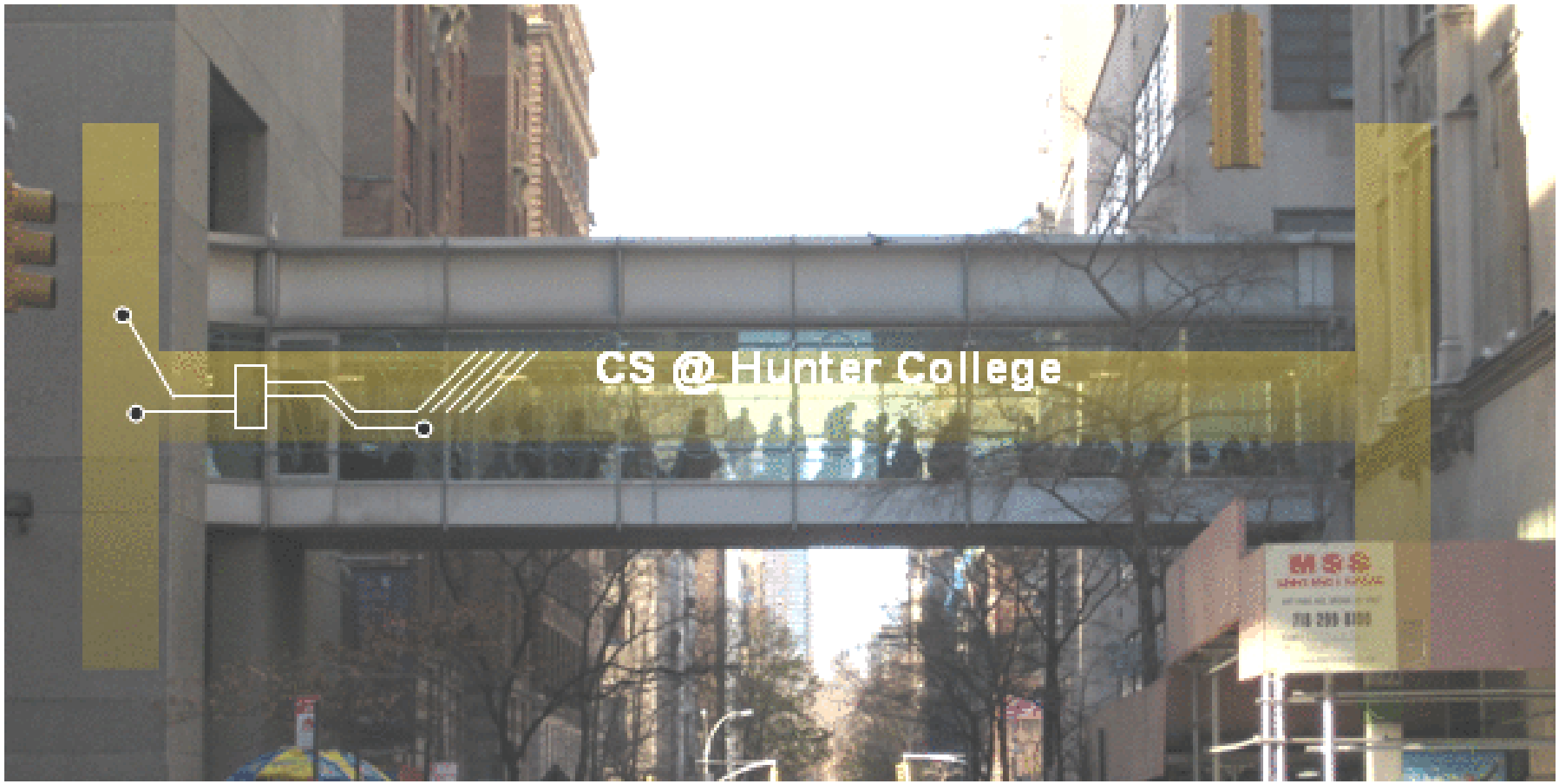
CSci 127: Introduction to Computer Science



hunter.cuny.edu/csci

- This lecture will be recorded

Frequently Asked Questions

From email

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  e.g. (x == 2(y+3)) and (x <10)*
  We use square brackets [ ] to index or slice,
  i.e. take a piece, of a string, list or numpy array: my_string[2:5]

Today's Topics

- Recap: Slicing & Images
- Introduction to Functions
- NYC Open Data

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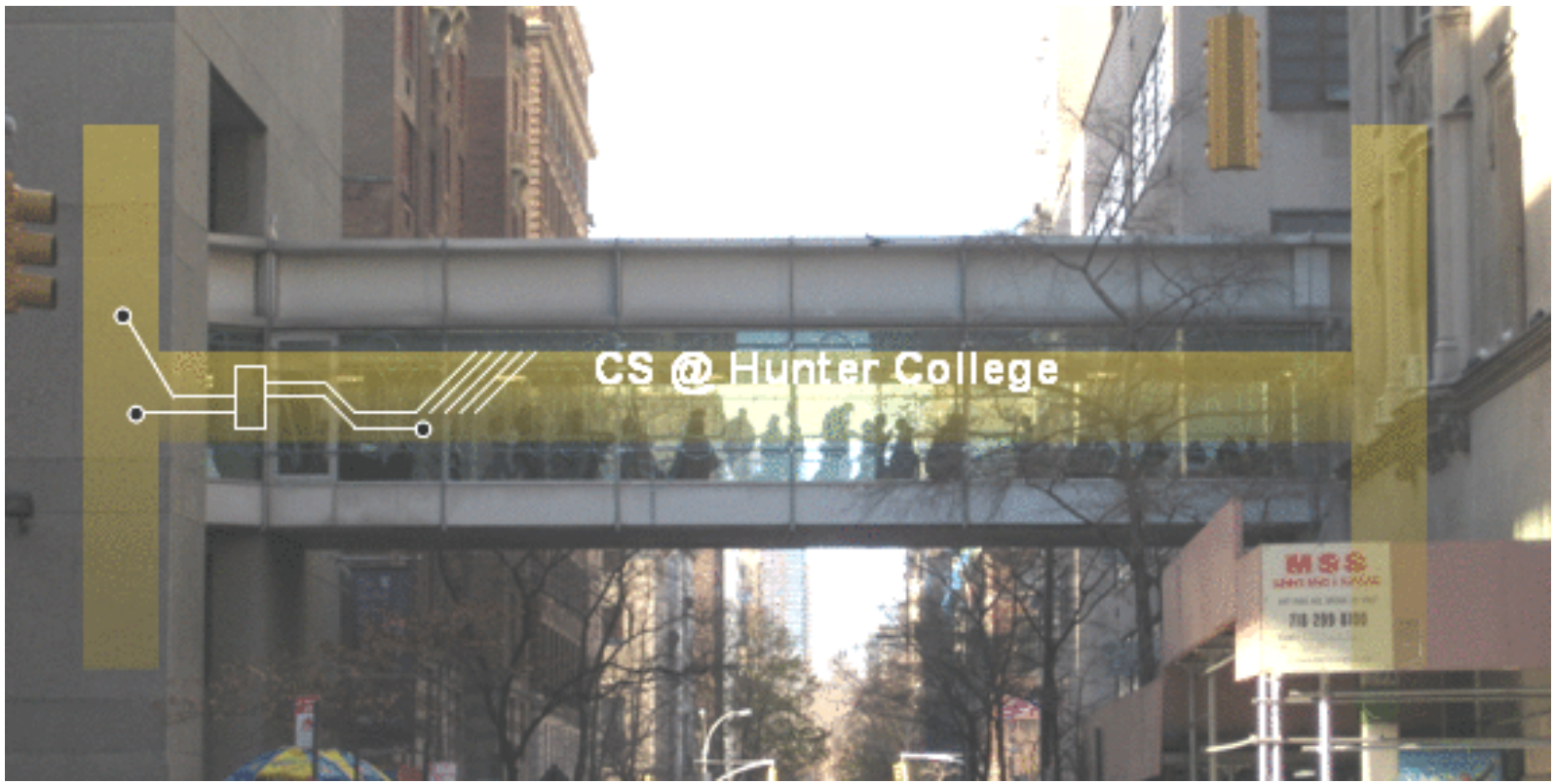
Challenge: Cropping Images

Crop an image to select the top quarter (upper left corner)



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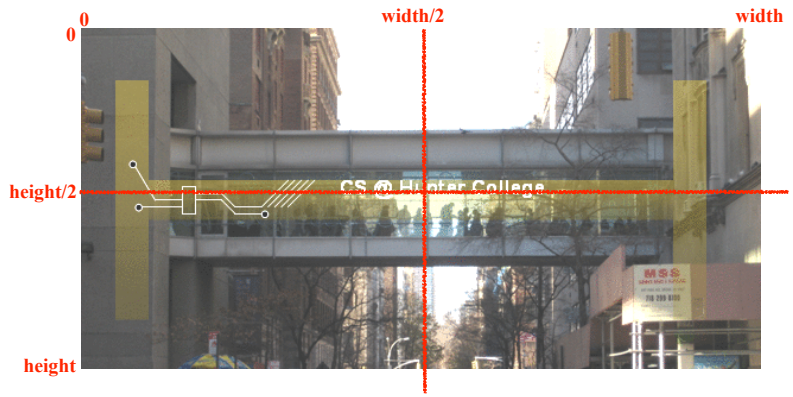

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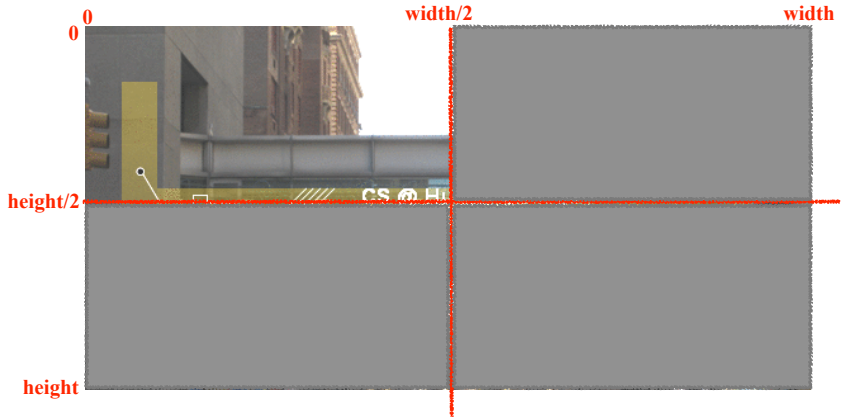

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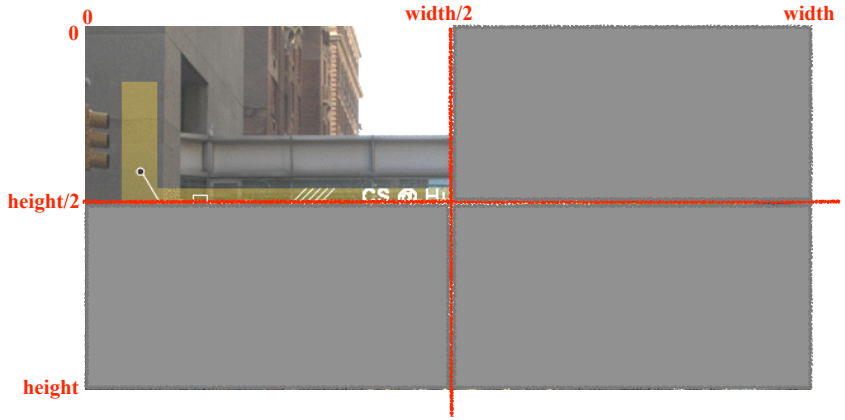

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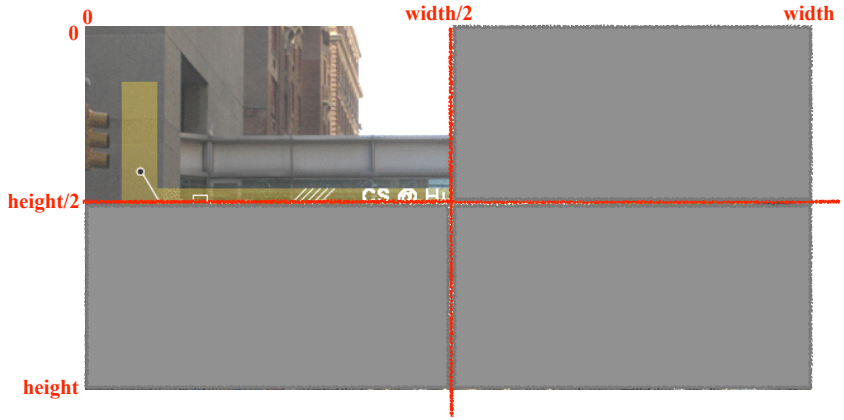

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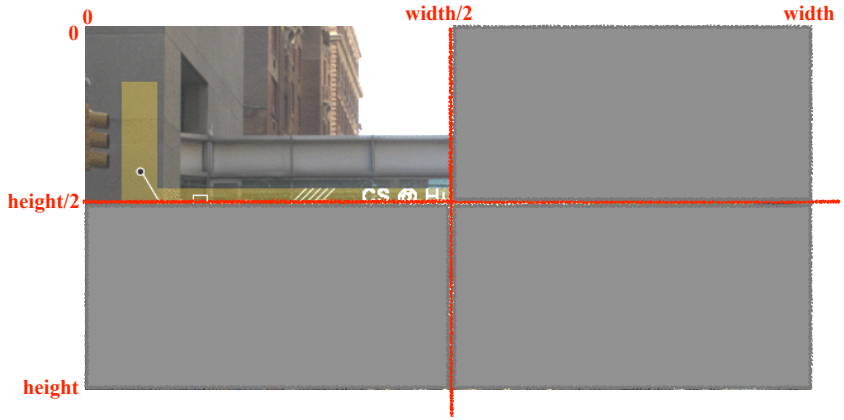

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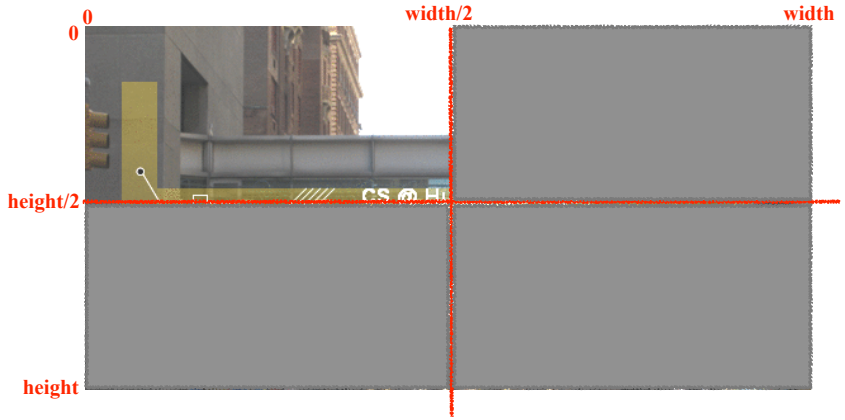

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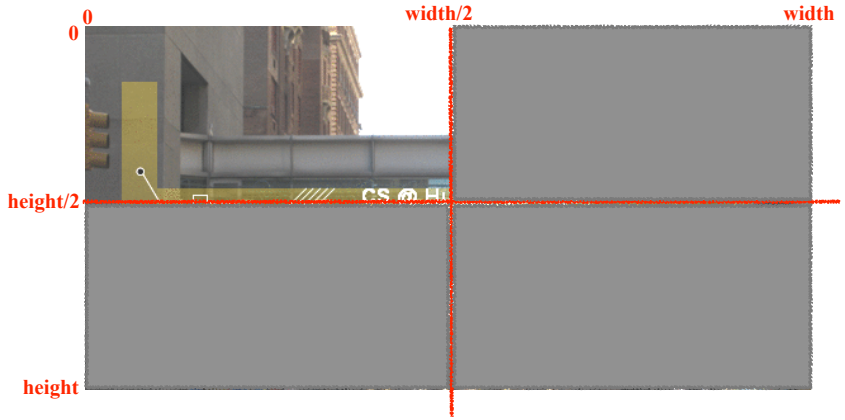

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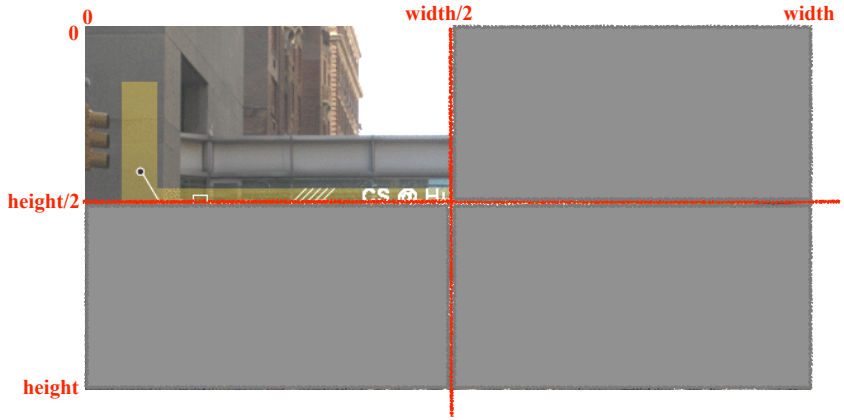

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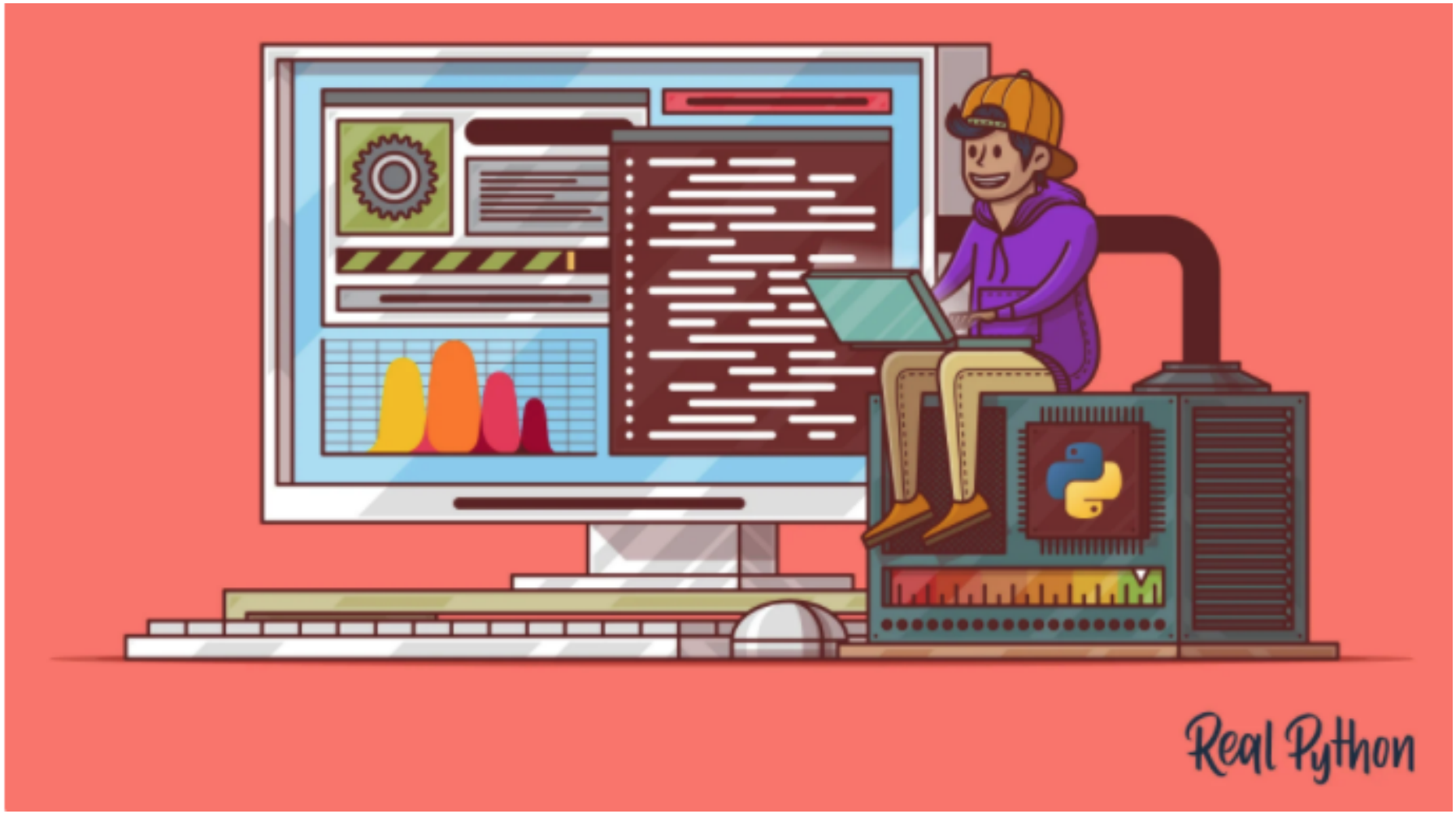
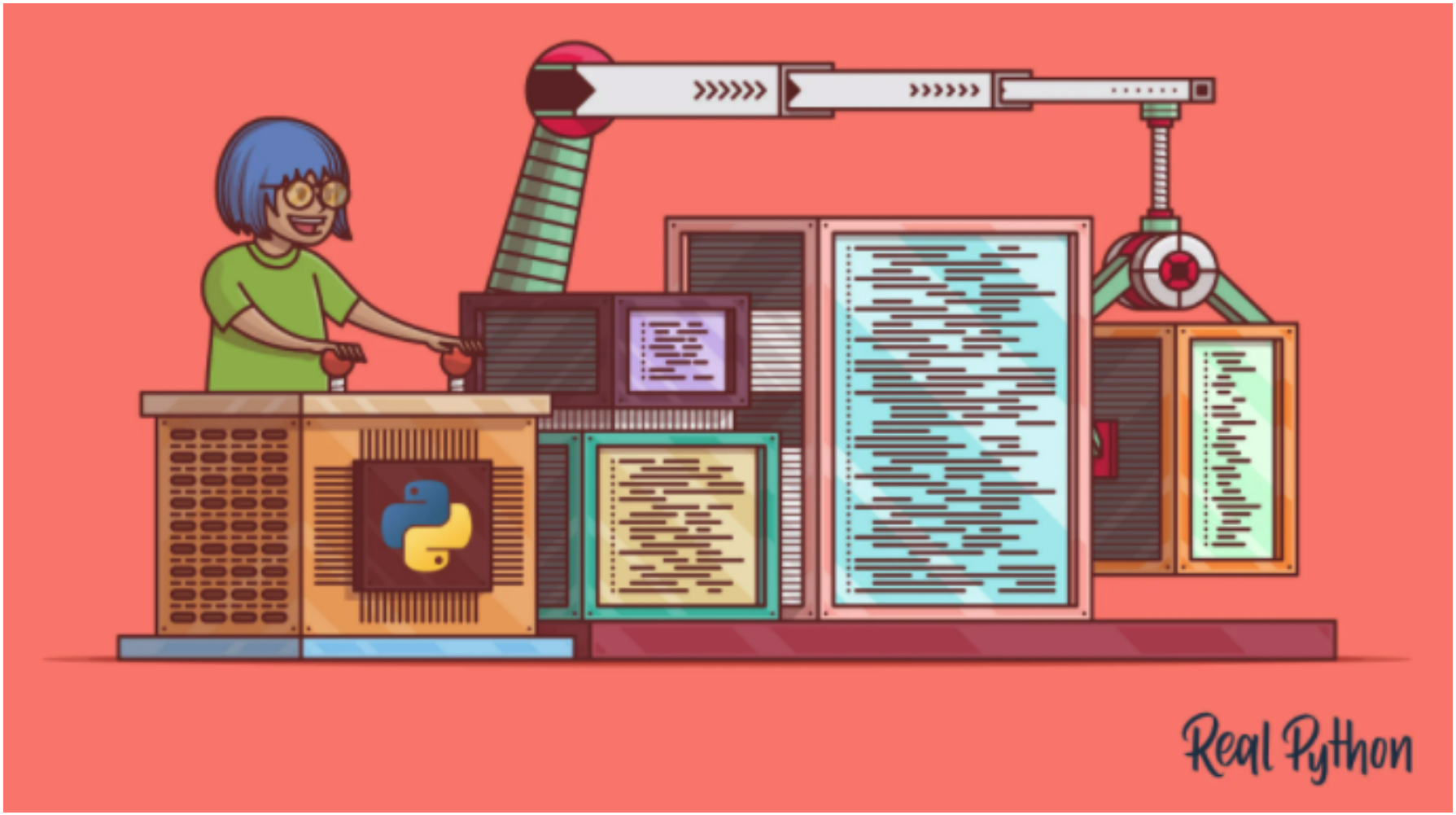
Scripts



Modularity



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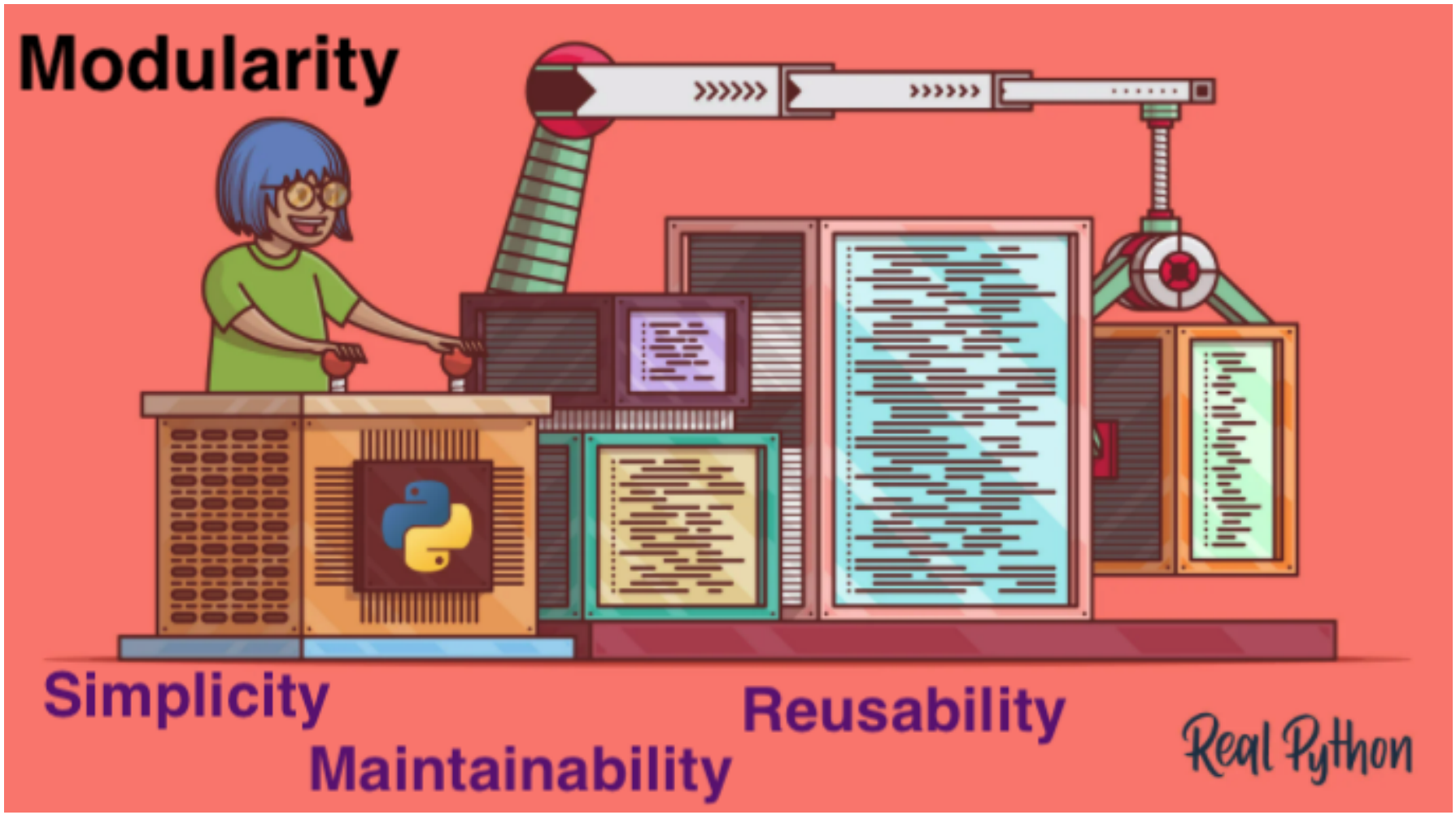
Modularity
Simplicity
Maintainability
Reusability
Real Python

Functions

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

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

def main():
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- Can write, or **define** your own functions, which are stored, until invoked or called.

"Hello, World!" with Functions

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Python Tutor

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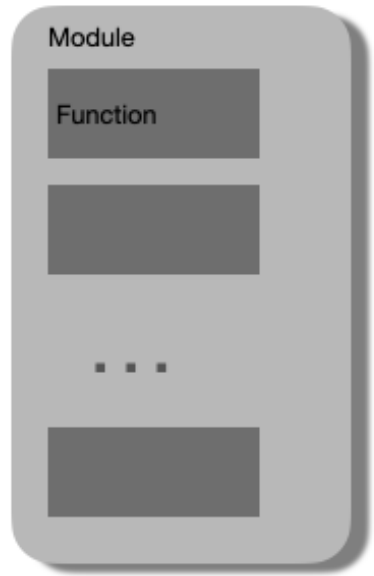
(Demo with pythonTutor)

functions - modules - packages



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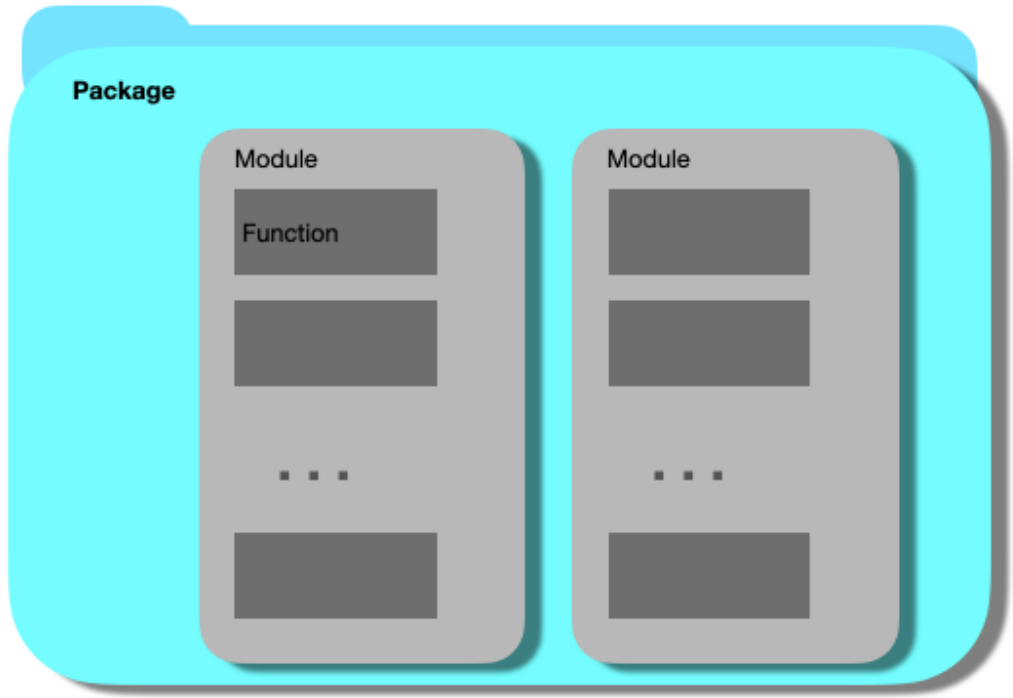

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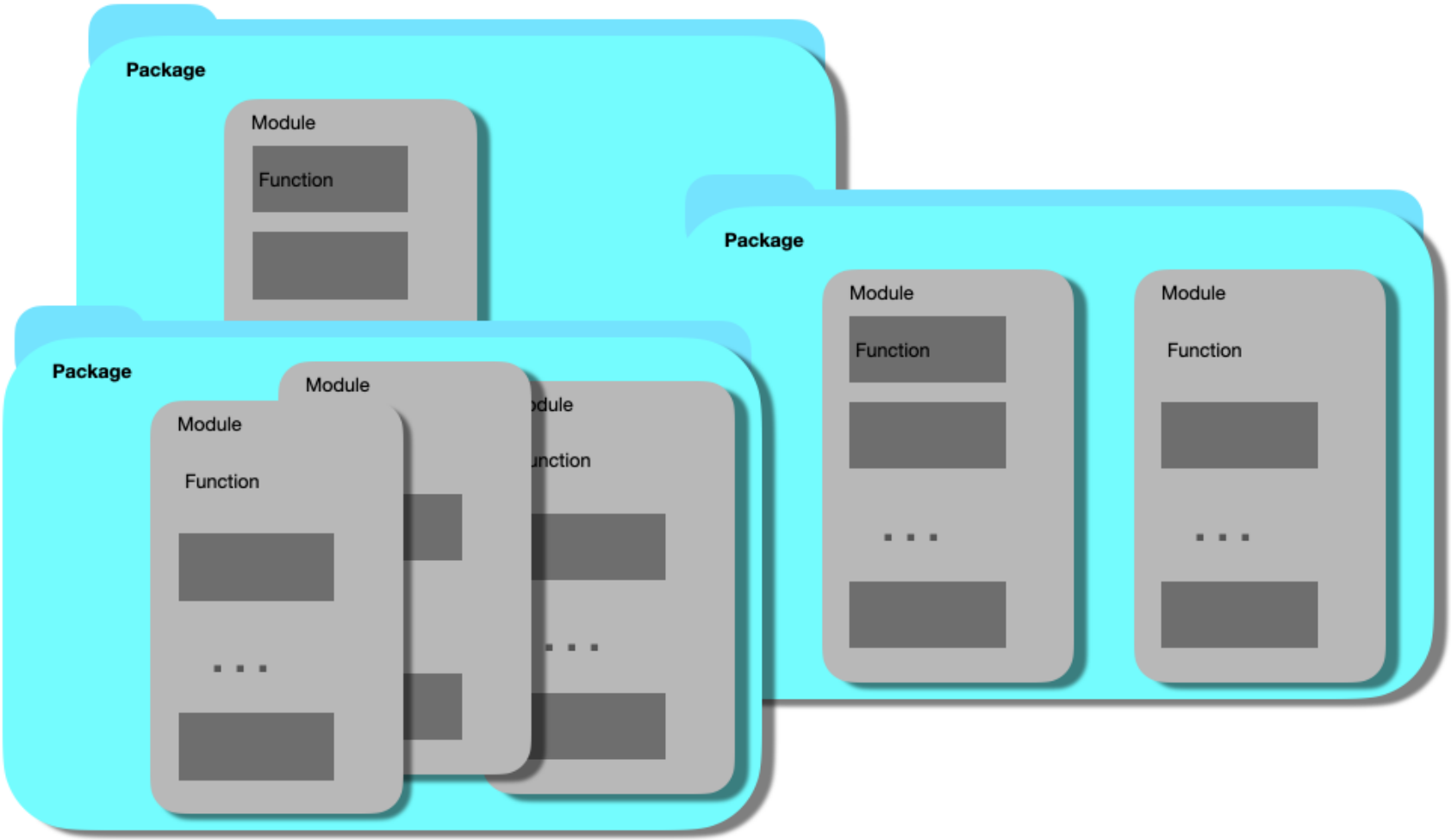
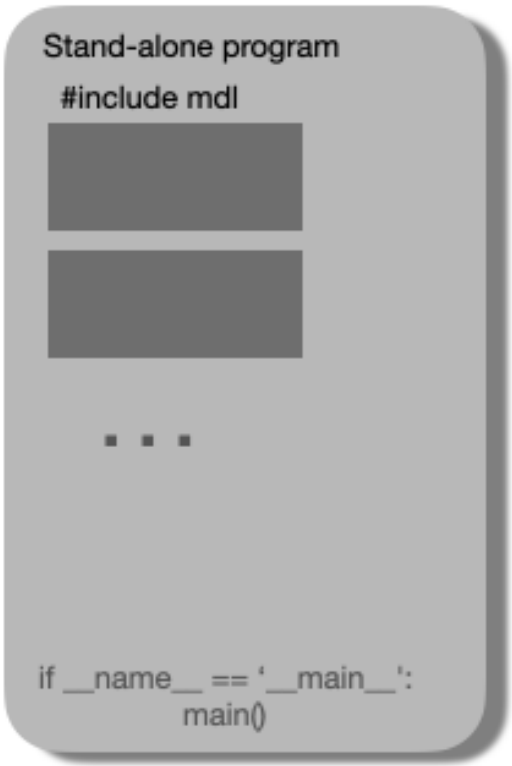


Stand-alone program



Challenge:

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)
print('Lunch total is', lTotal)

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(Demo with `pythonTutor`)

Scope

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    x = 5+3
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def nine():
    x = "nine"
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- You can have multiple functions.

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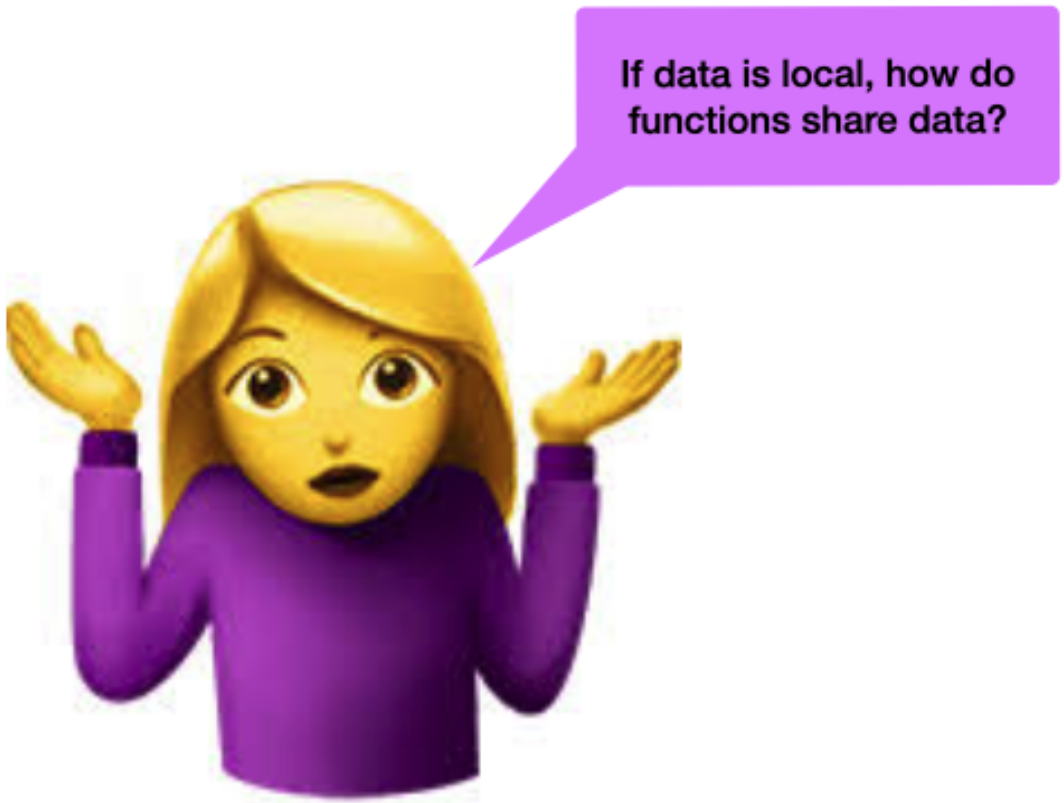
- Each function defines the **scope** of its local variables
- A variable defined inside a function is **local**, i.e. defined only inside that function.

Local Data?



Input Parameters & Return Values

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- The "placeholders" in the function definition: **formal parameters**.

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

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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**.

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.

Challenge:

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()
```

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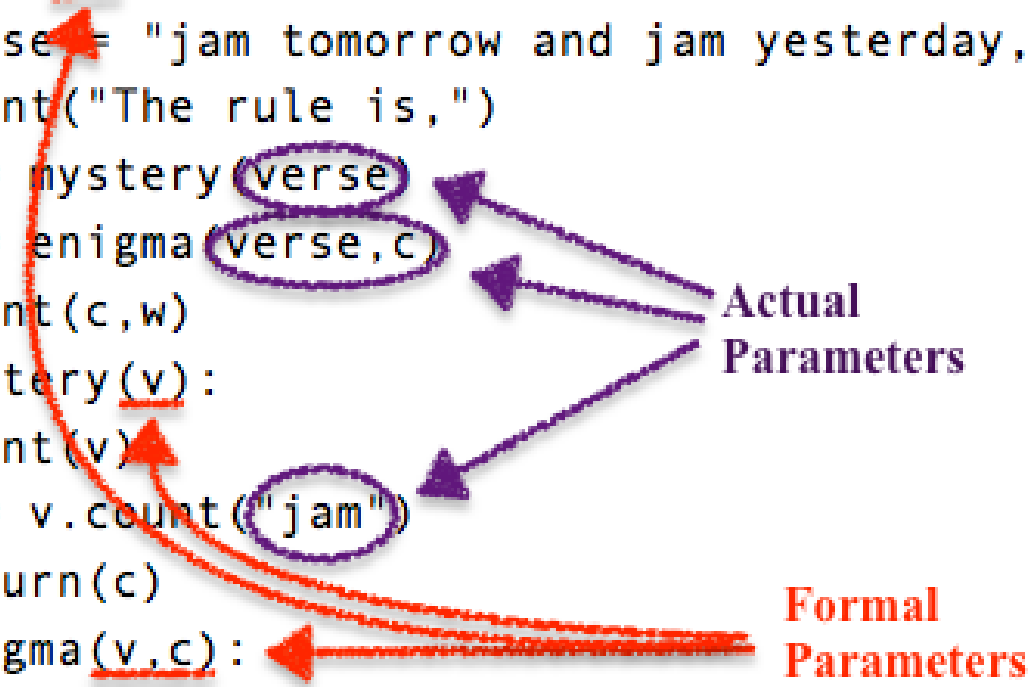

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Predict what the code will do:

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Python Tutor

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```

(Demo with `pythonTutor`)

Challenge:

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

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#Greet loop example

def greetLoop(person):
    print("Greetings")
    for i in range(5):
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sing("Fred")
sing("Thomas")
sing("Hunter")
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(Demo with `pythonTutor`)

Challenge:

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

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    return(monthString)

def main():
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```

(Demo with IDLE)

Github

- Used to collaborate on and share code, documents, etc.

Octocat

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- Also convenient place to host websites (i.e. `huntercsci127.github.io`).
- In Lab6 you set up github accounts to copy (‘**clone**’) documents from the class repo. (More in future courses.)

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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- Can write, or **define** your own functions, which are stored, until invoked or called.

Lecture Quiz

- Log-in to Gradescope
- Find LECTURE 7 Quiz
- Take the quiz
- **You have 3 minutes**

Today's Topics

- Recap: Slicing & Images
- Introduction to Functions
- **NYC Open Data**

Accessing Structured Data: NYC Open Data

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- Will use `pandas`, `pyplot` & `folium` libraries to analyze, visualize and map the data.
- Lab 7 covers accessing and downloading NYC OpenData datasets.

Example: OpenData Film Permits

Home Data About Learn

Film Permits

Permits are generally required when asserting the exclusive use of city property, like a sidewalk, a street, or a park. See http://www1.nyc.gov/site/mome/permits/when-permit-required.page

EventID	EventType	StartDateTi...	EndDateTime	EnteredOn	EventAg...	ParkingHeld	Borou...
455063	Shooting Permit	12/06/2018 07:00...	12/06/2018 09:00...	12/05/2018 12:36...	Mayor's Offic...	STARR AVENUE b...	Queens
454967	Shooting Permit	12/06/2018 07:00...	12/06/2018 05:00...	12/04/2018 09:11...	Mayor's Offic...	EAGLE STREET be...	Brooklyn
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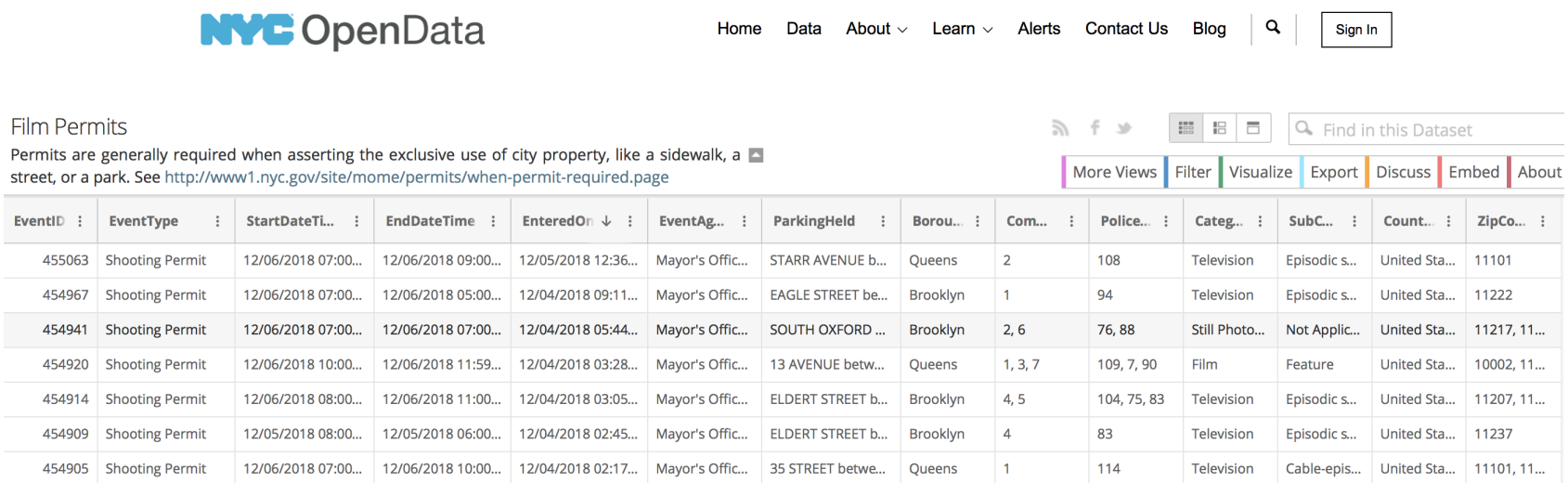
Example: OpenData Film Permits



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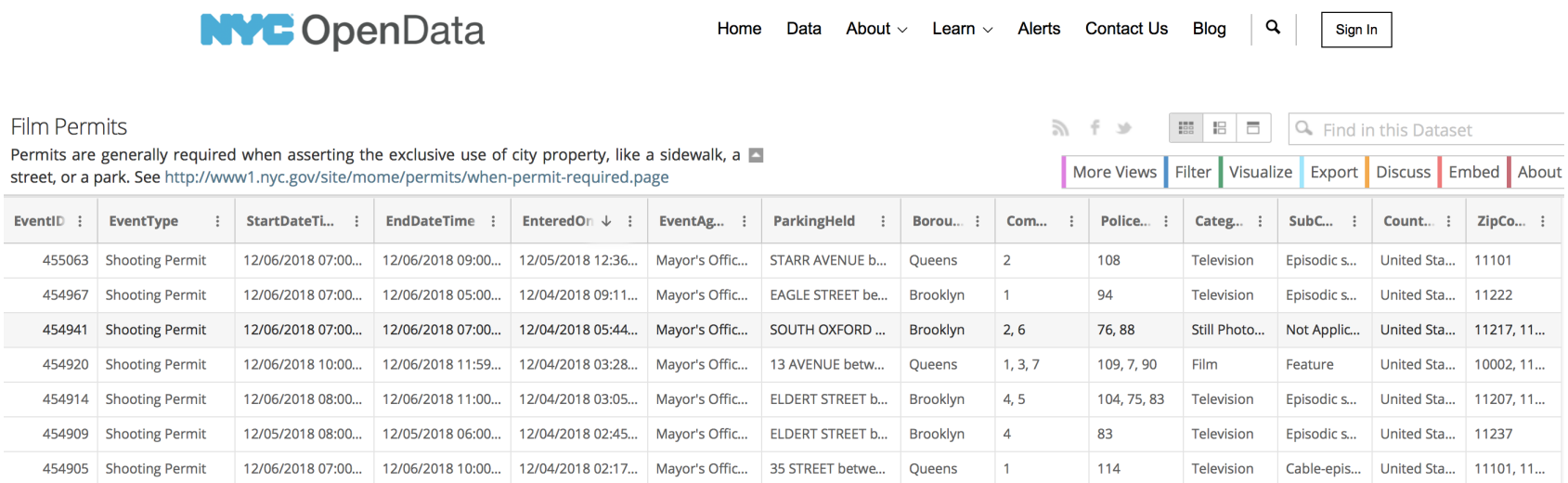
- What's the most popular street for filming?

Example: OpenData Film Permits



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- What's the most popular street for filming?
- What's the most popular borough?

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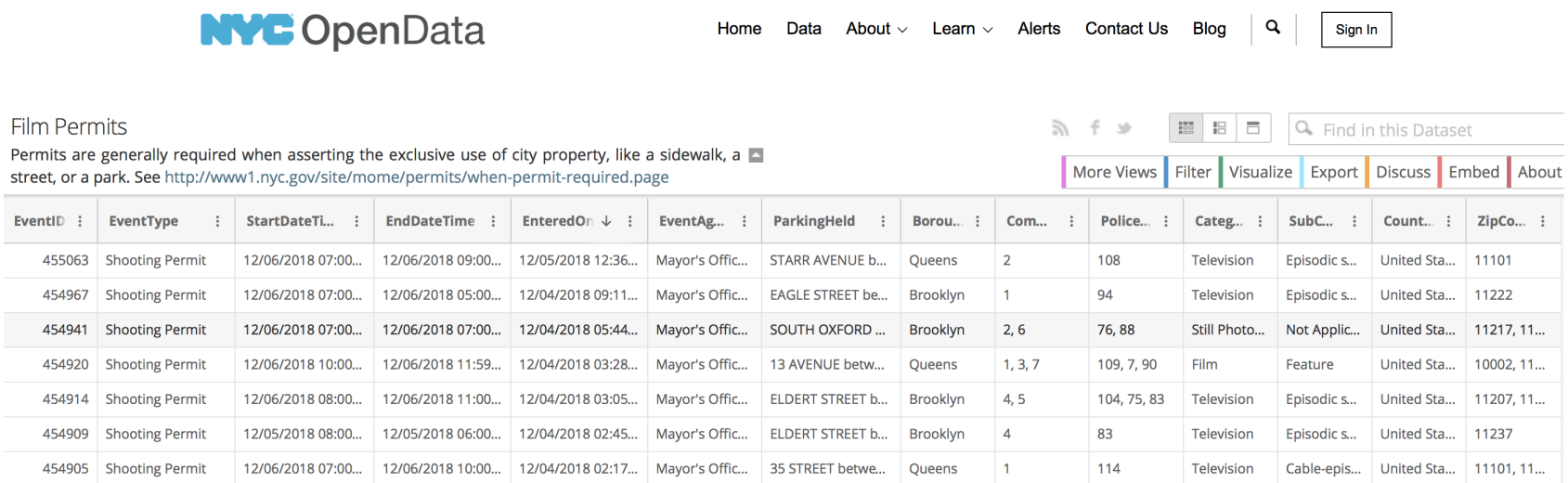

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- What's the most popular street for filming?
- What's the most popular borough?
- How many TV episodes were filmed?

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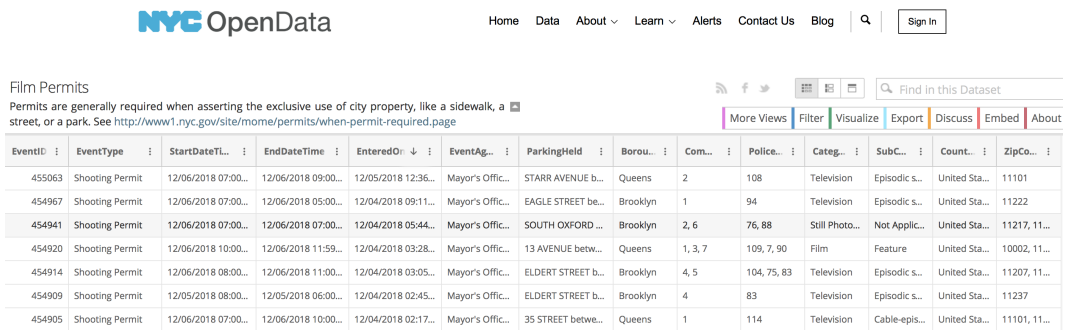

- Download the data as a CSV file and store on your computer.

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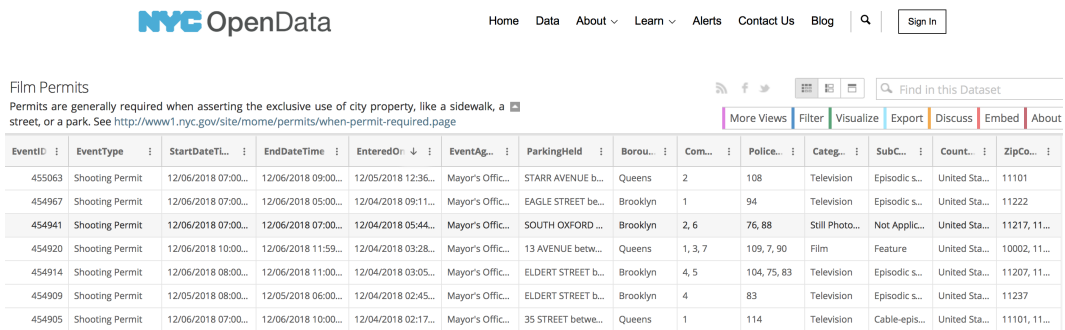

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```
#CSci 127 Teaching Staff
#March 2019
#OpenData Film Permits

#Import pandas for reading and analyzing CSV data:
import pandas as pd
csvFile = "filmPermits.csv"   #Name of the CSV file
tickets = pd.read_csv(csvFile)#Read in the file to a dataframe
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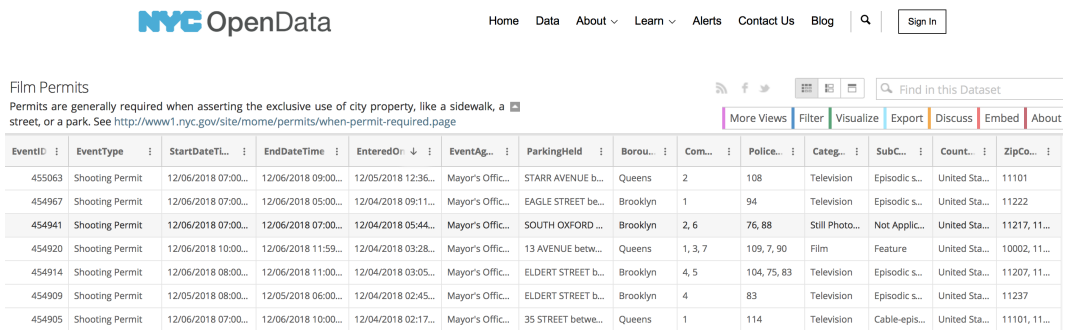

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tickets = pd.read_csv(csvFile)#Read in the file to a dataframe
print(tickets)                 #Print out the dataframe
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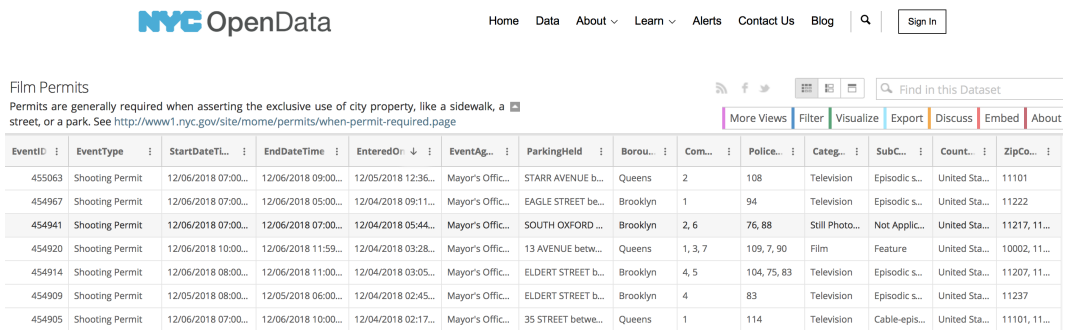

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#March 2019
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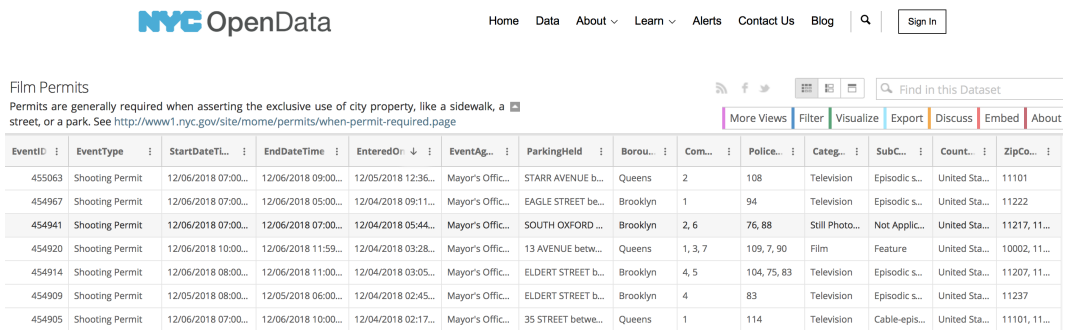

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455063	Shooting Permit	12/06/2018 07:00...	12/06/2018 09:00...	12/05/2018 12:36...	Mayor's Offic...	STARR AVENUE b...	Queens	2	108	Television	Episodic s...	United Sta...	11101
454967	Shooting Permit	12/06/2018 07:00...	12/06/2018 05:00...	12/04/2018 09:11...	Mayor's Offic...	EAGLE STREET be...	Brooklyn	1	94	Television	Episodic s...	United Sta...	11222
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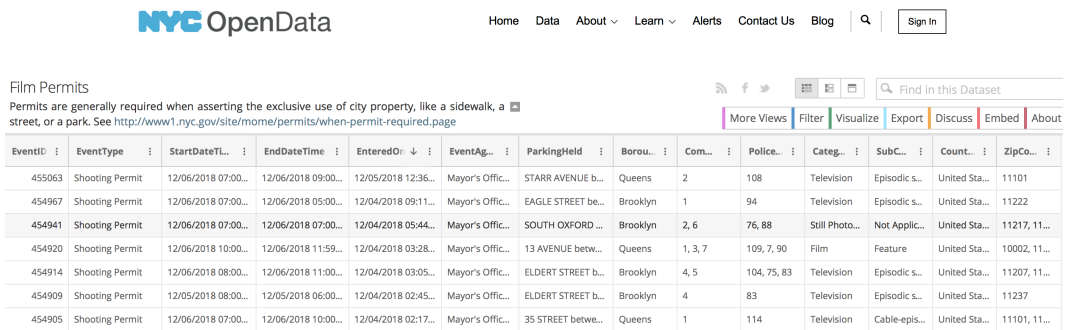

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print(tickets["ParkingHeld"].value_counts()) #Print out streets & number of times used
print(tickets["ParkingHeld"].value_counts()[:10])  #Print 10 most popular
```

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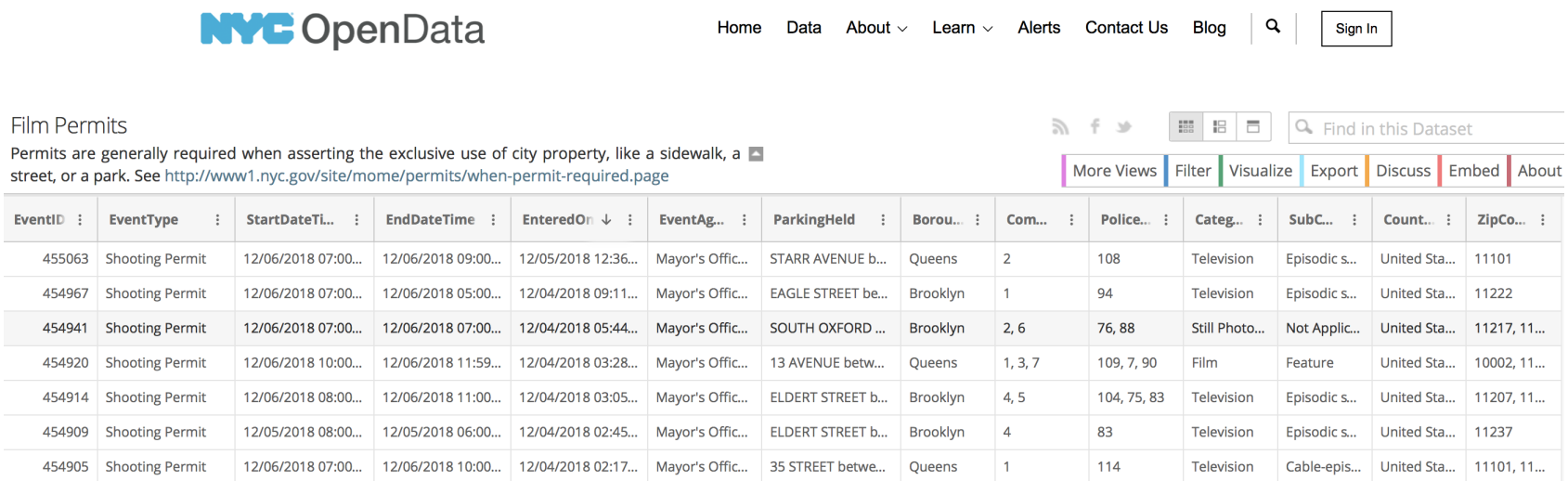

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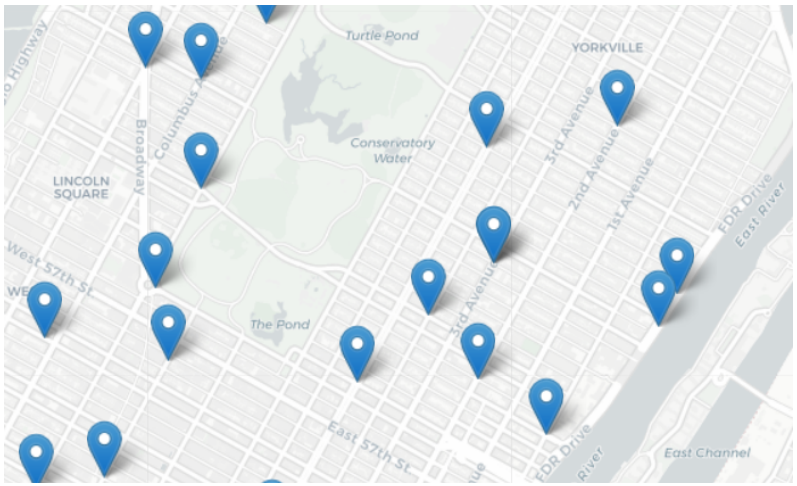
Can approach the other questions in the same way:

- What's the most popular street for filming?
- What's the most popular borough?
- How many TV episodes were filmed?

Design Question



Design an algorithm that finds the collision that is closest to input location.

DATE	TIME	BOROUGH	ZIP CODE	LATITUDE	LONGITUDE	LOCATION	ON STREET N	CROSS STREE	OFF STREET I	NUMBER OF
12/31/16	9:56						2 AVENUE			0
12/31/16	9:55	BRONX	10462	40.83521	-73.85497	(40.8352098	UNIONPORT	OLMSTEAD AVENUE		0
12/31/16	9:50						JESUP AVENUE			0
12/31/16	9:40	BROOKLYN	11225	40.66911	-73.95335	(40.6691137	ROGERS AVE	UNION STREET		0
12/31/16	20:23	BROOKLYN	11209	40.62578	-74.02415	(40.6257805	80 STREET	5 AVENUE		0
12/31/16	20:20	QUEENS	11375	40.71958	-73.83977	(40.719584,	ASCAN AVEN	QUEENS BOULEVARD		0
12/31/16	20:15	BROOKLYN	11204				60 STREET	BAY PARKWAY		0
12/31/16	20:10			40.66479	-73.82047	(40.6647944, -73.8204653)				0
12/31/16	20:10						69 STREET	37 AVENUE		0
12/31/16	20:05	BRONX	10457	40.85429	-73.90026	(40.8542925	RYER AVENU	EAST 181 STREET		0

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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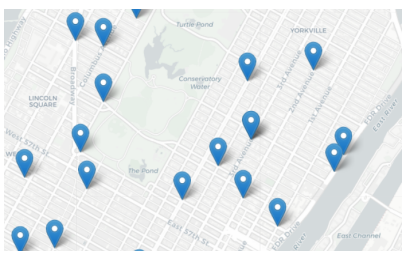
  5. Save the location with the smallest distance.

Recap



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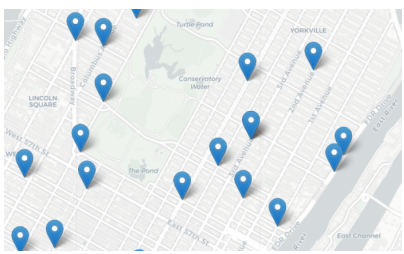

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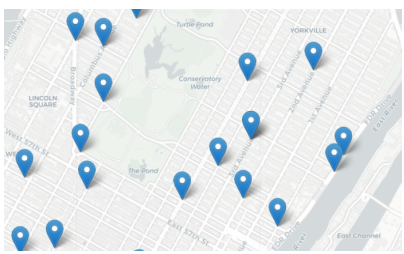

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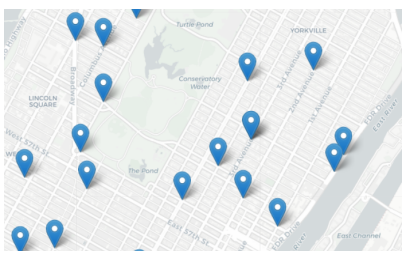

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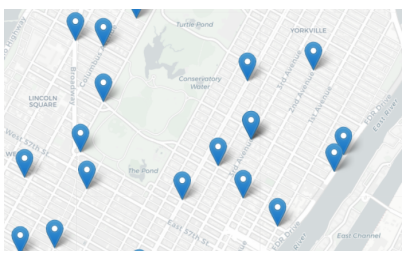

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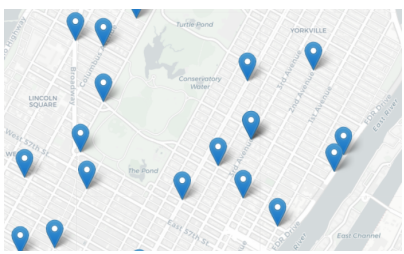

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- Accessing Formatted Data: NYC OpenData

Practice Quiz & Final Questions

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#Name:  your name here
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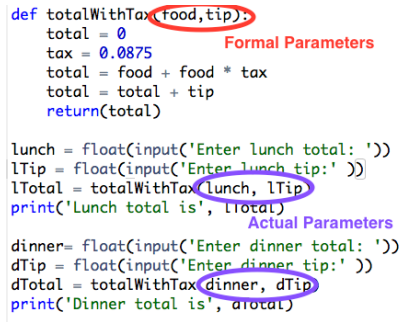

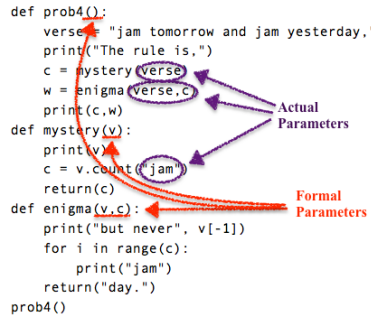

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dTotal = totalWithTax(dinner, dTip)
print('Dinner total is', dTotal)
```

Formal Parameters

Actual Parameters

```
def prob4():
    verse = "jam tomorrow and jam yesterday."
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    c = mystery(verse)
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    print(c,w)
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def enigma(v,c):
    print("but never", v[-1])
    for i in range(c):
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prob4()
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- Lightning rounds:
  - write as much you can for 60 seconds;
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  - repeat.
- Past exams are on the webpage (under Final Exam Information).
- Theme: Functions!
  Starting with Spring 19 V3, #4(b).

Weekly Reminders!

Before next lecture, don't forget to:

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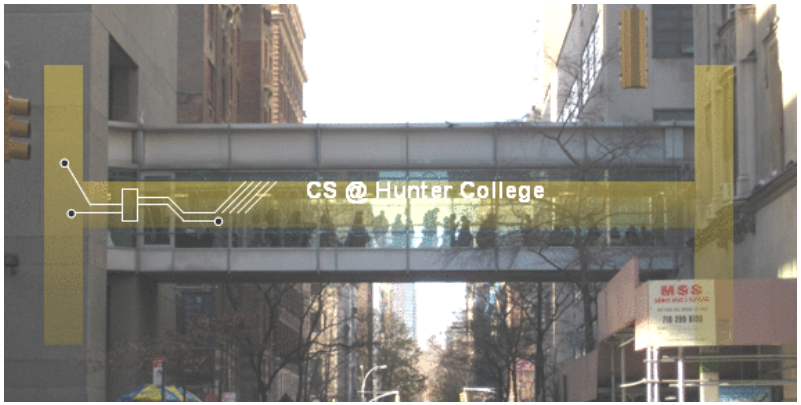

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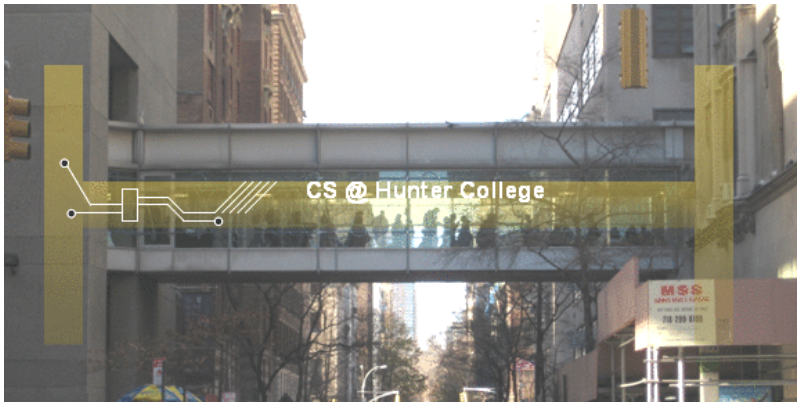

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- Take the Lecture Preview on Blackboard on Monday (or no later than 10am on Tuesday)