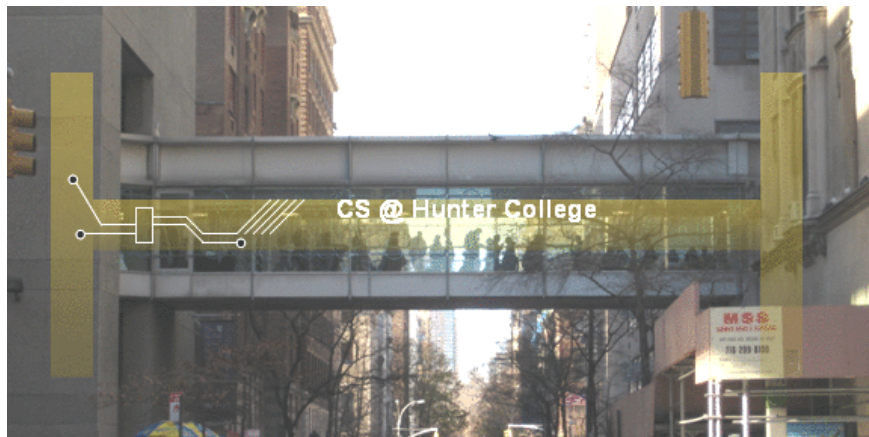


CSci 127: Introduction to Computer Science



hunter.cuny.edu/csci

- This lecture will be recorded

Frequently Asked Questions

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The CSci 127 Week!!! ... on the course webpage.

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- ▶ *More practice opportunities will be provided closer to the exam.*

Today's Topics



- Recap: Functions & Top Down Design
- Mapping GIS Data
- Random Numbers
- Indefinite Loops

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Challenge:

```
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)
```

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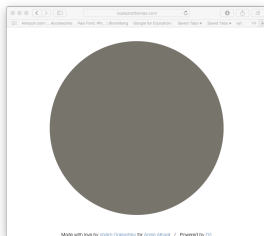
Python Tutor

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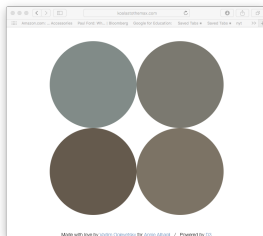
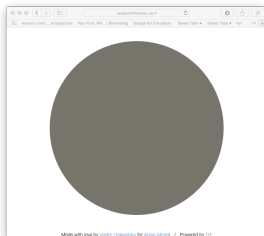
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(Demo with pythonTutor)

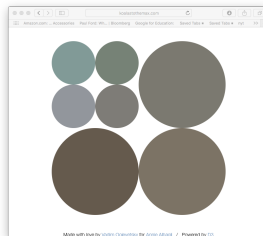
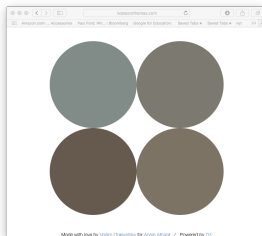
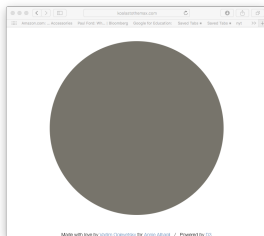
From Last Time: koalas



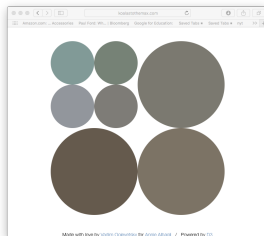
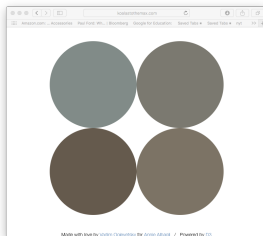
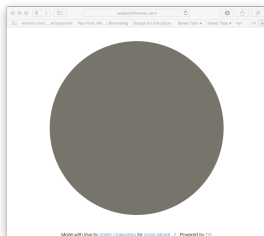
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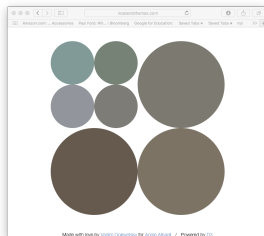
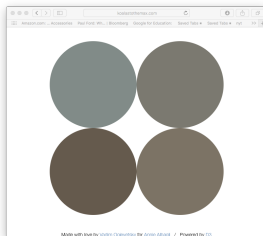
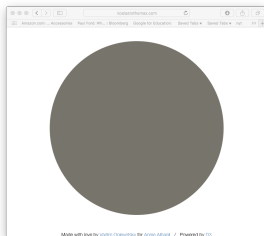


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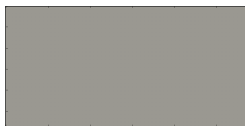


<http://koalastothemax.com>

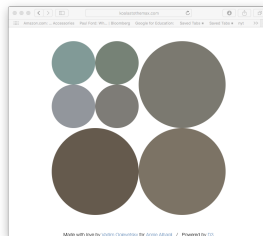
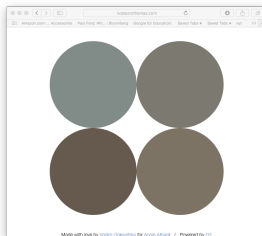
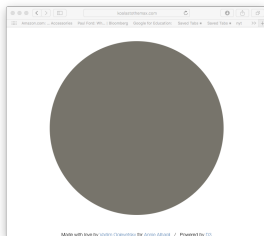
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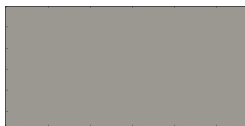
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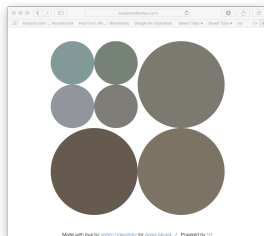
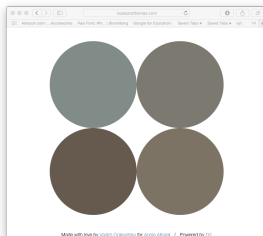
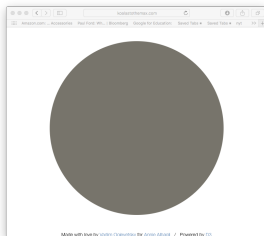
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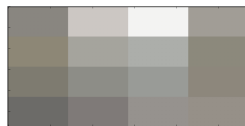
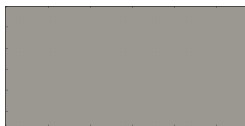
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From Last Time: koalas



<http://koalastothemax.com>



From Last Time: koalas

Process:



Get template
from github



Fill in missing
functions



Test locally
idle3/python3



Submit to
Gradescope

From Last Time: koalas



```
69 def main():
70     inFile = input('Enter image file name: ')
71     img = plt.imread(inFile)
72
73     #Divides the image in 1/2, 1/4, 1/8, ... 1/2^8, and displays each:
74     for i in range(8):
75         img2 = img.copy()    #Make a copy to average
76         quarter(img2,i)      #Split in half i times, and average regions
77
78         plt.imshow(img2)     #Load our new image into pyplot
79         plt.show()           #Show the image (waits until closed to continue)
80
81     #Shows the original image:
82     plt.imshow(img)          #Load image into pyplot
83     plt.show()               #Show the image (waits until closed to continue)
84
85
```


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```

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

Top-Down Design

- The last example demonstrates **top-down design**: breaking into subproblems, and implementing each part separately.



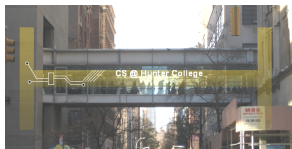
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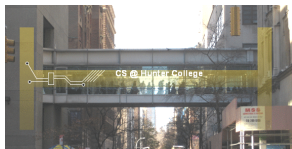


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 - ▶ Break the problem into tasks for a "To Do" list.
 - ▶ Translate list into function names & inputs/returns.
 - ▶ Implement the functions, one-by-one.
- Excellent approach since you can then test each part separately before adding it to a large program.
- Very common when working with a team: each has their own functions to implement and maintain.

Challenge:

- 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.
```

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Group Work: Fill in Missing Pieces

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Group Work: Fill in Missing Pieces

- 1 Write import statements.

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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.

```
import turtle
def setUp():
    #FILL IN
def getInput():
    #FILL IN
def markLocation(t,x,y):
    #FILL IN

def main():
    tess = setUp()      #Returns a purple turtle with pen up.
    for i in range(5):
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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):
    #FILL IN


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

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- For example,
 - ▶ `num2string(0)` returns: zero
 - ▶ `num2string(1)` returns: one
 - ▶ `num2string(2)` returns: two
- You may assume that only single digits, 0,1,...,9, are given as input.

Python Tutor



(numsConvert.py on On github)

Lecture Quiz

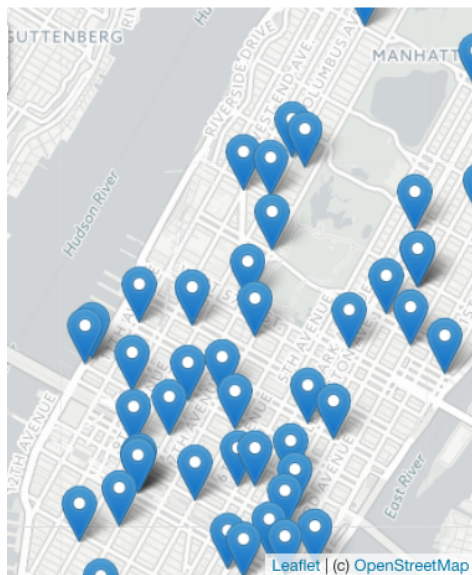
- Log-in to Gradescope
- Find LECTURE 9 Quiz
- Take the quiz
- **You have 3 minutes**

Today's Topics



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- **Mapping GIS Data**
- Random Numbers
- Indefinite Loops

Folium



Folium

- A module for making HTML maps.

Folium



Folium

Folium



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Folium

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- Outputs `.html` files which you can open in a browser.
- An extra step:

Folium

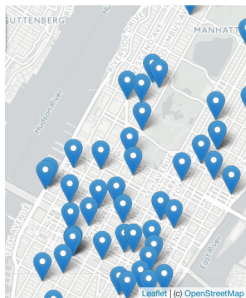
Folium



- A module for making HTML maps.
- It's a Python interface to the popular `leaflet.js`.
- Outputs `.html` files which you can open in a browser.
- An extra step:

Write code. → *Run program.* → *Open .html in browser.*

Demo



(Map created by Folium.)

Folium

- To use:
`import folium`

Folium



Folium

Folium



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`myMap = folium.Map()`

Folium

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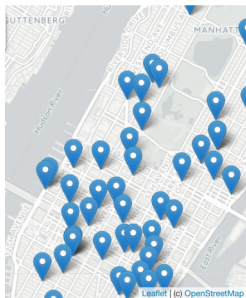
Folium

Folium



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`import folium`
- Create a map:
`myMap = folium.Map()`
- Make markers:
`newMark = folium.Marker([lat,lon],popup=name)`
- Add to the map:
`newMark.add_to(myMap)`
- 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)

Today's Topics



- Recap: Functions & Top Down Design
- Mapping GIS Data
- **Random Numbers**
- Indefinite Loops

Python's random package

- Python has a built-in package for generating pseudo-random numbers.

```
import turtle
import random

trey = turtle.Turtle()
trey.speed(10)

for i in range(100):
    trey.forward(10)
    a = random.randrange(0,360,90)
    trey.right(a)
```


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- Useful command to generate whole numbers:

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which gives a number chosen (uniformly) at random from $[0.0, 1.0)$.

- Very useful for simulations, games, and testing.

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Trinket

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(Demo turtle
random walk)

Today's Topics



- Recap: Functions & Top Down Design
- Mapping GIS Data
- Random Numbers
- **Indefinite Loops**

Challenge:

Predict what the code will do:

```
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 Tutor

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dist = int(input('Enter distance: '))
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(Demo with pythonTutor)

Indefinite Loops

- Indefinite loops repeat as long as the condition is true.

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dist = int(input('Enter distance: '))
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```
#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]
    i=i+1
print(nums)
```

Indefinite Loops

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- Very useful for checking input, simulations, and games.

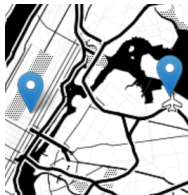
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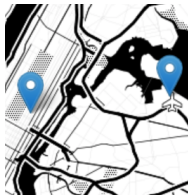
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- Could execute the body of the loop zero times, 10 times, infinite number of times.
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- Very useful for checking input, simulations, and games.
- More details next lecture...

Recap



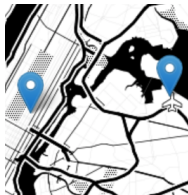
- Top-down design: breaking into subproblems, and implementing each part separately.

Recap



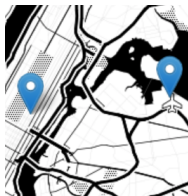
- Top-down design: breaking into subproblems, and implementing each part separately.
- Excellent approach: can then test each part separately before adding it to a large program.

Recap



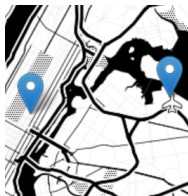
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- When possible, design so that your code is flexible to be reused (“code reuse”).

Recap



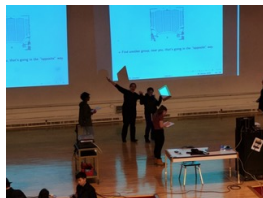
- Top-down design: breaking into subproblems, and implementing each part separately.
- Excellent approach: can then test each part separately before adding it to a large program.
- When possible, design so that your code is flexible to be reused (“code reuse”).
- Introduced a Python library, `Folium` for creating interactive HTML maps.

Recap



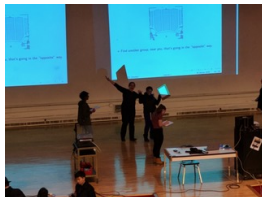
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- When possible, design so that your code is flexible to be reused (“code reuse”).
- Introduced a Python library, Folium for creating interactive HTML maps.
- Introduced `while` loops for repeating commands for an indefinite number of times.

Practice Quiz & Final Questions



- Lightning rounds:
 - ▶ write as much you can for 60 seconds;
 - ▶ followed by answer; and
 - ▶ repeat.
- Past exams are on the webpage (under [Final Exam Information](#)).

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

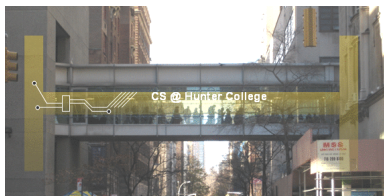
Weekly Reminders!



Before next lecture, don't forget to:

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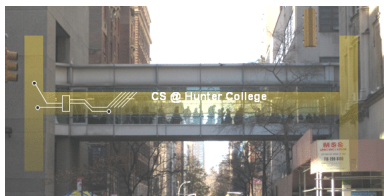
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- Take the Lecture Preview on Blackboard on Monday (or no later than 10am on Tuesday)