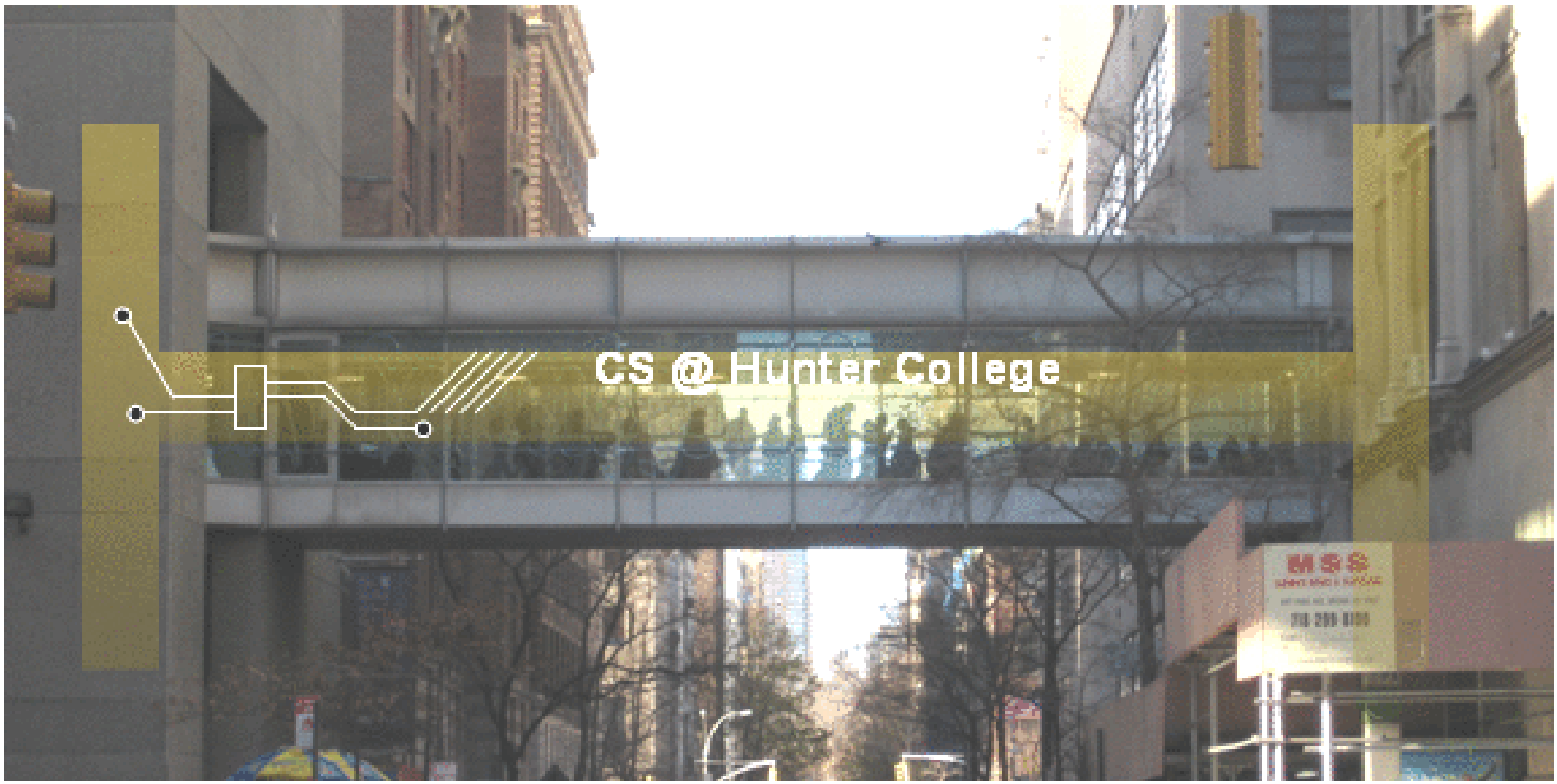
CSci 127: Introduction to Computer Science



hunter.cuny.edu/csci

Announcements

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- 11:10am: Informal Q&A with Adrienne & Albert in 1203 Hunter East.

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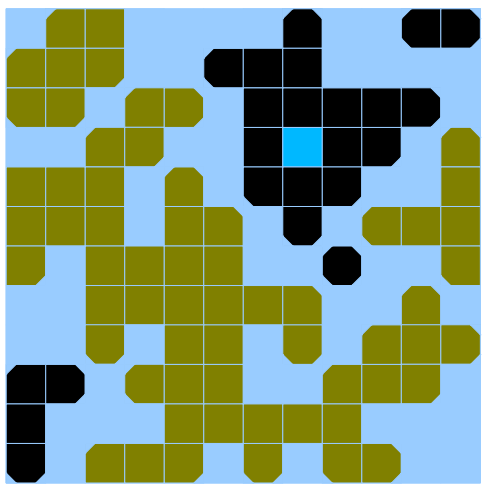
- For the intrepid few that keep asking: When are you covering recursion?
  When we cover functions. See today and next week's lecture, and Program #40.

Today's Topics

- Recap: Prof. Saad's torus-land
- Introduction to Functions
- NYC Open Data

Recap: Living on a Torus

A random torus with
5 islands and 2 pools



- How many pools and how many islands does each version have? (Collect all 5!)

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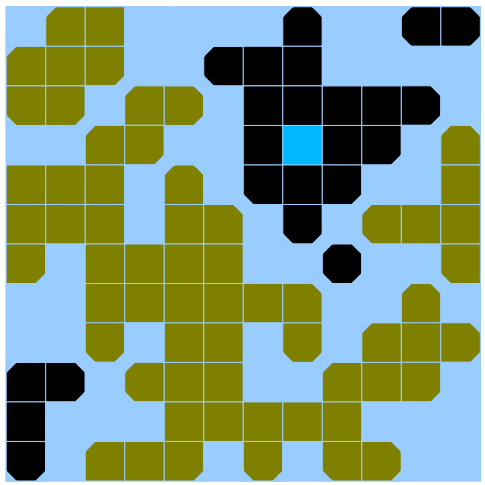

- How many pools and how many islands does each version have? (Collect all 5!)
- Design an algorithm that will count the number of islands.

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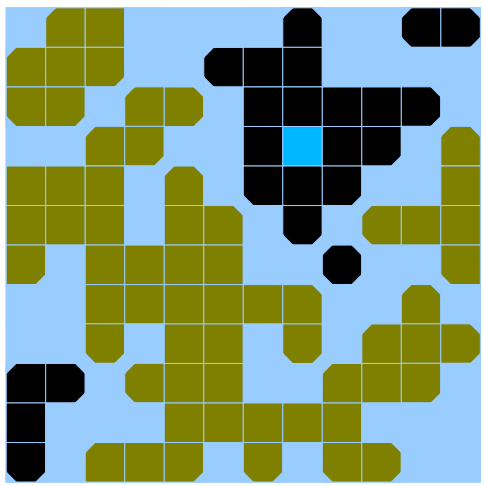

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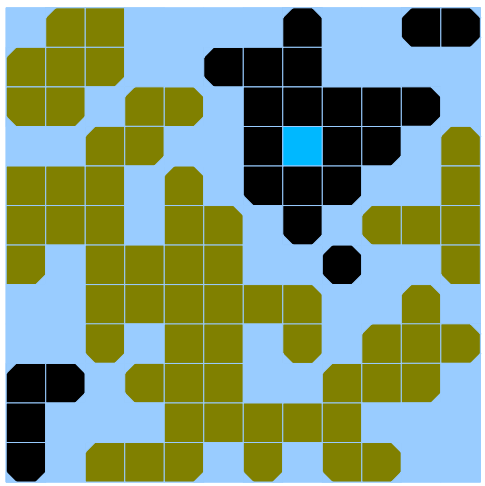

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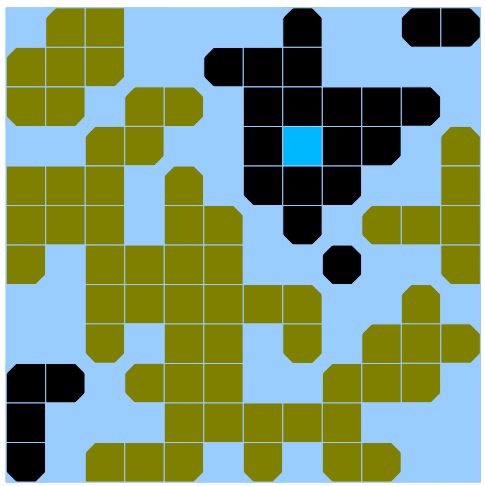

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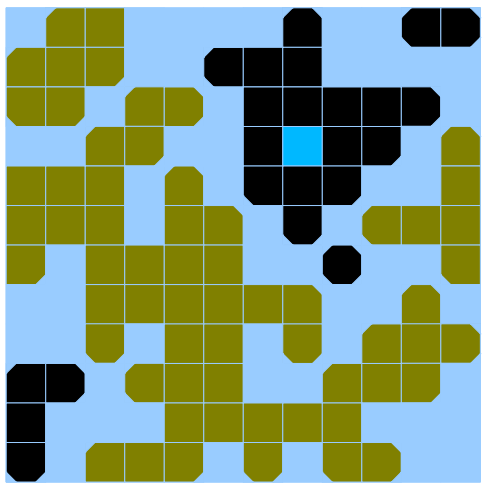

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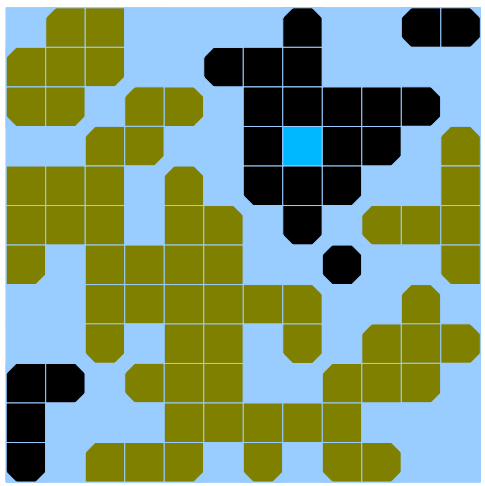

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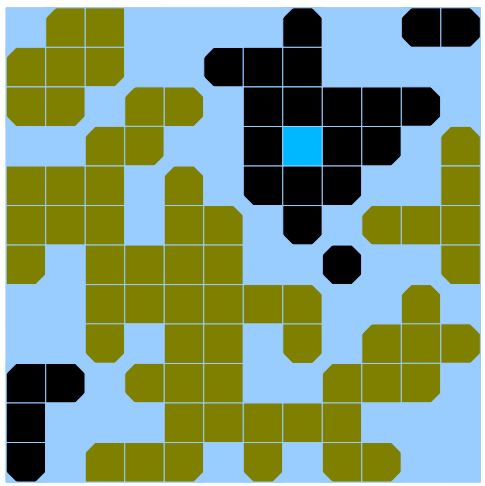

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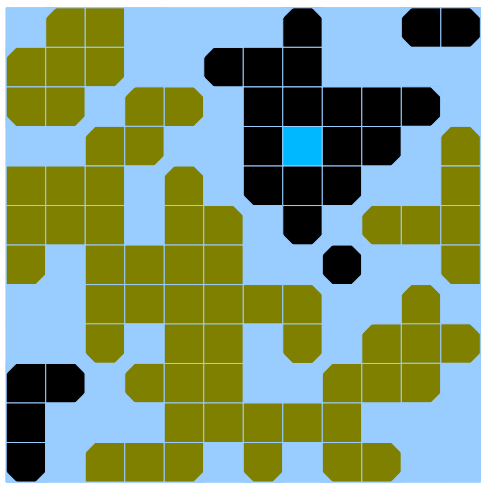

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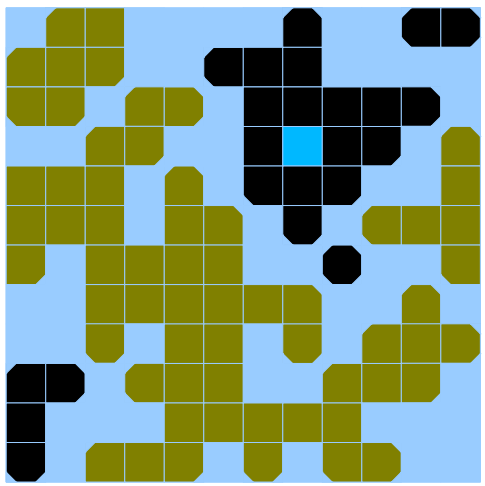

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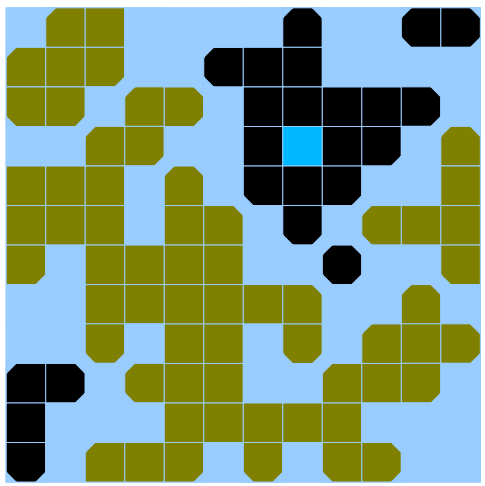

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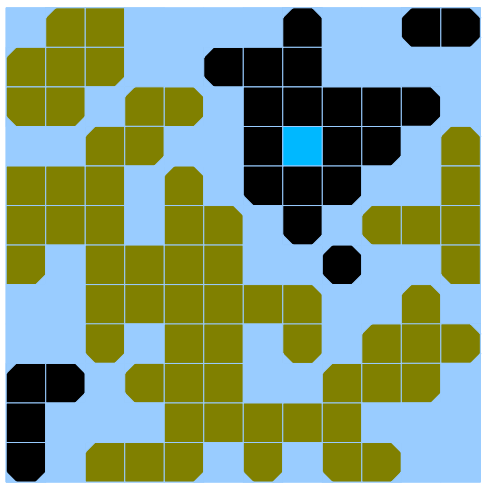

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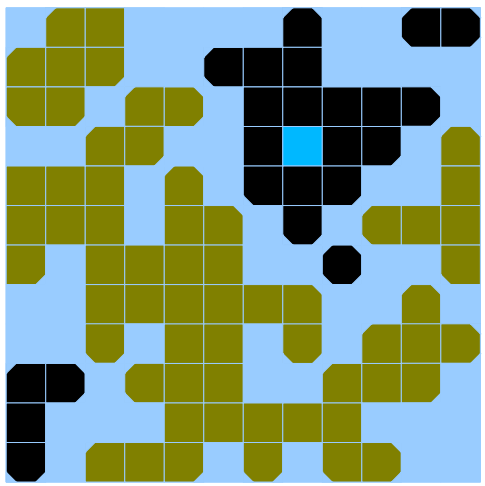

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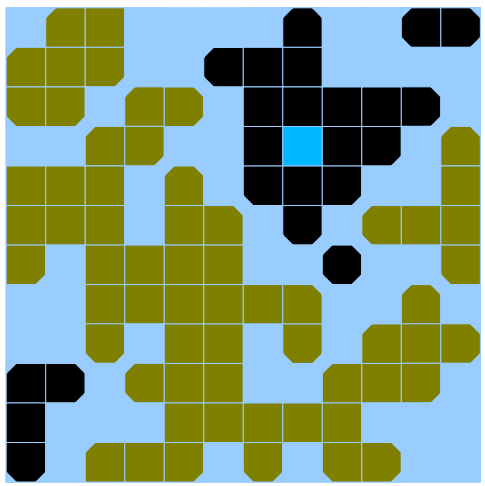

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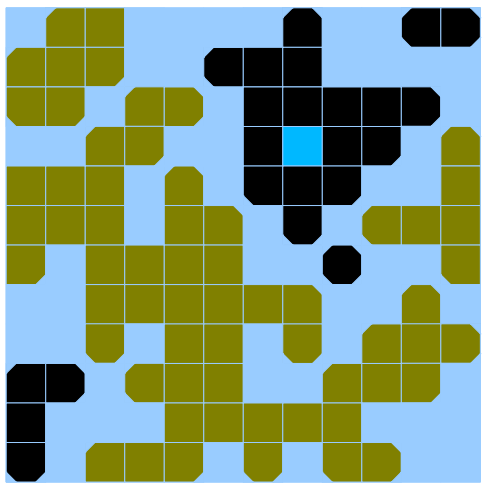

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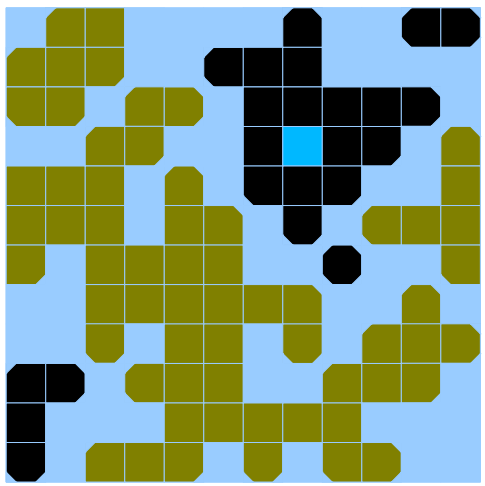

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  - Return `count`.

Functions

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#Date:  October 2017
#This program, uses functions,
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def main():
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"Hello, World!" with Functions

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(Demo with pythonTutor)

In Pairs or Triples:

Predict what the code will do:

```
def totalWithTax(food,tip):
    total = 0
    tax = 0.0875
    total = food + food * tax
    total = total + tip
    return(total)

lunch = float(input('Enter lunch total: '))
lTip = float(input('Enter lunch tip:' ))
lTotal = totalWithTax(lunch, lTip)
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Input Parameters & Return Values

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- The ones in the function call: **actual parameters**

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- Surrounded by parentheses, both in the function definition, and in the function call (invocation).
- The "placeholders" in the function definition: **formal parameters**.
- The ones in the function call: **actual parameters**
- Functions can also **return values** to where it was called.

Input Parameters & Return Values

```
def totalWithTax(food,tip):
    total = 0
    tax = 0.0875
    total = food + food * tax
    total = total + tip
    return(total)

lunch = float(input('Enter lunch total: '))
lTip = float(input('Enter lunch tip:' ))
lTotal = totalWithTax(lunch, lTip)
print('Lunch total is', lTotal)

dinner= float(input('Enter dinner total: '))
dTip = float(input('Enter dinner tip:' ))
dTotal = totalWithTax(dinner, dTip)
print('Dinner total is', dTotal)
```

Formal Parameters

Actual Parameters

- Functions can have **input parameters**.
- Surrounded by parentheses, both in the function definition, and in the function call (invocation).
- The "placeholders" in the function definition: **formal parameters**.
- The ones in the function call: **actual parameters**.
- Functions can also **return values** to where it was called.

In Pairs or Triples:

Circle the actual parameters and underline the formal parameters:

```
def prob4():
    verse = "jam tomorrow and jam yesterday,"
    print("The rule is,")
    c = mystery(verse)
    w = enigma(verse,c)
    print(c,w)
def mystery(v):
    print(v)
    c = v.count("jam")
    return(c)
def enigma(v,c):
    print("but never", v[-1])
    for i in range(c):
        print("jam")
    return("day.")
prob4()
```

In Pairs or Triples:

Circle the actual parameters and underline the formal parameters:

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def prob4():
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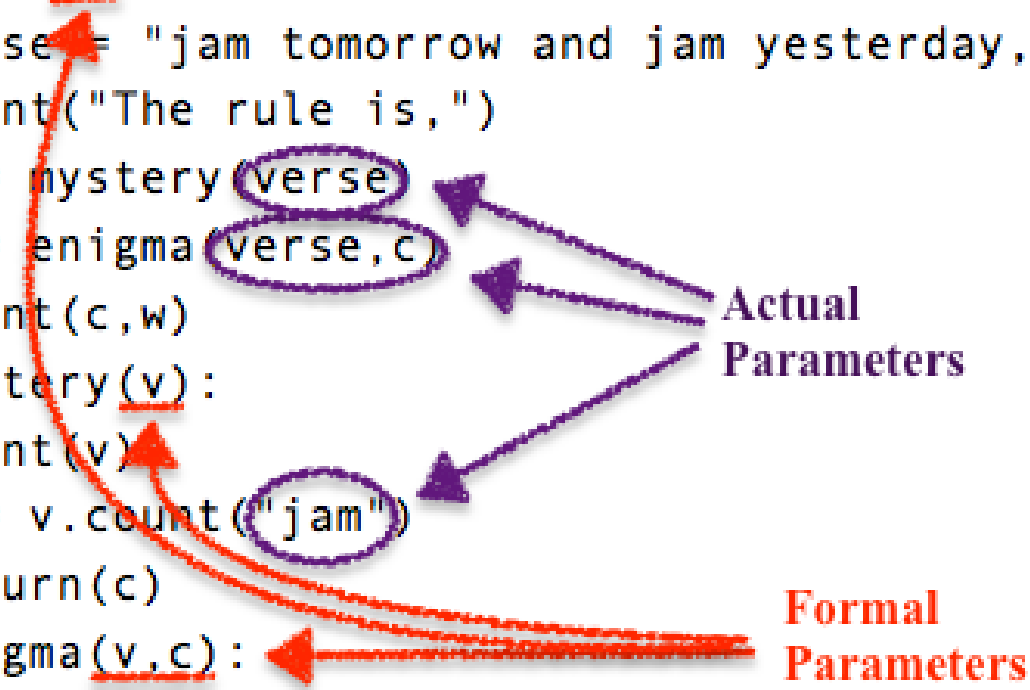

In Pairs or Triples:

Predict what the code will do:

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prob4()
```

```
#Fall 2013 Final Exam, 5

def kuwae( inLst ):
    tot = 1
    for item in inLst:
        tot = tot * item
    return tot

def foo( inLst ):
    if ( inLst[-1] > inLst[0] ):
        return kuwae( inLst )
    else:
        return -1

foo( [2, 4, 6, 8] )

foo( [4002, 328, 457, 1] )
```

Python Tutor

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def prob4():
    verse = "jam tomorrow and jam yesterday,"
    print("The rule is,")
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    w = enigma(verse,c)
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def enigma(v,c):
    print("but never", v[-1])
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foo( [2, 4, 6, 8] )

foo( [4002, 328, 457, 1] )
```

(Demo with `pythonTutor`)

In Pairs or Triples:

Predict what the code will do:

```
#Greet loop example

def greetLoop(person):
    print("Greetings")
    for i in range(5):
        print("Hello", person)

greetLoop("Thomas")
```

```
# From "Teaching with Python" by John Zelle

def happy():
    print("Happy Birthday to you!")

def sing(P):
    happy()
    happy()
    print("Happy Birthday dear " + P + "!")
    happy()


sing("Fred")
sing("Thomas")
sing("Hunter")
```

Python Tutor

```
#Greet loop example

def greetLoop(person):
    print("Greetings")
    for i in range(5):
        print("Hello", person)

greetLoop("Thomas")
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    happy()


sing("Fred")
sing("Thomas")
sing("Hunter")
```

(Demo with `pythonTutor`)

In Pairs or Triples:

Fill in the missing code:

```
def monthString(monthNum):
    """
    Takes as input a number, monthNum, and
    returns the corresponding month name as a string.
    Example: monthString(1) returns "January".
    Assumes that input is an integer ranging from 1 to 12
    """

    monthString = ""

    ###################################
    ### FILL IN YOUR CODE HERE      ###
    ### Other than your name above, ###
    ### this is the only section    ###
    ### you change in this program. ###
    ###################################

    return(monthString)

def main():
    n = int(input('Enter the number of the month: '))
    mString = monthString(n)
    print('The month is', mString)
```

IDLE

```
def monthString(monthNum):
    """
    Takes as input a number, monthNum, and
    returns the corresponding month name as a string.
    Example: monthString(1) returns "January".
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    monthString = ""

    ###################################
    ### FILL IN YOUR CODE HERE      ###
    ### Other than your name above, ###
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    ###################################

    return(monthString)

def main():
    n = int(input('Enter the number of the month: '))
    mString = monthString(n)
    print('The month is', mString)
```

(Demo with IDLE)

In Pairs or Triples:

Predict what the code will do:

```
#CSci 127 Teaching Staff
#Triangles two ways...
import turtle

def setUp(t, dist, col):
     t.penup()
     t.forward(dist)
     t.pendown()
     t.color(col)

def nestedTriangle(t, side):
     if side > 10:
          for i in range(3):
               t.forward(side)
               t.left(120)
          nestedTriangle(t, side/2)

def fractalTriangle(t, side):
     if side > 10:
          for i in range(3):
               t.forward(side)
               t.left(120)
               fractalTriangle(t, side/2)
```

```
def main():
     nessa = turtle.Turtle()
     setUp(nessa, 100, "violet")
     nestedTriangle(nessa, 160)

     frank = turtle.Turtle()
     setUp(frank, -100, "red")
     fractalTriangle(frank, 160)

if __name__ == "__main__":
     main()
```

IDLE

```
#CSci 127 Teaching Staff
#Triangles two ways...
import turtle

def setUp(t, dist, col):
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               t.forward(side)
               t.left(120)
               fractalTriangle(t, side/2)
```

(Demo with IDLE)

Recap: Functions

```
#Name:  your name here
#Date:  October 2017
#This program, uses functions,
#     says hello to the world!

def main():
     print("Hello, World!")

if __name__ == "__main__":
     main()
```

- Functions are a way to break code into pieces, that can be easily reused.

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- You **call** or **invoke** a function by typing its name, followed by any inputs, surrounded by parenthesis:

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- Functions are a way to break code into pieces, that can be easily reused.
- You **call** or **invoke** a function by typing its name, followed by any inputs, surrounded by parenthesis: Example: `print("Hello", "World")`
- Can write, or **define** your own functions, which are stored, until invoked or called.

Accessing Structured Data: NYC Open Data

- Freely available source of data.

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Accessing Structured Data: NYC Open Data

- Freely available source of data.
- Maintained by the NYC data analytics team.
- We will use several different ones for this class.
- Will use pandas, pyplot & folium libraries to analyze, visualize and map the data.
- Lab 7 covers accessing and downloading NYC OpenData datasets.

Example: Reading in CSV Files

```
Source:  https://en.wikipedia.org/wiki/Demographics_of_New_York_City,,,,,,
All population figures are consistent with present-day boundaries.,,,,,,
First census after the consolidation of the five boroughs,,,,,,
,,,,,,
,,,,,,
Year,Manhattan,Brooklyn,Queens,Bronx,Staten Island,Total
1698,4937,2017,,,727,7681
1771,21863,3623,,,2847,28423
1790,33131,4549,6159,1781,3827,49447
1800,60515,5740,6642,1755,4563,79215
1810,96373,8303,7444,2267,5347,119734
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1830,202589,20535,9049,3023,7082,242278
1840,312710,47613,14480,5346,10965,391114
1850,515547,138882,18593,8032,15061,696115
1860,813669,279122,32903,23593,25492,1174779
1870,942292,419921,45468,37393,33029,1478103
1880,1164673,599495,56559,51980,38991,1911698
1890,1441216,838547,87050,88908,51693,2507414
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1910,2331542,1634351,284041,430980,85969,4766883
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1990,1487536,2300664,1951598,1203789,378977,7322564
2000,1537195,2465326,2229379,1332650,443728,8008278
2010,1585873,2504700,2230722,1385108,468730,8175133
2015,1644518,2636735,2339150,1455444,474558,8550405
```

`nycHistPop.csv`

In Lab 6

Example: Reading in CSV Files

```
import matplotlib.pyplot as plt
import pandas as pd
```

```
Source:  https://en.wikipedia.org/wiki/Demographics_of_New_York_City,,,,,,
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```

`nycHistPop.csv`

In Lab 6

Example: Reading in CSV Files

```
import matplotlib.pyplot as plt
import pandas as pd

pop = pd.read_csv('nycHistPop.csv',skiprows=5)
```

```
Source:  https://en.wikipedia.org/wiki/Demographics_of_New_York_City,,,,,,
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```

nycHistPop.csv

In Lab 6

Example: Reading in CSV Files

```
import matplotlib.pyplot as plt
import pandas as pd

pop = pd.read_csv('nycHistPop.csv',skiprows=5)

pop.plot(x="Year")
plt.show()
```

```
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nycHistPop.csv

In Lab 6

Example: Reading in CSV Files

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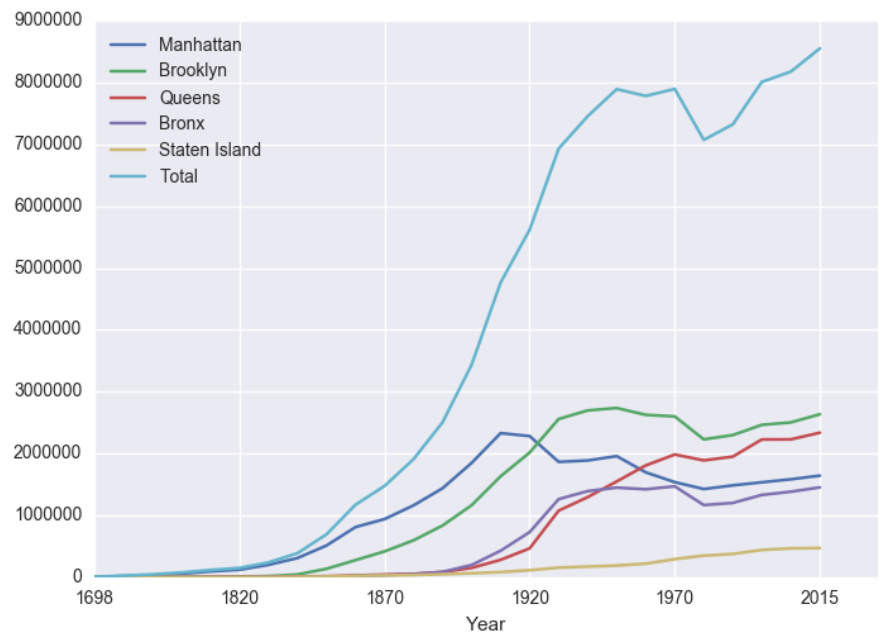
nycHistPop.csv

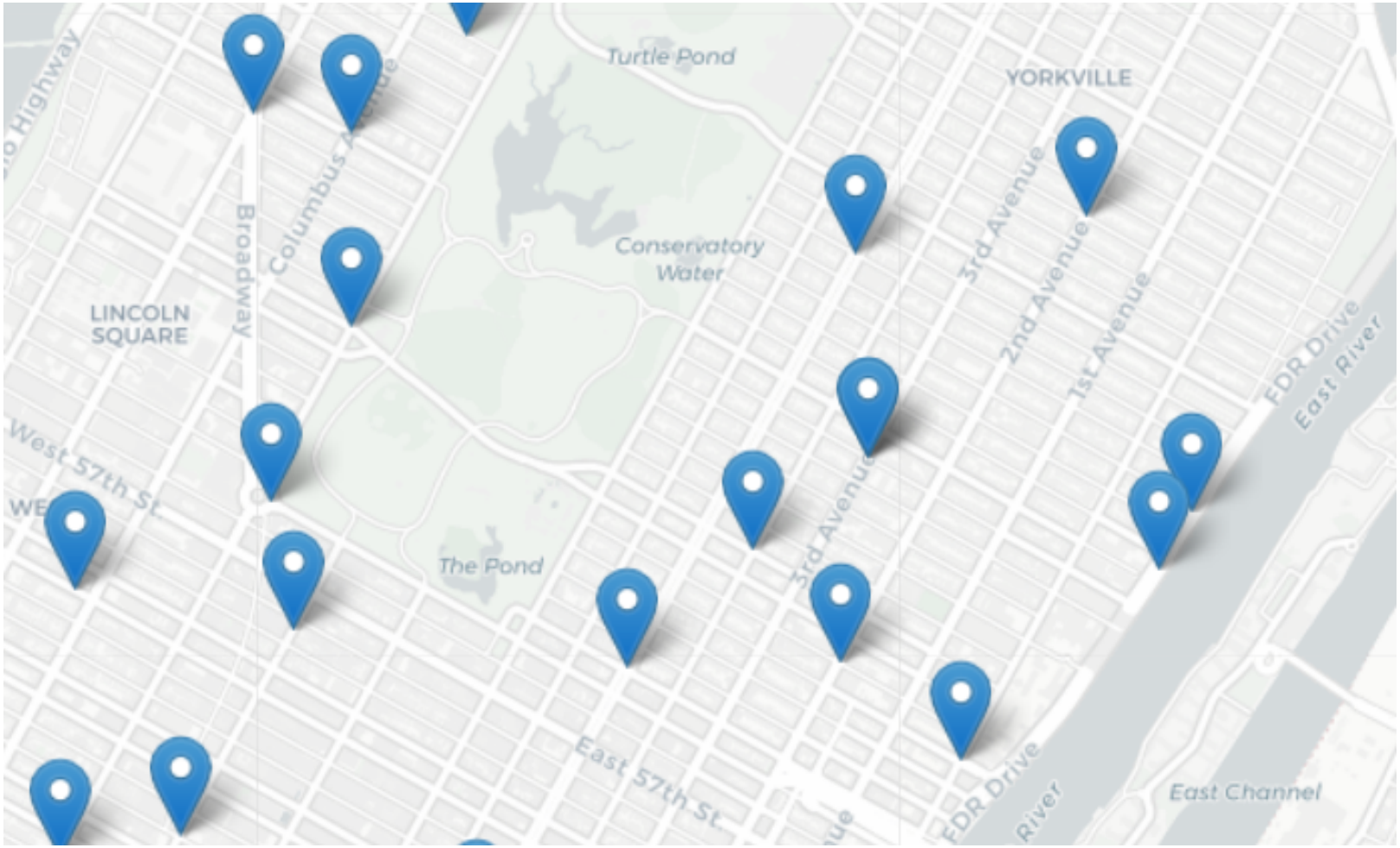
In Lab 6



CS Survey: Adrienne Schmoeker & Albert Webber

- Adrienne Schmoeker & Albert Webber
  NYC Mayor's Office of Data Analytics

Design Question



Design an algorithm that finds the closest collision.

(Sample NYC OpenData collision data file on back of lecture slip.)

Design Question

Design an algorithm that uses NYC OpenData collision data and computes the closest collision to the location the user provides.

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How to approach this:

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How to approach this:

- Create a "To Do" list of what your program has to accomplish.
- Read through the problem, and break it into "To Do" items.
- Don't worry if you don't know how to do all the items you write down.

Design Question

Design an algorithm that uses NYC OpenData collision data and computes the closest collision to the location the user provides.

How to approach this:

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- Read through the problem, and break it into "To Do" items.
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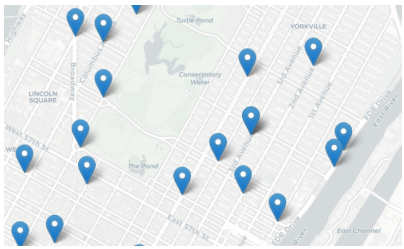
Recap

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



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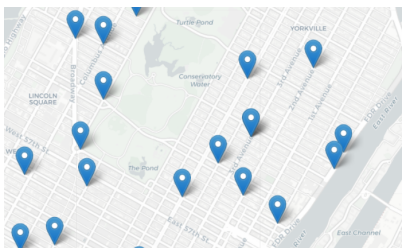

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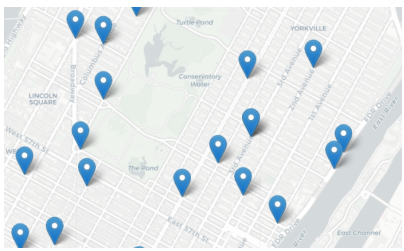

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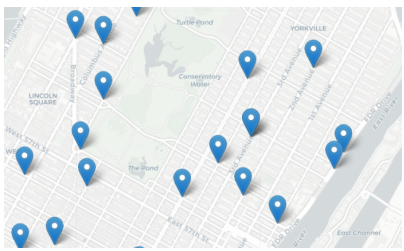

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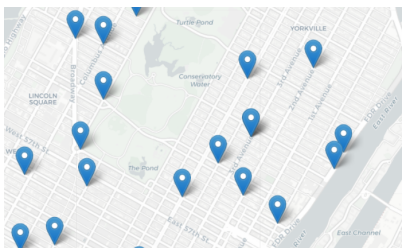

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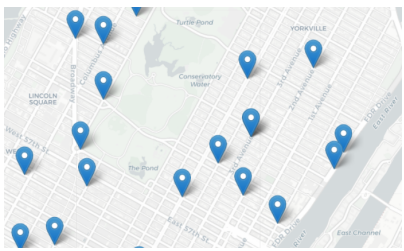

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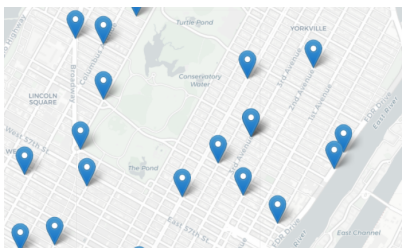

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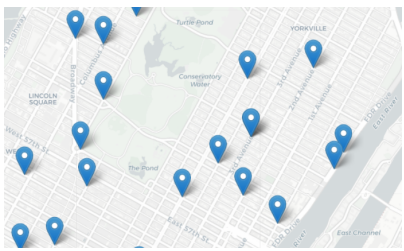

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- Pass your lecture slips to the aisles for the UTAs to collect.

Practice Quiz & Final Questions

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#Name:  your name here
#Date:  October 2017
#This program, uses functions,
#     says hello to the world!

def main():
     print("Hello, World!")

if __name__ == "__main__":
     main()
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```
def totalWithTax(food,tip):
    total = 0
    tax = 0.0875
    total = food + food * tax
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    return(total)

lunch = float(input('Enter lunch total: '))
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lTotal = totalWithTax(lunch, lTip)
print('Lunch total is', lTotal)

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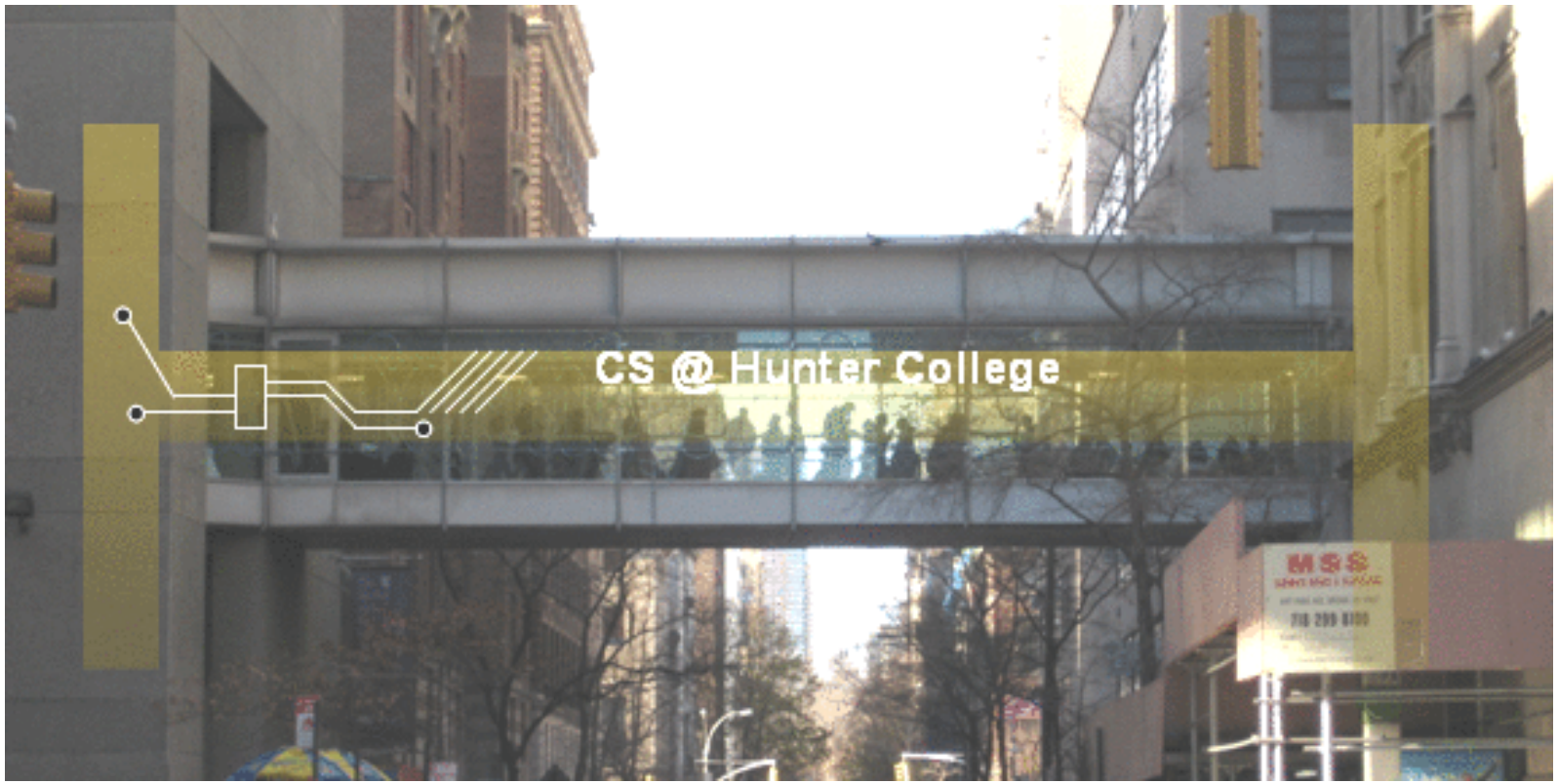
- Theme: Functions!

Writing Boards



- Return writing boards as you leave...