CompSci 101
Fall 2021

Lecture 9

Reminders

- Regrade Requests-9/28-9/30 via Gradescope

- Assignments
  - APT 2 due today
  - APT 3 live today

Key instructions

- Input ←
- Output ←
- Assignments* ✔
- Math/Logic ✔
- Conditionals ✔
- Repetition ←

**not listed in book*

Python Data Types

- int, float, bool ✔
- Collections
  - Strings ✔
  - Lists ✔
  - Tuples
  - Sets
  - Dictionaries

PFTD

- Loops
  - Turtles
- Accumulator
  - Bagels
- Files

“The mere imparting of information is not education.”

- Dr. Carter G. Woodson

KISS Principle

- Think of the non-computing context for any word/terms
- KISS model
  - Work smarter, not harder!!
- “Good programmers are simply good designers.”
  - *-Dr. Washington*
- Design first and always!
- Importance of reusability
- *USE PYTHONTUTOR IF YOU HAVE QUESTIONS!*

People to Know: Prof. Victoria Chávez

- BA-Computer Science & Hispanic Literatures and Culture (Brown)
- MA-Urban Education Policy (Brown)
- SNAPy creator
  - SMS-based app, where food stamps accepted
- Lecturer
  - University of Rhode Island (CS)
- Consultant
  - CS for Rhode Island (CS4RI)

Turtle Programming

- **Must:**
  - Import turtle module
  - Create window/Screen and exit on click
  - Create turtles to use, name/type/value
- **Review Turtle commands and concepts**
  - http://bit.ly/turtle_tutorial for more, and book

- **See Snowpeople.py, ColorMyWorld.py, and Spiro.py for some ideas (zip file linked in course calendar)**
  - Color, Position, Leaving Turtle where started
  - Many more commands than this

What are key concepts in Spiro.py?

```
8   import turtle
9
10  def draw(turt):
11      colors = ['red', 'purple', 'blue', 'green', 'yellow', 'orange']
12      turt.speed(0)
13      for x in range(360):
14          turt.pencolor(colors[x % 6])
15          turt.width(x/100 + 1)
16          turt.forward(x)
17          turt.left(59)
18
19  if __name__ == '__main__':
20      win = turtle.Screen()
21      t = turtle.Turtle()
22      draw(t)
23      win.exitonclick()
```

Import turtle

1 – slowest
10 – fastest
0 – No animation

Create screen/window

Create turtle

Close on click

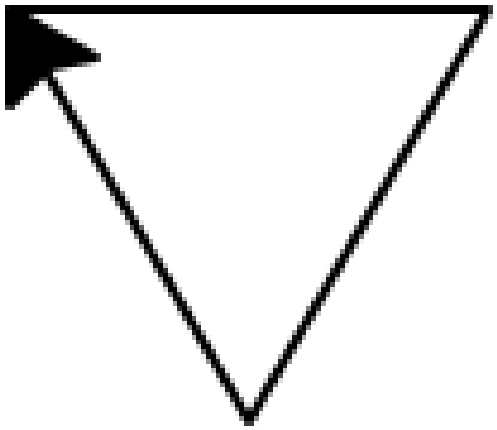
Question

After the code executes, where is the turtle with respect to where it started?

```
if __name__ == '__main__':
    win = turtle.Screen()
    t = turtle.Turtle()
    t.forward(100)
    t.backward(50)
    t.forward(-50)
    win.exitonclick()
```

Activity 1: https://bit.ly/101f21-09-28-1

- Equilateral triangle
  - Corner degrees: 60
  - Side length: 50
- Demo: PyCharm



Useful turtle functions

- **`forward(n)/backward(n)`** – move turtle n pixels
- **`left(n)/right(n)`** – turn turtle n degrees
- **`pendown()/pendup()`** – whether actually drawing
- **`setposition(x, y)`** – puts turtle in this (x,y) coordinate (a.k.a. **`goto`**, **`setpos`**)
- **`sethead(n)`** – points turtle in this direction (n=0 is east)
- Many more in documentation!
  - https://docs.python.org/3/library/turtle.html

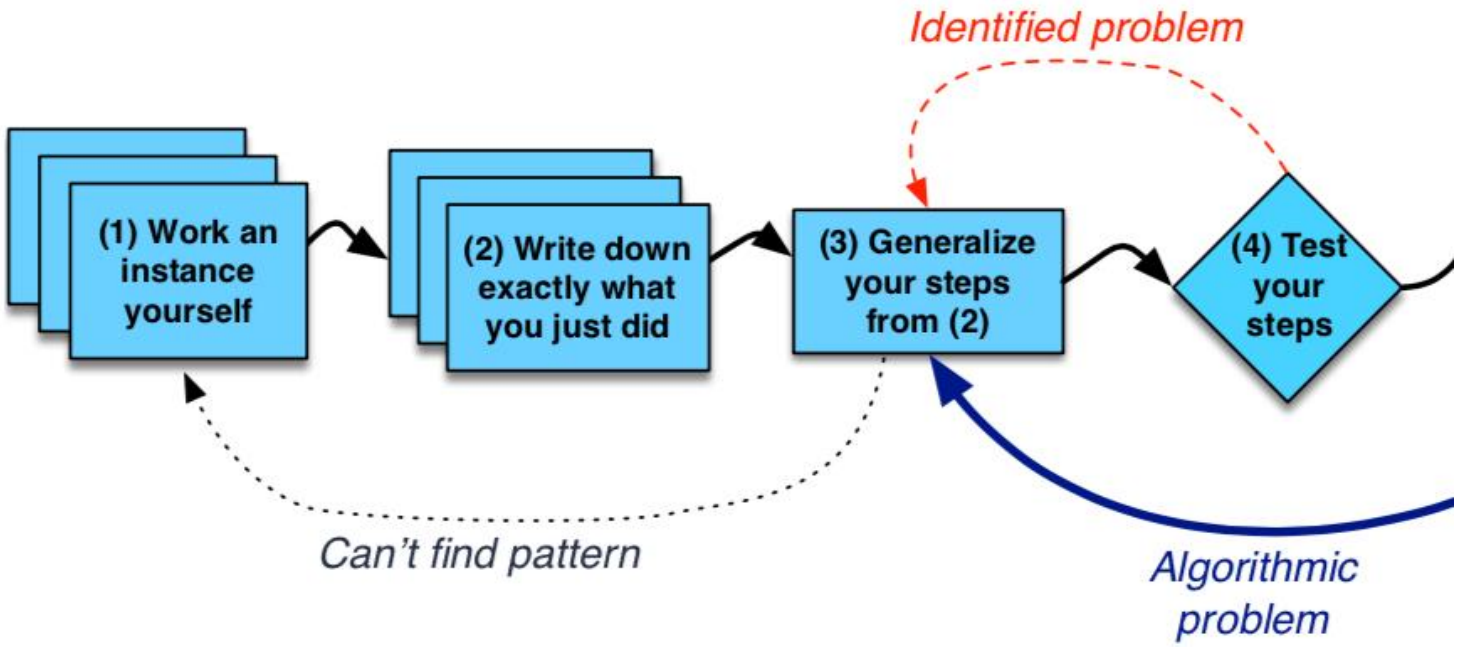
Turtle Concepts

- Create a screen so you can ..
  - Exit On Click
  - Some other Screen Functions
- Create a turtle so you can …
  - Move and draw using the turtle
- Drawing Concepts
  - Pen [up and down]
  - Fill
  - Color
  - Position

Bagels (Accumulation)

APT Bagels

- How figure out how many bagels needed?
  - 7-steps!



Step 1 and 2

- Step 1: Solve an instance (TPS)
  - orders = [11, 3, 24, 17]

Step 1 and 2

- Step 1: Solve an instance (TPS)
  - orders = [11, 3, 24, 17]
  - Total: 58

- Step 2: What did we do?
  - 11 + 3 + (24+2) + (17+1) = 58

Step 3: Generalize

- Go through list
- If less than 12
  - Do nothing
- If greater than or equal to 12
  - Add however many times 12 goes into the order
- Sum everything

Step 4: Test steps

- Go through list
- If less than 12
  - Do nothing
- If greater than or equal to 12
  - Add however many times 12 goes into the order
- Sum everything

- [11, 22, 33, 44, 55]
- 11
  - Nothing (less than 12)
- 22
  - +1
- 33
  - +2
- 44
  - +3
- 55
  - +4
- Sum: 175

Step 5: Code

- Go through list
- If less than 12
  - Do nothing
- If greater than or equal to 12
  - Add however many times 12 goes into the order
- Sum everything

- for loop!
- if statement
- if's or if…else statement?
  - floor div: //

Could we use the accumulator pattern?

Yes!

Step 5: Code

```
def bagelCount(orders):
    """
    return number of bagels needed to fulfill
    the orders in integer list parameter orders
    """
    total = 0
    for order in orders:
        if order < 12:
            total += order
        else:
            extra = order // 12
            total += order + extra

    return total
```

Initialize before loop

Update inside loop

Do something with value after loop

Code-Tracing a Loop

1. Find the changing variables/expressions
2. Create table, columns are variables/expressions
    1. First column is loop variable
    2. Add columns to help track everything else
3. Each row is an iteration of the loop
    1. *Before* execute code block, copy down each variable's value
    2. Execute code block, update a value in the row as it changes

Code-Tracing a Loop

1. Find the changing variables/expressions
2. Create table, columns are variables/expressions
    1. First column is loop variable
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```
def mystery(lst):
    idxMax = 0
    for i in range(len(lst)):
        if lst[idxMax] < lst[i]:
            idxMax = i

    return idxMax
```

TPS: What should be the table's columns?

Code-Tracing a Loop

1. Find the changing variables
2. Create table, columns are the variables
    1. First column is loop variable
    2. Add columns to help track everything else

```
def mystery(lst):
    idxMax = 0
    for i in range(len(lst)):
        if lst[idxMax] < lst[i]:
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    return idxMax
```

Other variable

Loop variable

Useful expression to track

TPS: Fill in table

1. Before execute code block, copy down each variable's value
2. Execute code block, update a value in the row as it changes

```
def mystery(lst):
    idxMax = 0
    for i in range(len(lst)):
        if lst[idxMax] < lst[i]:
            idxMax = i

    return idxMax

mystery([2, 12, 4, 15, 15])
```

i	idxMax	lst[idxMax]	lst[i]	lst[idxMax] < lst[i]

TPS: Fill in table

1. Before execute code block, copy down each variable's value
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def mystery(lst):
    idxMax = 0
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    return idxMax

mystery([2, 12, 4, 15, 15])
```

#1

i	idxMax	lst[idxMax]	lst[i]	lst[idxMax] < lst[i]
0	0	2	2	False
1	0			

TPS: Fill in table

1. Before execute code block, copy down each variable's value
2. Execute code block, update a value in the row as it changes

```
def mystery(lst):
    idxMax = 0
    for i in range(len(lst)):
        if lst[idxMax] < lst[i]:
            idxMax = i

    return idxMax

mystery([2, 12, 4, 15, 15])
```

#2

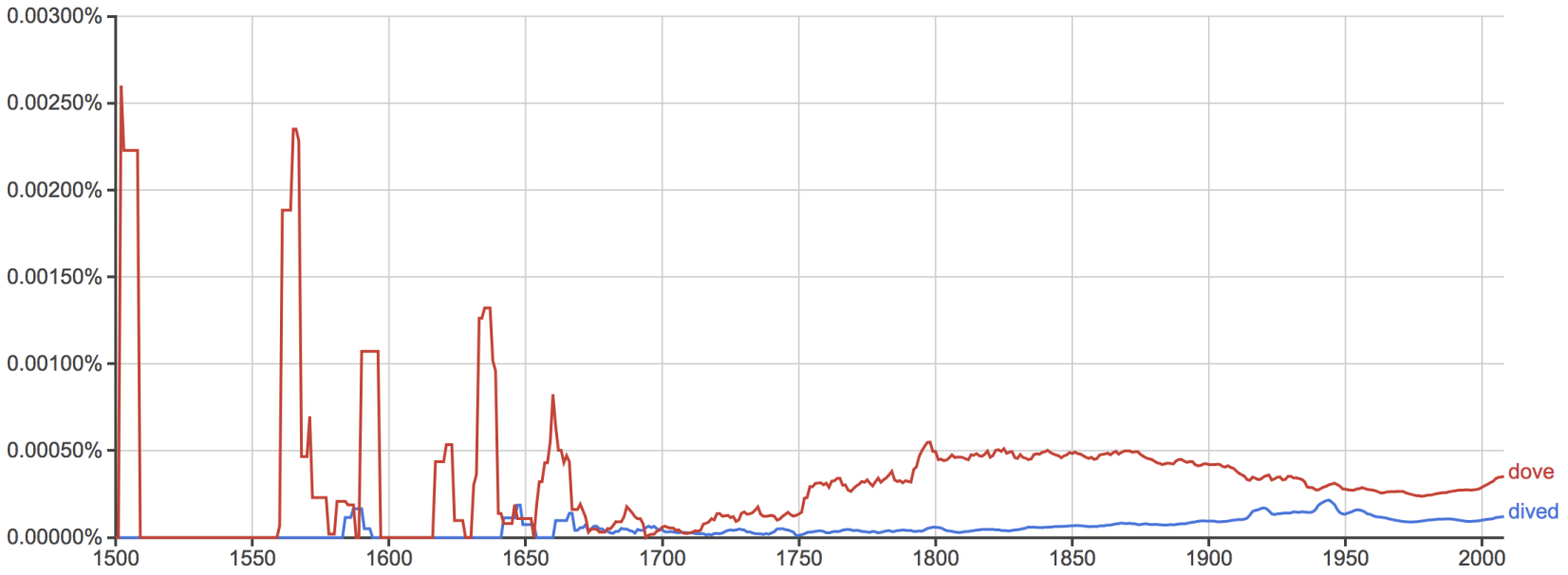
i	idxMax	lst[idxMax]	lst[i]	lst[idxMax] < lst[i]
0	0	2	2	False
1	~~0~~ 1	2	12	True

Examples of Processing Data

- Google Ngram viewer
  - https://books.google.com/ngrams

Studying Language Evolution

- Ngram informs how words evolve
- From dove to dived
- https://www.youtube.com/watch?v=tFW7orQsBuo



Sequences, Repetition

- Parameters? What are they to this query?
  - https://books.google.com/ngrams/graph?content=terrorism%2Cpatriot&year_start=1800&year_end=2000&corpus=15&smoothing=3

What can the URL tell you?

Sequences, Repetition

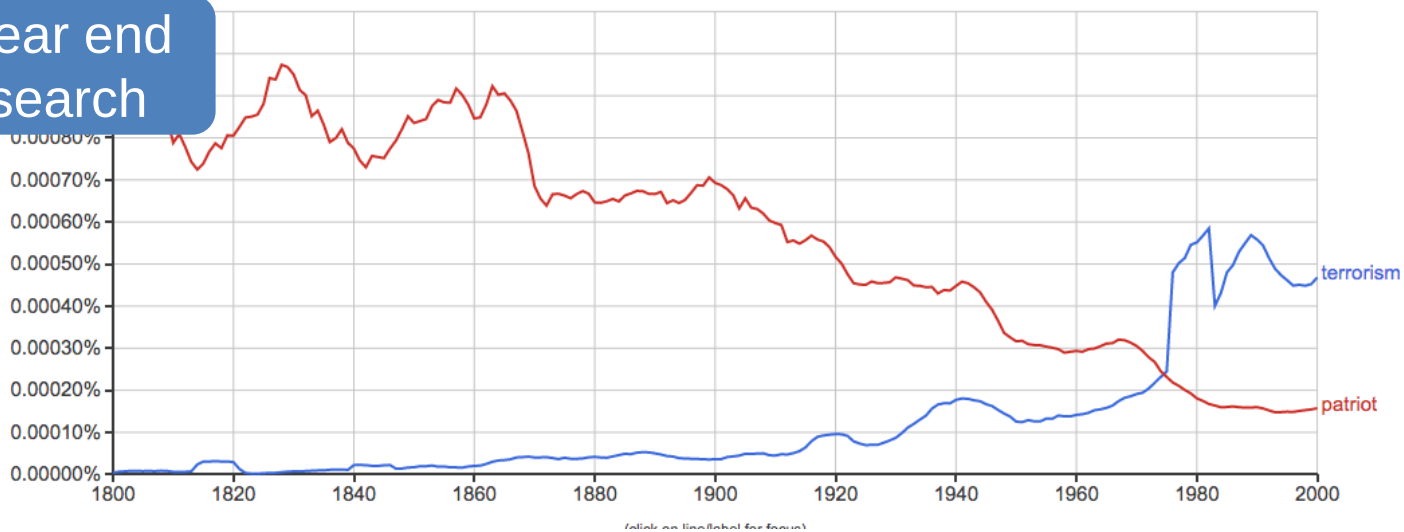
- Parameters? What are they to this query?

Search words

https://books.google.com/ngrams/graph?content=terrorism%2Cpatriot&year_start=1800&year_end=2000&corpus=15&smoothing=3

Year start search

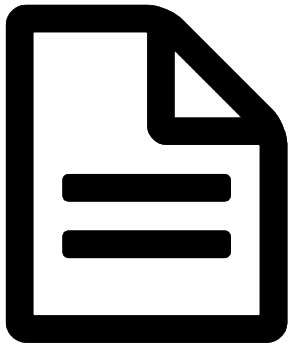
Year end search



Processing Data

- How do we find the longest word in .. Any text?
- How do we find the word that occurs the most?
- How is this related to how Google Search works?

- Text files can be viewed as sequences
  - Sequences of lines
  - Each line is a string
  - Some clean-up because of '\n'

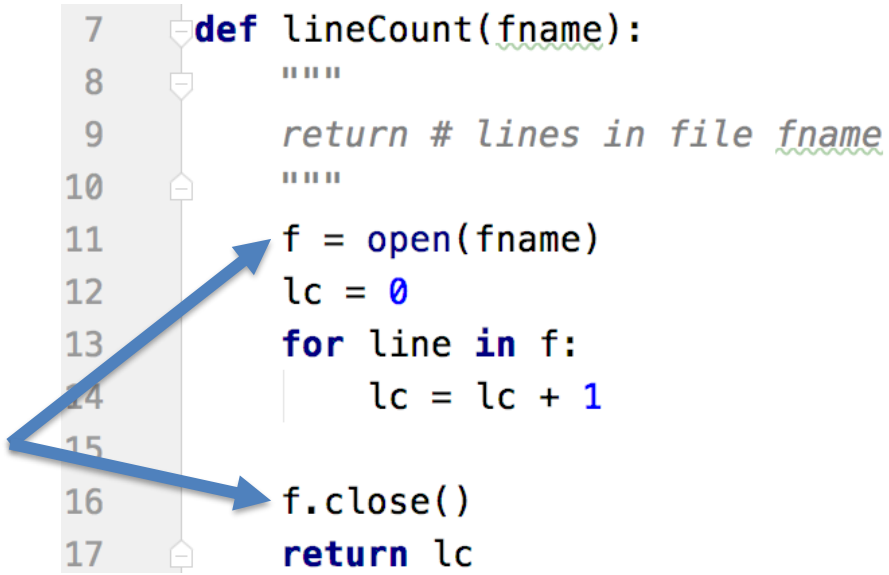


One line at a time

- Simplest and reasonably efficient Python pattern
  - Open, loop, close, return/process
  - LineCounter.py in code zip file

- File as sequence
  - One line at-a-time

- Asymmetry in Open vs Close steps



```
7   def lineCount(fname):
8       """
9       return # lines in file fname
10      """
11      f = open(fname)
12      lc = 0
13      for line in f:
14          lc = lc + 1
15
16      f.close()
17      return lc
```

File Objects

- A file is an object, like a string
  - Functions applied to object: **`len("word")`**
  - To get file object use **`open("data.txt")`**
  - What is returned? Integer value, file object

- Often methods (aka function) applied to object
  - **`f.readlines(), f.read(), f.close()`**
  - Just like: **`st.lower(), st.count("e")`**

Text File Processing Pattern

- See module **`FileStuff.py`** in code zip file
  - If newline **`'\n'`** is read, call **`.strip()`**
  - If want to break line into "words", call **`.split()`**

- Process the list returned by **`.split()`**
  - May need to convert strings to int or float or …

- The **`for line in f:`** pattern is efficient
  - Contrast list returned by **`f.readlines()`**

Lists of Data

- String lists: **`["ant","fox","cat","dog"]`**
- Lists of int/float numbers: **`[5, 3.14159, -15]`**
- What about lists of lists? Variable **`plist =`**

`[["Washington",1789,57],["Clinton",1993,46]]`

- What is **`plist[0]?`**
- What is **`plist[0][2]?`**
- Can always use a variable:
  - **`val = plist[0]`**, then **`val[2]`**

Reminders

- Work smarter, not harder
- Design first
- Try to identify where you are stuck
  - Identify resources to help solve problem
- Leverage your design and PythonTutor to understand program flow of control
  - http://pythontutor.com