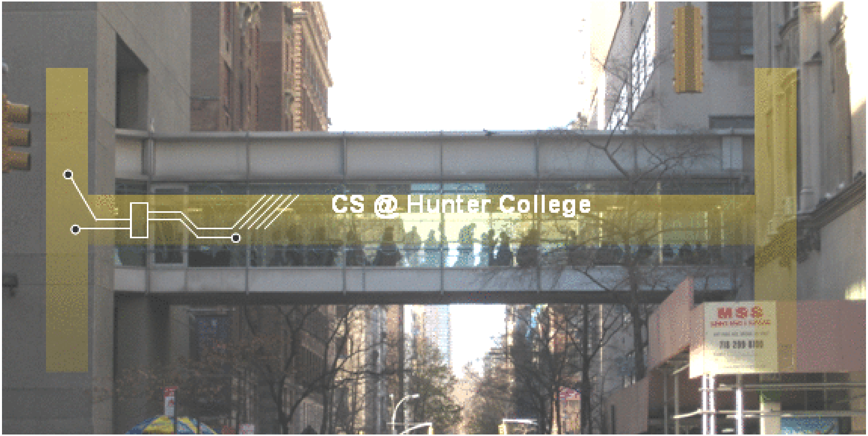
CSci 127: Introduction to Computer Science



hunter.cuny.edu/csci

Announcements

- Each lecture includes a survey of computing research and tech in NYC.

  Today: Prof. Susan Epstein
  Machine Learning

Today's Topics

- Recap: Functions & Top Down Design
- Mapping GIS Data
- Loops
- CS Survey

In Pairs or Triples:

```
def prob4(amy, beth):
    if amy > 4:
        print("Easy case")
        kate = -1
    else:
        print("Complex case")
        kate = helper(amy,beth)
    return(kate)
```

```
def helper(meg,jo):
    s = ""
    for j in range(meg):
        print(j, ": ", jo[j])
        if j % 2 == 0:
            s = s + jo[j]
            print("Building s:", s)
    return(s)
```

- What are the formal parameters for the functions?
- What is the output of:

```
r = prob4(4,"city")
print("Return:  ", r)
```

- What is the output of:

```
r = prob4(2,"university")
print("Return:  ", r)
```

Python Tutor

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        kate = helper(amy,beth)
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            s = s + jo[j]
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    return(s)
```

(Demo with `pythonTutor`)

In Pairs or Triples:

- Write the missing functions for the program:

```
def main():
    tess = setUp()     #Returns a purple turtle with pen up.
    for i in range(5):
        x,y = getInput()       #Asks user for two numbers.
        markLocation(tess,x,y) #Move tess to (x,y) and stamp.
```

Group Work: Fill in Missing Pieces

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def main():
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Group Work: Fill in Missing Pieces

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import turtle
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Third Part: Fill in Missing Pieces

1. Write import statements.
2. Write down new function names and inputs.

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import turtle
def setUp():
    #FILL IN
def getInput():
    #FILL IN
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    #FILL IN




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Third Part: Fill in Missing Pieces

1. Write import statements.
2. Write down new function names and inputs.
3. Fill in return values.

```
import turtle
def setUp():
    #FILL IN
    return(newTurtle)
def getInput():
    #FILL IN
    return(x,y)
def markLocation(t,x,y):
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def main():
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Third Part: Fill in Missing Pieces

1. Write import statements.
2. Write down new function names and inputs.
3. Fill in return values.
4. Fill in body of functions.

```
import turtle
def setUp():
    newTurtle = turtle.Turtle()
    newTurtle.penup()
    return(newTurtle)
def getInput():
    x = int(input('Enter x: '))
    y = int(input('Enter y: '))
    return(x,y)
def markLocation(t,x,y):
    t.goto(x,y)
    t.stamp()
def main():
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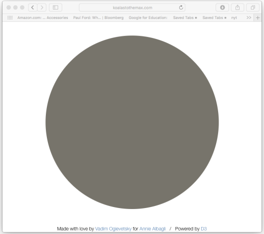
  - Translate list into function names & inputs/returns.
  - Implement the functions, one-by-one.
- Excellent approach since you can then test each part separately before adding it to a large program.
- Very common when working with a team: each has their own functions to implement and maintain.

From Last Time: koalas



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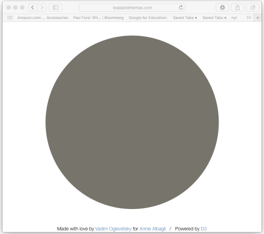

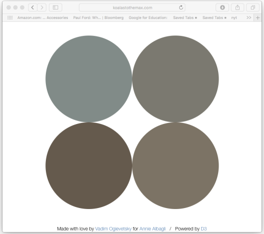

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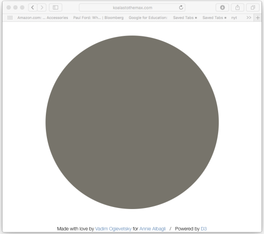

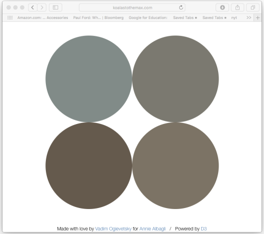

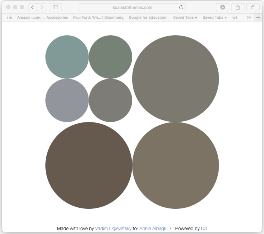

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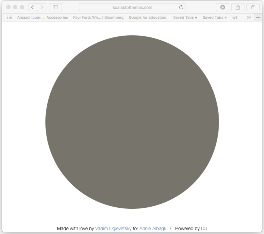

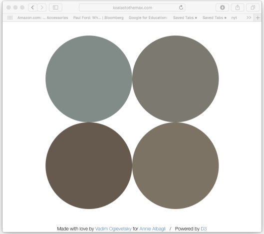

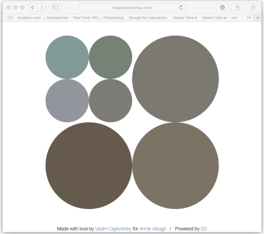

`http://koalastothemax.com`

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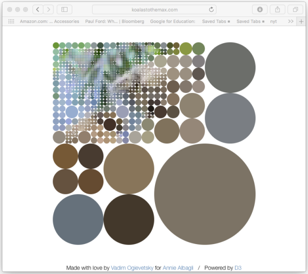

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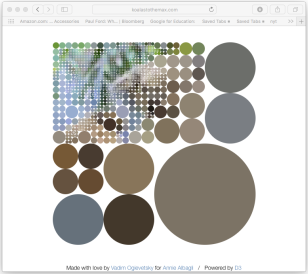

- Top-down design puzzle:
  - What does `koalastomax` do?
  - What does each circle represent?
- Write a high-level design for it.
- Translate into a `main()` with function calls.

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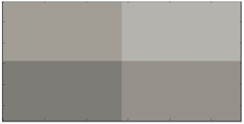

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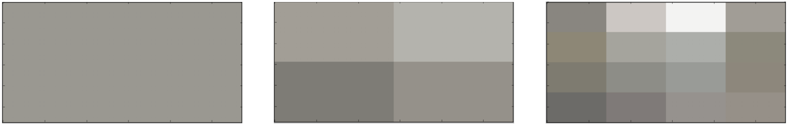

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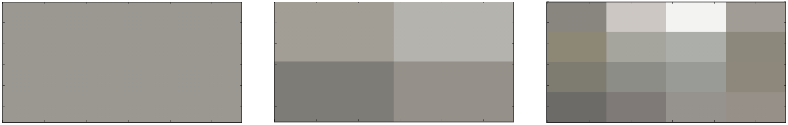

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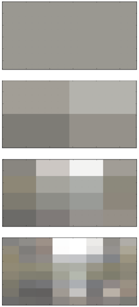

```python
def main():
    inFile = input('Enter image file name: ')
    img = plt.imread(inFile)

    #Divides the image in 1/2, 1/4, 1/8, ... 1/2^8, and displays each:
    for i in range(8):
        img2 = img.copy()    #Make a copy to average
        quarter(img2,i)      #Split in half i times, and average regions

        plt.imshow(img2)     #Load our new image into pyplot
        plt.show()           #Show the image (waits until closed to continue)

    #Shows the original image:
    plt.imshow(img)          #Load image into pyplot
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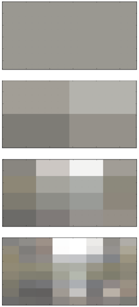

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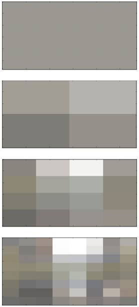

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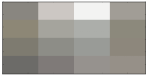
- The `main()` is written for you.
- Only fill in two functions: `average()` and `setRegion()`.

From Last Time: koalas

Process:



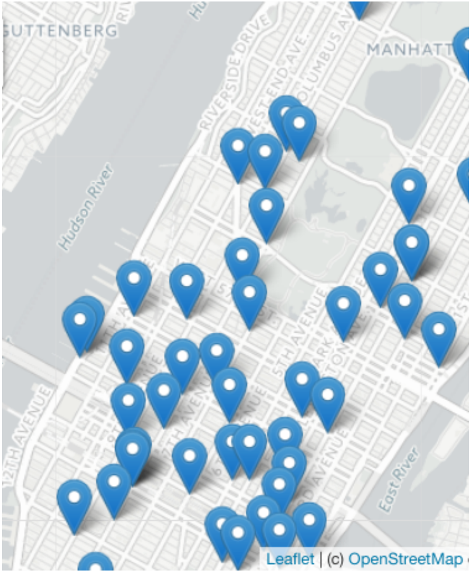


Get template from `github`	→	Fill in missing functions	→	Test locally idle3/python3	→	Submit to Gradescope

Today's Topics

- Recap: Functions & Top Down Design
- **Mapping GIS Data**
- Loops
- CS Survey

Folium


GUTTENBERG
MANHATT
RIVERSIDE DRIVE
COLUMBUS AV
Hudson River
East River
Leaflet | (c) OpenStreetMap

Folium

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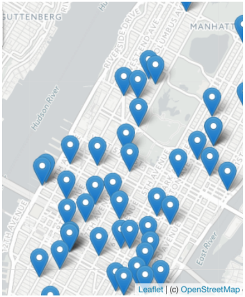
- An extra step:

Write code.	$\rightarrow$	*Run program.*	$\rightarrow$	*Open .html in browser.*

Demo



(Map created by Folium.)

Folium

- To use:

  ```
  import folium
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  `import folium`

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- Make markers:

  `newMark = folium.Marker([lat,lon],popup=name)`

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- Add to the map:

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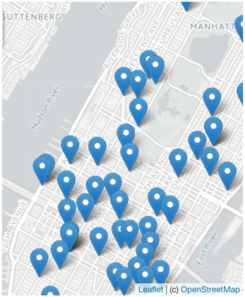
- Many options to customize background map ("tiles") and markers.

Demo



(Python program using Folium.)

In Pairs of Triples

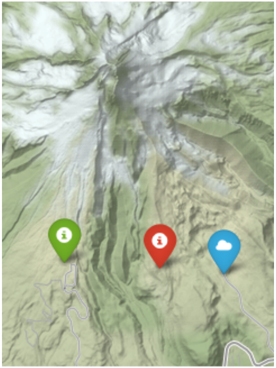
- Predict which each line of code does:

```
m = folium.Map(
    location=[45.372, -121.6972],
    zoom_start=12,
    tiles='Stamen Terrain'
)

folium.Marker(
    location=[45.3288, -121.6625],
    popup='Mt. Hood Meadows',
    icon=folium.Icon(icon='cloud')
).add_to(m)

folium.Marker(
    location=[45.3311, -121.7113],
    popup='Timberline Lodge',
    icon=folium.Icon(color='green')
).add_to(m)

folium.Marker(
    location=[45.3300, -121.6823],
    popup='Some Other Location',
    icon=folium.Icon(color='red', icon='info-sign')
).add_to(m)
```



(example from Folium documentation)

Python Tutor

```python
dist = int(input('Enter distance: '))
while dist < 0:
    print('Distances cannot be negative.')
    dist = int(input('Enter distance: '))

print('The distance entered is', dist)
```

```python
#Spring 2012 Final Exam, #8

nums = [1,4,0,6,5,2,9,8,12]
print(nums)
i=0
while i < len(nums)-1:
    if nums[i] < nums[i+1]:
        nums[i], nums[i+1] = nums[i+1], nums[i]
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(Demo with `pythonTutor`)

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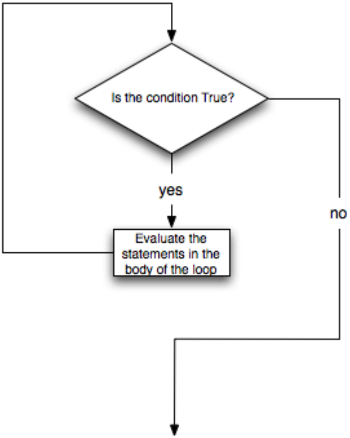

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- Indefinite loops repeat as long as the condition is true.
- Could execute the body of the loop zero times, 10 times, infinite number of times.
- The condition determines how many times.
- Very useful for checking input, simulations, and games.

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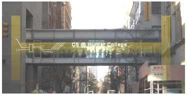
CS Survey Talk

Prof. Susan Epstein
(Machine Learning)

Recap

- On lecture slip, write down a topic you wish we had spent more time (and why).



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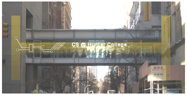

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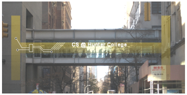

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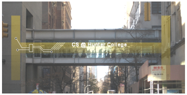
Recap



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- Top-down design: breaking into subproblems, and implementing each part separately.
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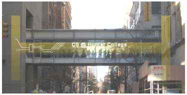

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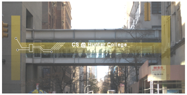

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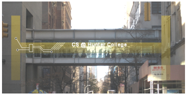

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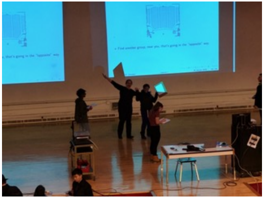
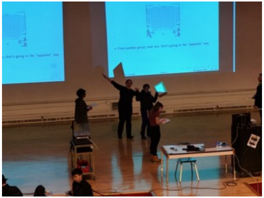
- Pass your lecture slips to the aisles for the UTAs to collect.

Practice Quiz & Final Questions



- Lightning rounds:

Practice Quiz & Final Questions



- Lightning rounds:
  - write as much you can for 60 seconds;

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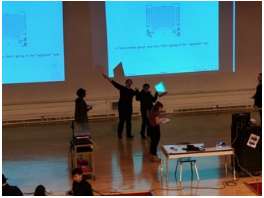

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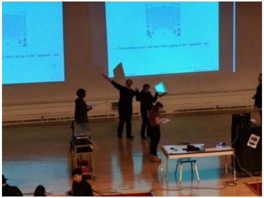

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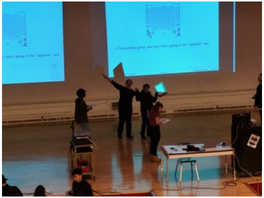

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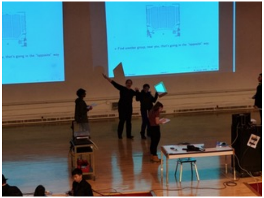

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- Theme: Functions & Top-Down Design (Summer 18, #7 & #5).