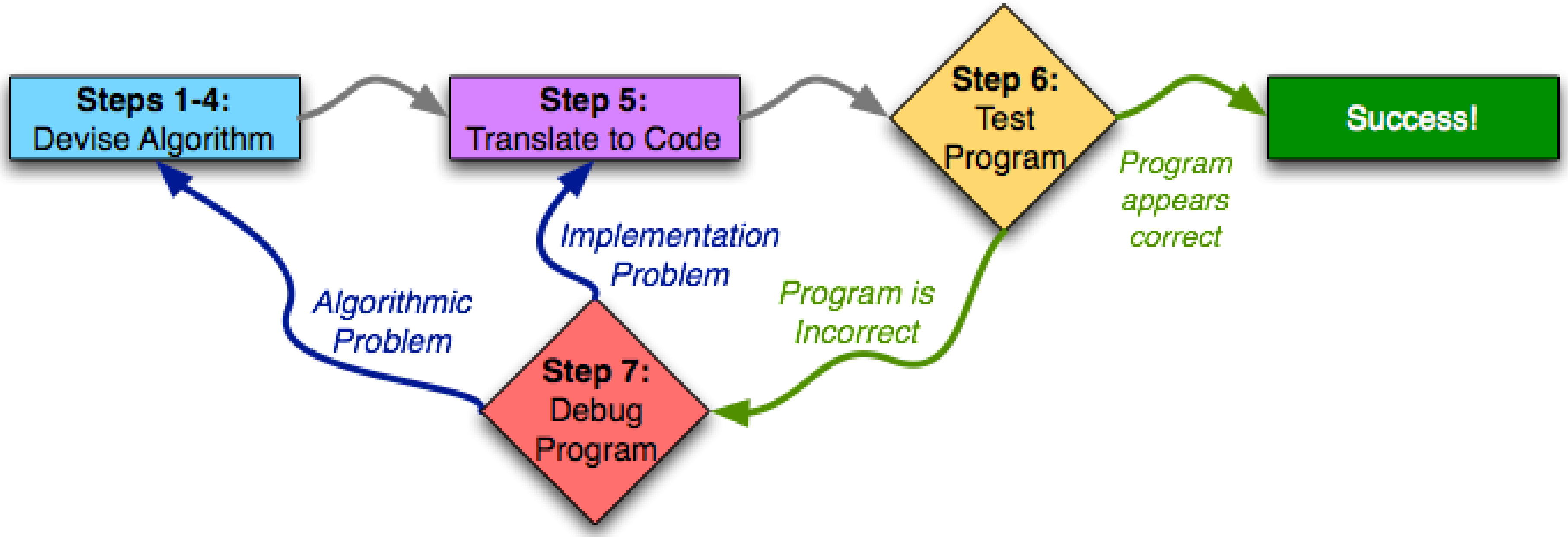
- **Next test our program**
  - Testing important, often under-taught skill

The Seven Steps
Programming Process: High-level



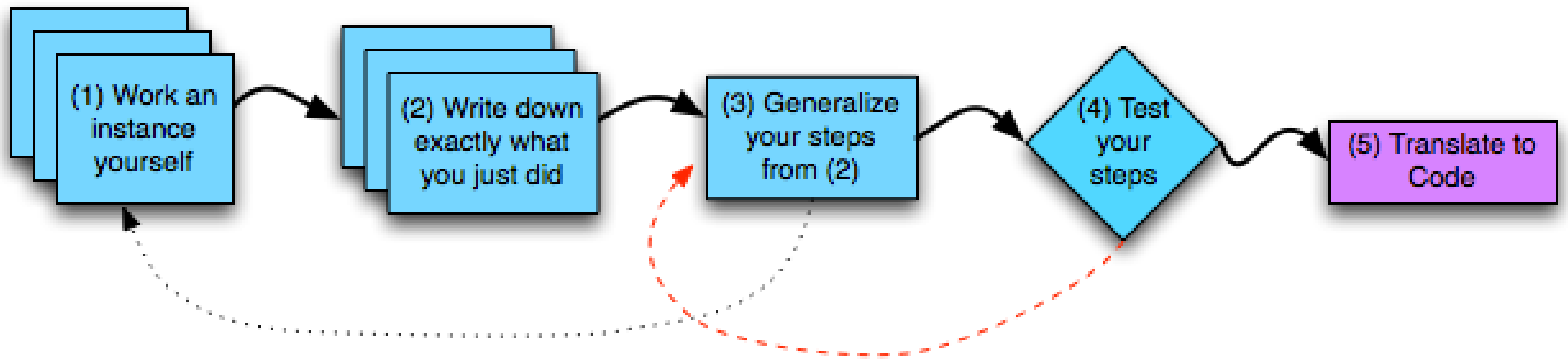
- **Ideally would be correct first time; may need to debug**
  - Identify problem (with science!)
  - Return to appropriate prior step to fix the problem

The Seven Steps
Programming Process: High-level



- **Work through cycle until program works**

Steps 1—4: Devise Algorithm


(1) Work an instance yourself
(2) Write down exactly what you just did
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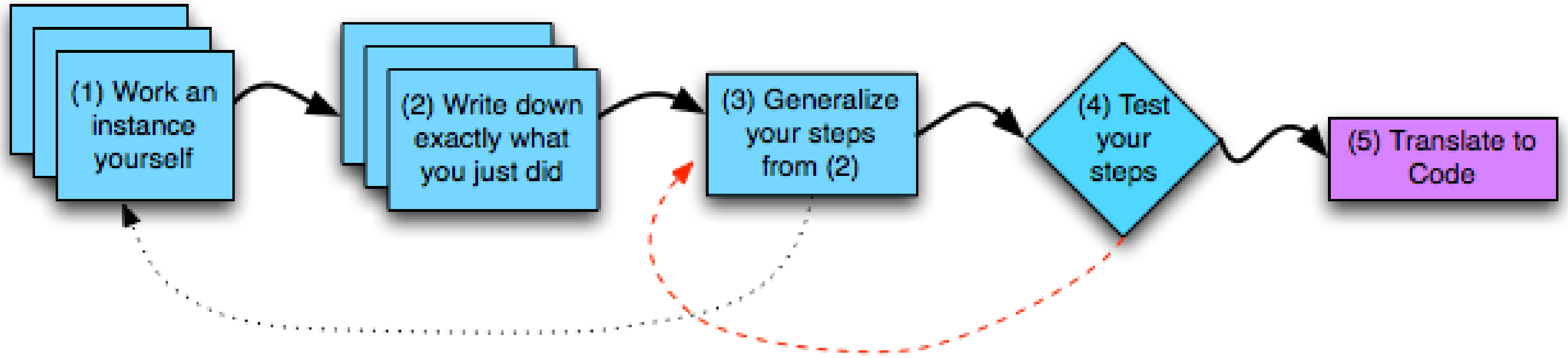
(4) Test your steps
(5) Translate to Code

- **Steps 1—4: devise the algorithm**
    - Learn to do this well, be an excellent programmer
    - Language: does not matter

Steps 1—4: Example: Calculate the average of two numbers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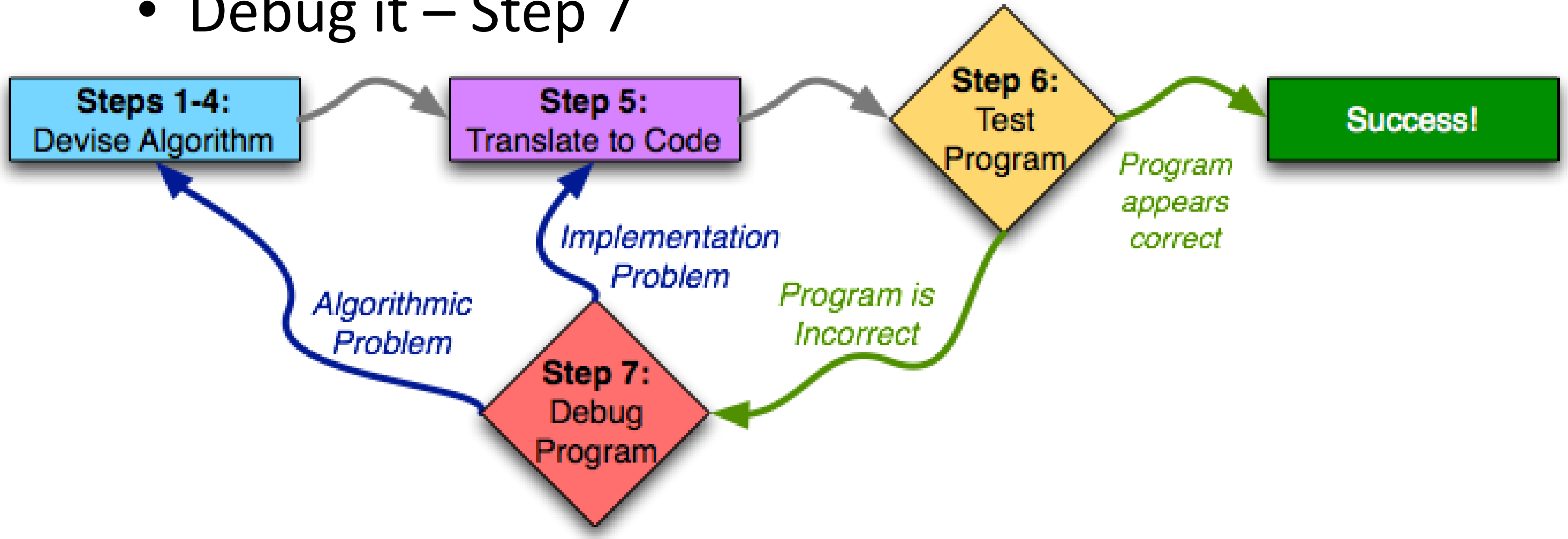
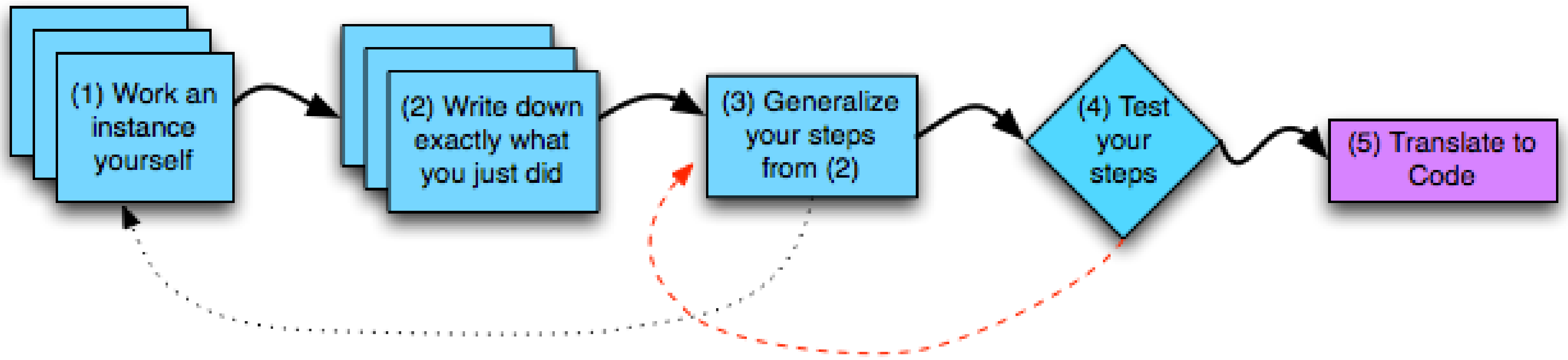
Step 5: let's convert it to code!

- **Go to Pycharm**
- **We will also:**
  - Test it – Step 6
  - Debug it – Step 7



Seven Steps

Steps 1-4



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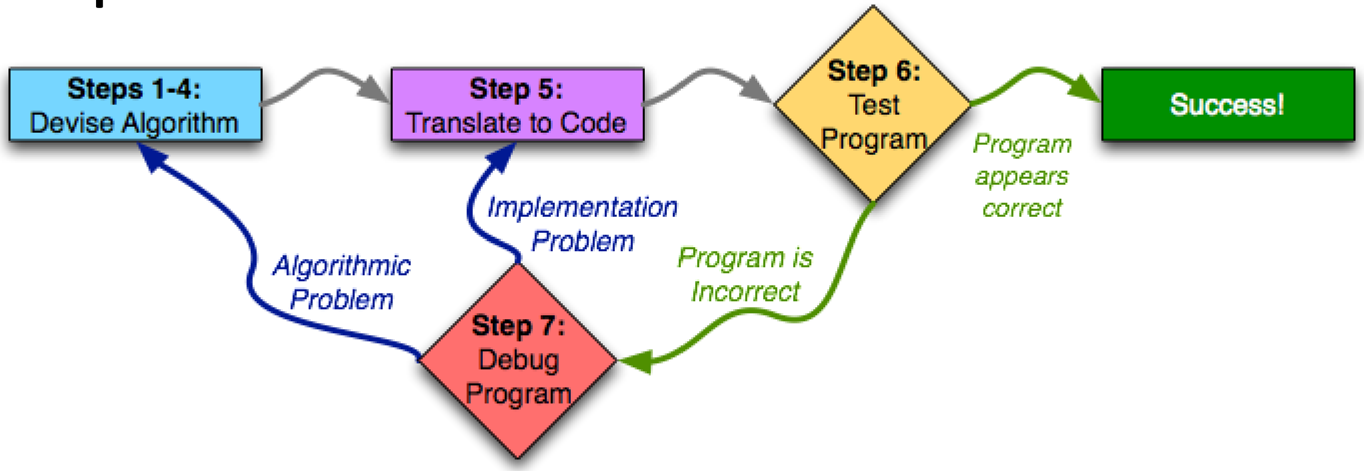
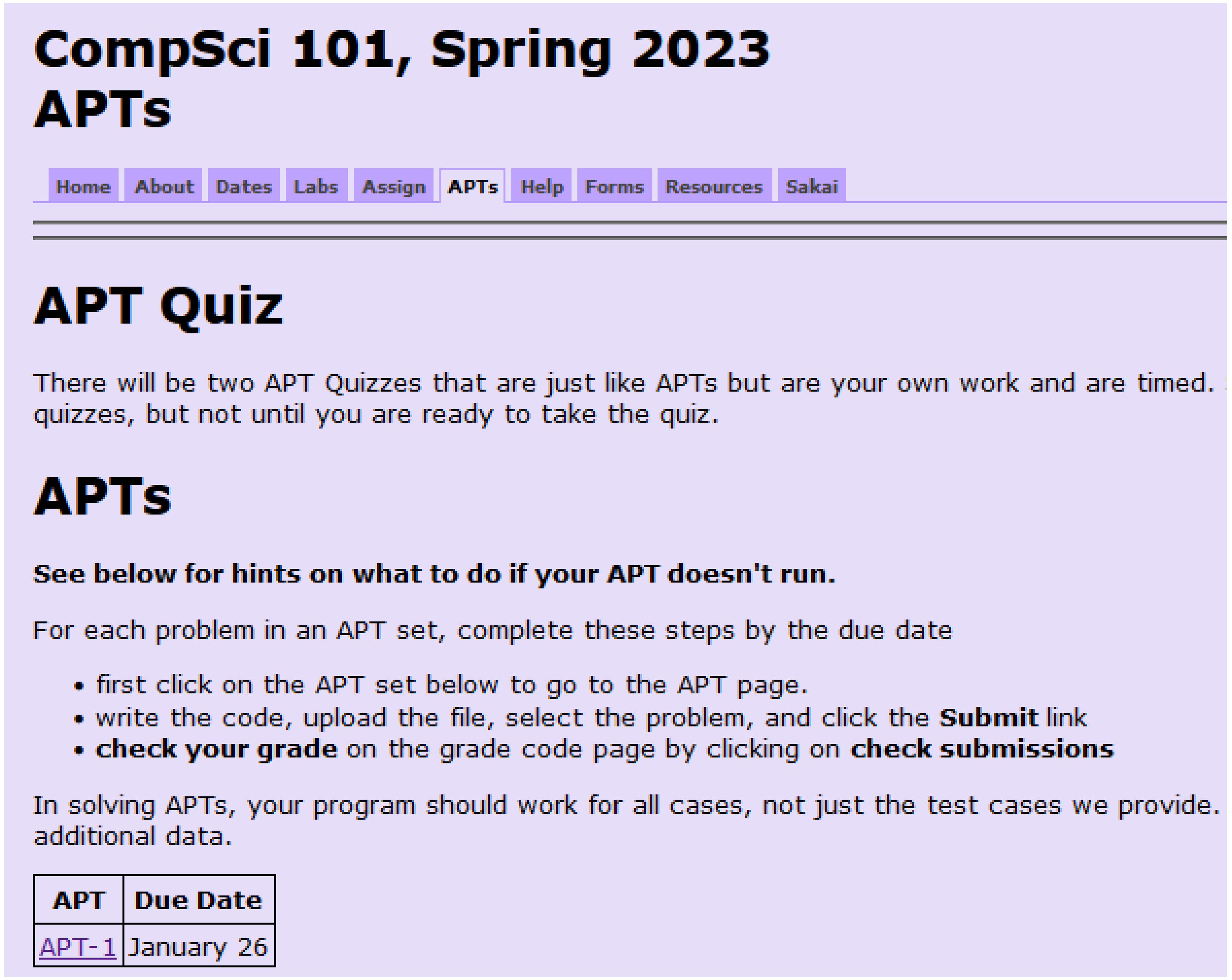
Steps 1-7



Solving Laundry APT

- **Navigate to APTs in class website and …**



CompSci 101, Spring 2023
APTs

APT Quiz

There will be two APT Quizzes that are just like APTs but are your own work and are timed.
quizzes, but not until you are ready to take the quiz.

APTs

See below for hints on what to do if your APT doesn't run.

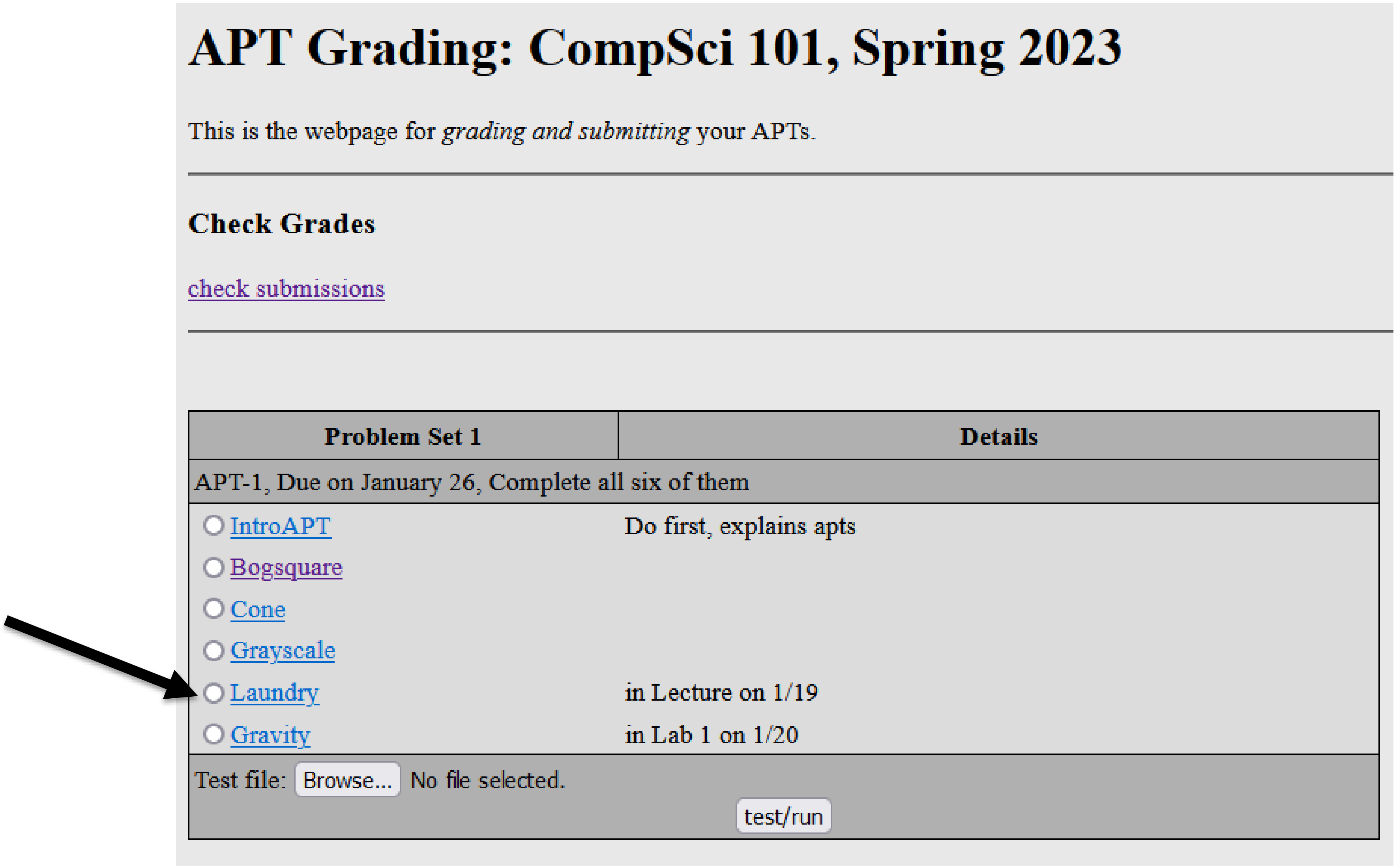
For each problem in an APT set, complete these steps by the due date

- first click on the APT set below to go to the APT page.
- write the code, upload the file, select the problem, and click the **Submit** link
- **check your grade** on the grade code page by clicking on **check submissions**

In solving APTs, your program should work for all cases, not just the test cases we provide.
additional data.

APT	Due Date
APT-1	January 26

Solving Laundry APT



APT Grading: CompSci 101, Spring 2023

This is the webpage for *grading and submitting* your APTs.

Check Grades

check submissions

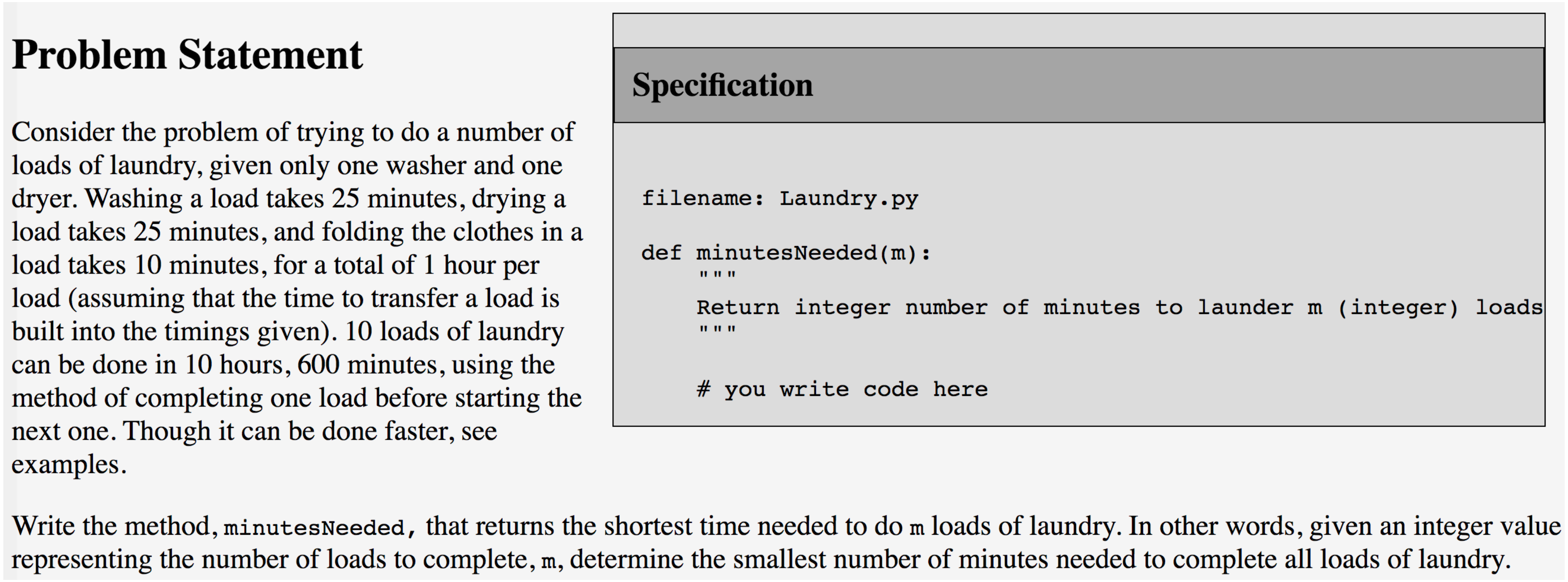
Problem Set 1	Details
APT-1, Due on January 26, Complete all six of them	
○ IntroAPT	Do first, explains apts
○ Bogsquare	
○ Cone	
○ Grayscale	
○ Laundry	in Lecture on 1/19
○ Gravity	in Lab 1 on 1/20

Test file: Browse... No file selected.

test/run

Solving Laundry APT

- **Navigate to APTs in class website and …**



Problem Statement

Consider the problem of trying to do a number of loads of laundry, given only one washer and one dryer. Washing a load takes 25 minutes, drying a load takes 25 minutes, and folding the clothes in a load takes 10 minutes, for a total of 1 hour per load (assuming that the time to transfer a load is built into the timings given). 10 loads of laundry can be done in 10 hours, 600 minutes, using the method of completing one load before starting the next one. Though it can be done faster, see examples.

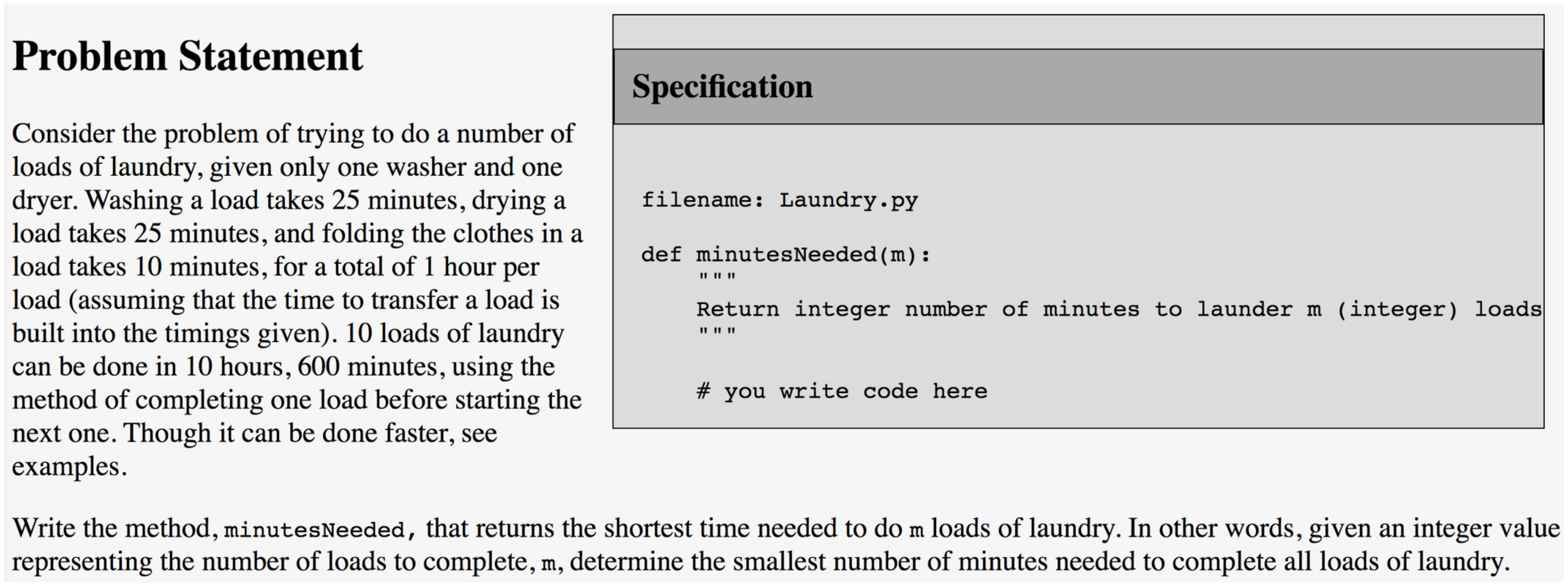
Specification

```
filename: Laundry.py

def minutesNeeded(m):
    """
    Return integer number of minutes to launder m (integer) loads
    """

    # you write code here
```

Write the method, `minutesNeeded`, that returns the shortest time needed to do `m` loads of laundry. In other words, given an integer value representing the number of loads to complete, `m`, determine the smallest number of minutes needed to complete all loads of laundry.

Solving Laundry APT – Step 1
WOTO: http://bit.ly/101s23-0119-2

- **What is important info?**



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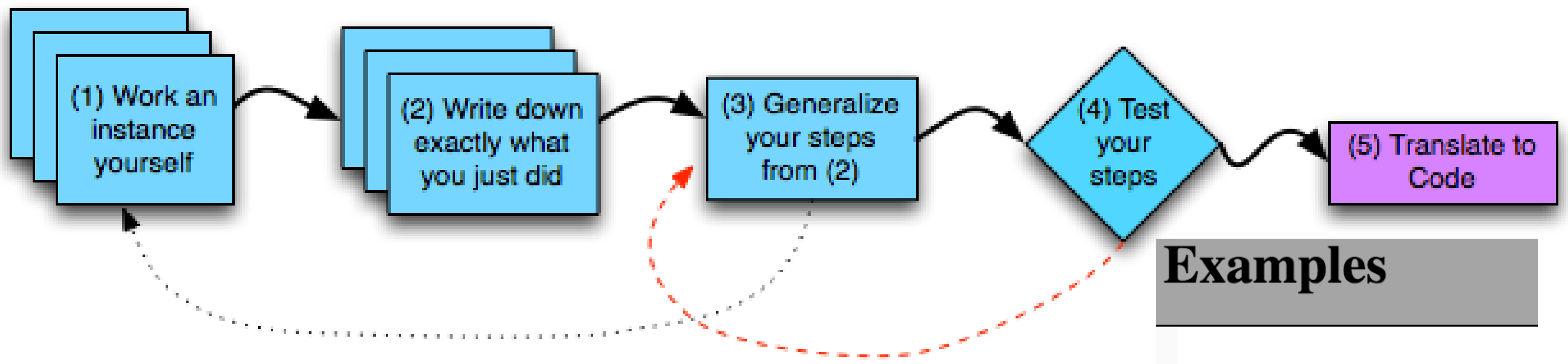
Reading an APT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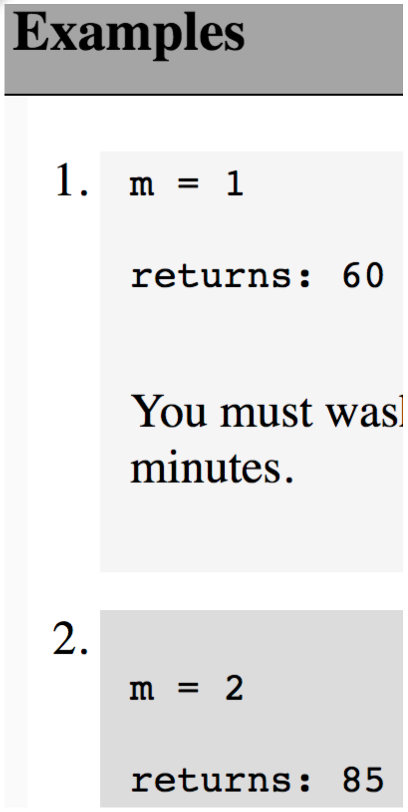
(4) Test your steps
(5) Translate to Code

- Step 1: Work an instance yourself
- Step 2: Write down exactly what you just did
- Step 3: Generalize your steps
- Step 4: Test your steps (with new input)

What should be a variable?



Examples

1. `m = 1`

   `returns: 60`

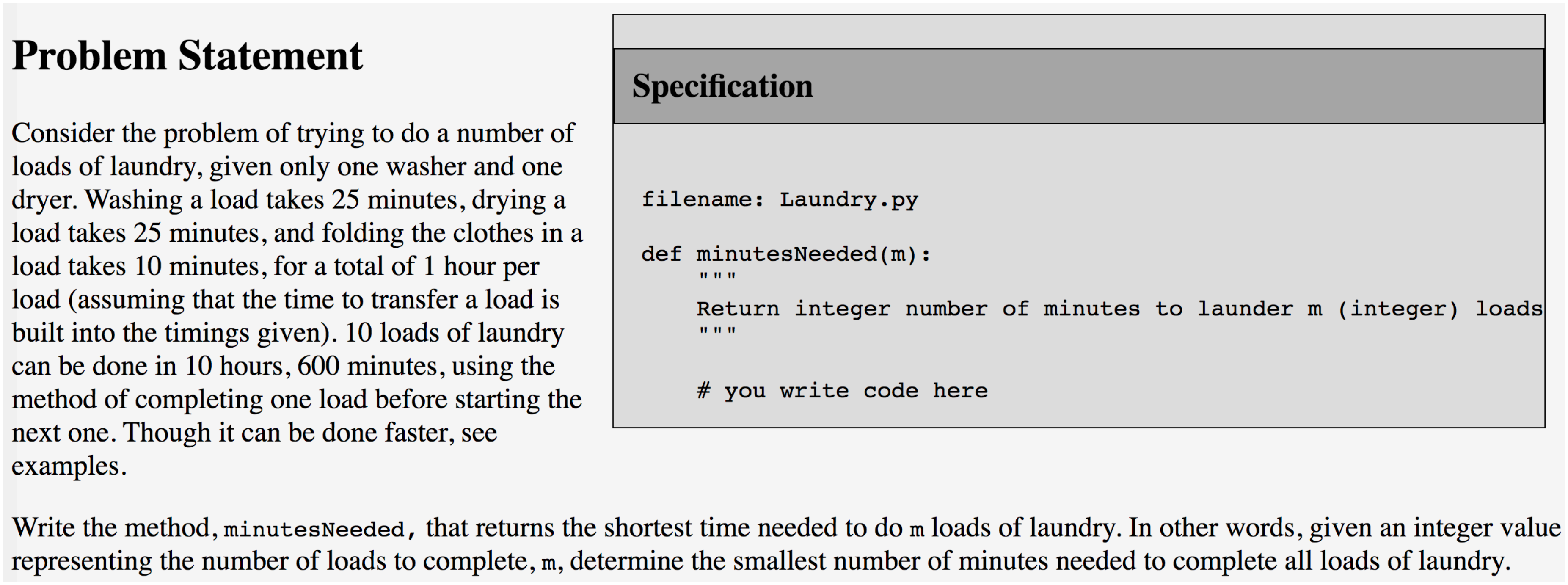
   You must was
   minutes.

2. `m = 2`

   `returns: 85`

Solving Laundry APT – Steps 3 and 4 WOTO: http://bit.ly/101s23-0119-3

- **What is important info?**



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Solving an APT

- **Create new project**
  - File > New Project
  - Existing interpreter (first project you made from installation)

- **Create new Python File**
  - Right click on project > New > Python File

- **Create function within module**
  - Name it properly!