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C  is for …

- **Computer Science and Computing**
  - It's what we do
- **Collaboration**
  - Review the policy
- **Cookies**
  - Good for the web and for …
- **CSV**
  - Comma Separated Values: Data

PFTD

- 7 steps of programming
- Functions
- APTs
In Python version 3 print is a function

• Functions have parentheses
  • Arguments are provided in parentheses
  • We can print(3+5) or print("hello") or ...
  • What is returned by print?

• When there is no return value...
  • None is returned, it has no representation
  • Its type is NoneType

• Note: in python version 2, print is NOT a function, looks different

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

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)

• 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

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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

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The Seven Steps
Programming Process: High-level

• Work through cycle until program works

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Steps 1—4: Devise Algorithm

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

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Steps 1—4: Example: Calculate the average of two numbers

- Step 1: $2 + 5 = 7$, $7/2 = 3.5$
- Step 2:
  - Add $2 + 5$ and get 7
  - Divide 7 by 2 and the result is 3.5

- Step 3:
  - Two variables num1 and num2
  - Add the two numbers together: result is num1 + num2
  - Divide the result by 2 and you have the answer: answer is result / 2

- Step 4: Try a different example
  - Use 8 and 6, num1 is 8, num2 is 6
  - Add the two numbers together: result is num1 + num2, is 14
  - Divide the result by 2 and you have the answer: Answer is result/2, which is 7

- IT WORKS!
Step 5: let’s convert it to code!

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

APT: Write a Python Function

- We def(ine) functions in Python
  - Use indentation to create body of the function
  - Calling function is different than writing function

```python
def inch2centi(inches):
    return 2.54*inches

length = inch2centi(72)
```

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

word = pluralize("fish")
```

Understanding Execution

- Using PythonTutor: [http://pythontutor.com](http://pythontutor.com)
  - How are functions defined?
  - Where does execution begin?
  - What is the global frame?
  - What is a local/function frame?