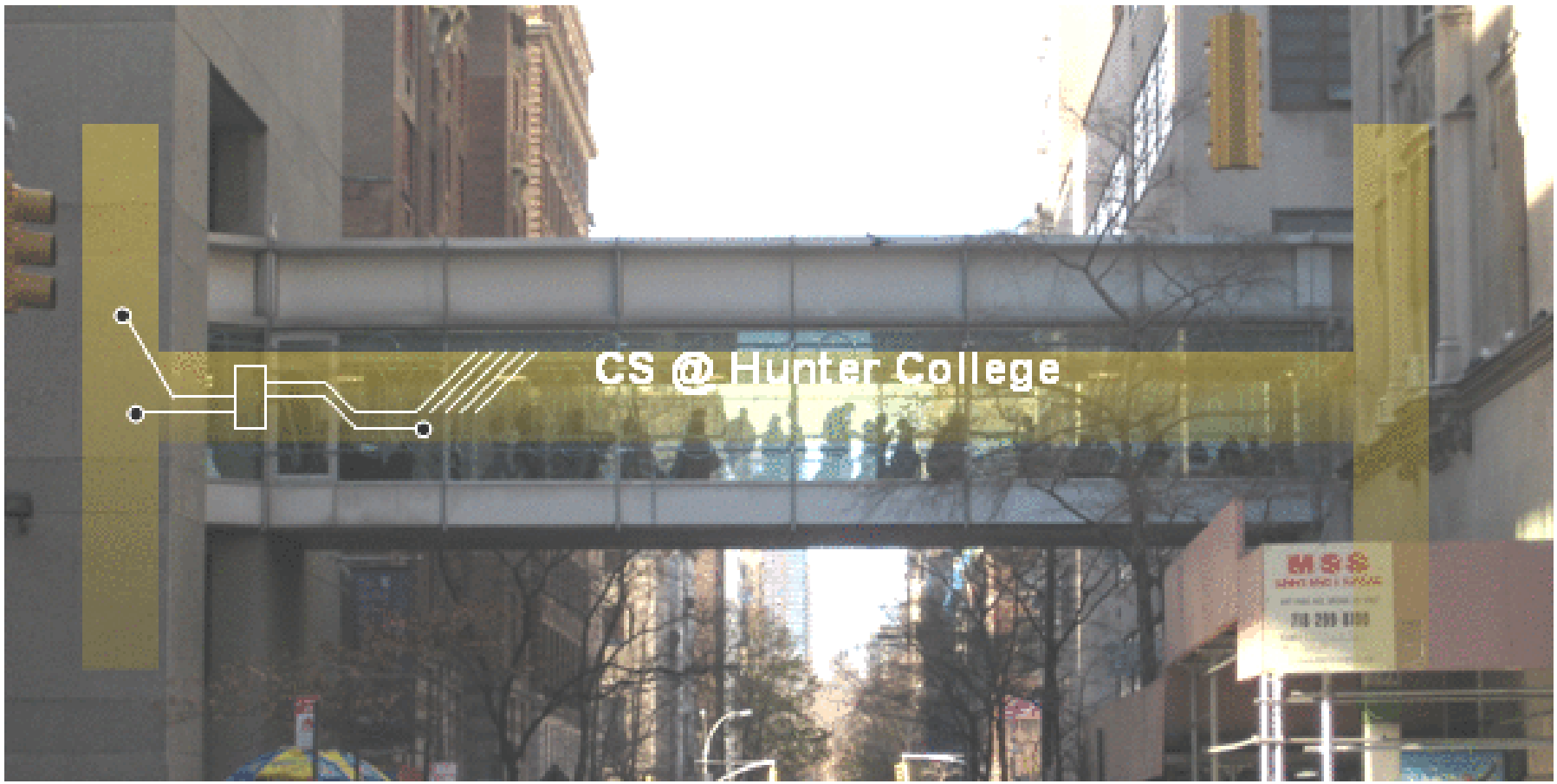
CSci 127: Introduction to Computer Science



hunter.cuny.edu/csci

Announcements

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

  Today: Prof. Raffi Khatchadourian (software engineering)

Frequently Asked Questions

From lecture slips & recitation sections.

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  Yes, we will, since 1) it's fundamental, and 2) the same ideas are used for accessing formatted data (today's topic).
- Could you spend more time on circuits/logical expressions/truth tables/decisions?
  We will do a bit today, but much more in the following weeks.

Today's Topics

- Recap: Logical Expressions & Circuits
- Accessing Formatted Data
- Preview: Functions
- Final Exam Overview

Recap: Logical Operators

and

in1		in2	*returns:*
`False`	`and`	`False`	`False`
`False`	`and`	`True`	`False`
`True`	`and`	`False`	`False`
`True`	`and`	`True`	`True`

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or

in1		in2	*returns:*
`False`	`or`	`False`	`False`
`False`	`or`	`True`	`True`
`True`	`or`	`False`	`True`
`True`	`or`	`True`	`True`

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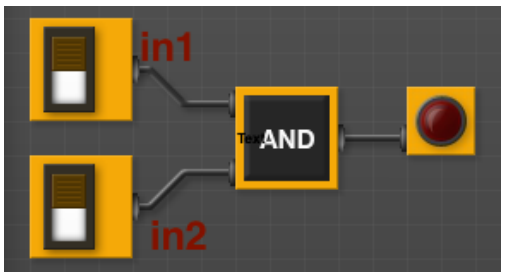
not

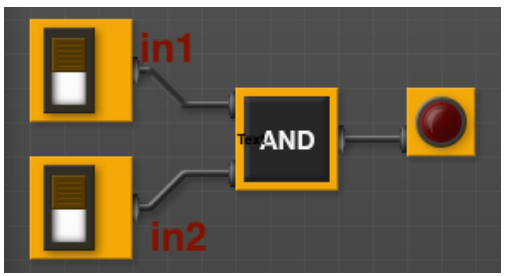
	in1	*returns:*
`not`	`False`	`True`
`not`	`True`	`False`

Logical Operators & Circuits

- Each logical operator (`and`, `or`, & `not`) can be used to join together expressions.



Logical Operators & Circuits



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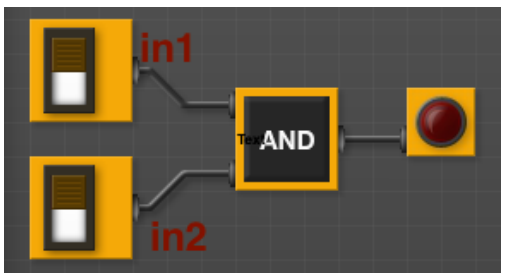
  Example: `in1 and in2`

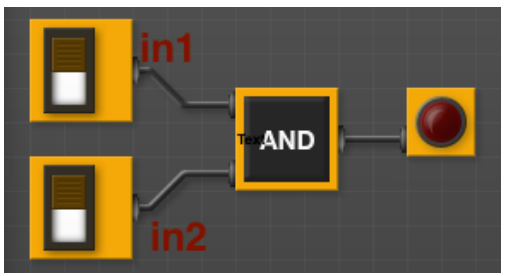
Logical Operators & Circuits



- Each logical operator (`and`, `or`, & `not`) can be used to join together expressions.

  Example: `in1 and in2`
- Each logical operator (`and`, `or`, & `not`) has a corresponding logical circuit that can be used to join together inputs.

Logical Operators & Circuits



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  Example: `in1 and in2`
- Each logical operator (`and`, `or`, & `not`) has a corresponding logical circuit that can be used to join together inputs.

  Example: see image.

Examples:

Examples from last lecture:

```
origin = "Indian Ocean"
winds = 100
if (winds > 74):
    print("Major storm, called a ", end="")
    if origin == "Indian Ocean" or origin == "South Pacific":
        print("cyclone.")
    elif origin == "North Pacific":
        print("typhoon.")
    else:
        print("hurricane.")

visibility = 0.2
winds = 40
conditions = "blowing snow"
if (winds > 35) and (visibility < 0.25) and \
      (conditions == "blowing snow" or conditions == "heavy snow"):
    print("Blizzard!")
```

In Pairs or Triples:

Predict what the code will do:

```
x = 6
y = x % 4
w = y**3
z = w // 2
print(x,y,w,z)
x,y = y,w
print(x,y,w,z)
x = y / 2
print(x,y,w,z)
```

```
sports = ["Field Hockey","Swimming","Water Polo"]
mess = "Qoauxca BrletRce crcx qvBnqa ocUxk"
result = ""
for i in range(len(mess)):
    if i % 3 == 0:
        print(mess[i])
        result = result + mess[i]
print(sports[1], result)
```

- And, design a program that asks the user for an image and then displays the upper left quarter of the image.
  (First, design the pseudocode. If time, expand to a Python program.)

Python Tutor

```
x = 6
y = x % 4
w = y**3
z = w // 2
print(x,y,w,z)
x,y = y,w
print(x,y,w,z)
x = y / 2
print(x,y,w,z)
```

(Demo with pythonTutor)

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- Example:
  1. Ask user for an image name.

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- Example:
  1. Ask user for an image name.
  2. Read in image.

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- Example:
  1. Ask user for an image name.
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  3. Figure out size of image.

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  1. Ask user for an image name.
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  4. Make a new image that's half the height and half the width.

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  2. Read in image.
  3. Figure out size of image.
  4. Make a new image that's half the height and half the width.
  5. Display the new image.

Structured Data

	Undergraduate		
College	Full-time	Part-time	Total
Baruch	11,288	3,922	15,210
Brooklyn	10,198	4,208	14,406
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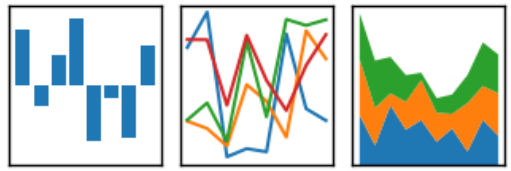
Structured Data

pandas

$y_{it} = \beta' x_{it} + \mu_i + \epsilon_{it}$



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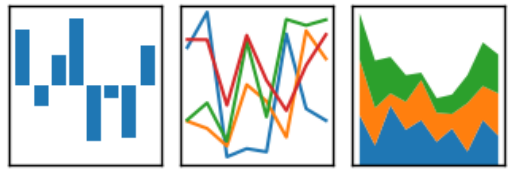

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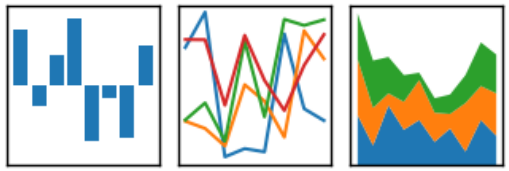

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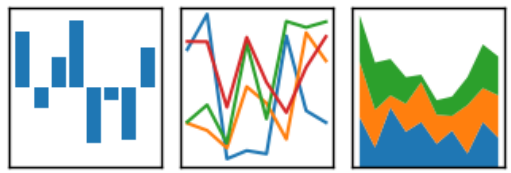

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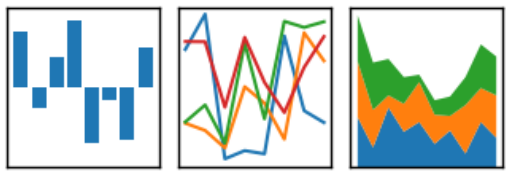

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- To use, add to the top of your file:

```
import pandas as pd
```

CSV Files

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- Columns are separated by commas on each line.

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
1820,123706,11187,8246,2782,6135,152056
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
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nycHistPop.csv

Reading in CSV Files

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College	Full-time	Part-time	Total
Baruch	11,288	3,922	15,210
Brooklyn	10,198	4,208	14,406
City	10,067	3,250	13,317
Hunter	12,223	4,500	16,723
John Jay	9,831	2,843	12,674
Lehman	6,600	4,720	11,320
Medgar Evers	4,760	2,059	6,819
NYCCT	10,912	6,370	17,282
Queens	11,693	4,633	16,326
Staten Island	9,584	2,948	12,532
York	5,066	3,192	8,258

- To read in a CSV file: `myVar = pd.read_csv("myFile.csv")`

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Example: Reading in CSV Files

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`nycHistPop.csv`

In Lab 6

Example: Reading in CSV Files

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import matplotlib.pyplot as plt
import pandas as pd
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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)
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nycHistPop.csv

In Lab 6

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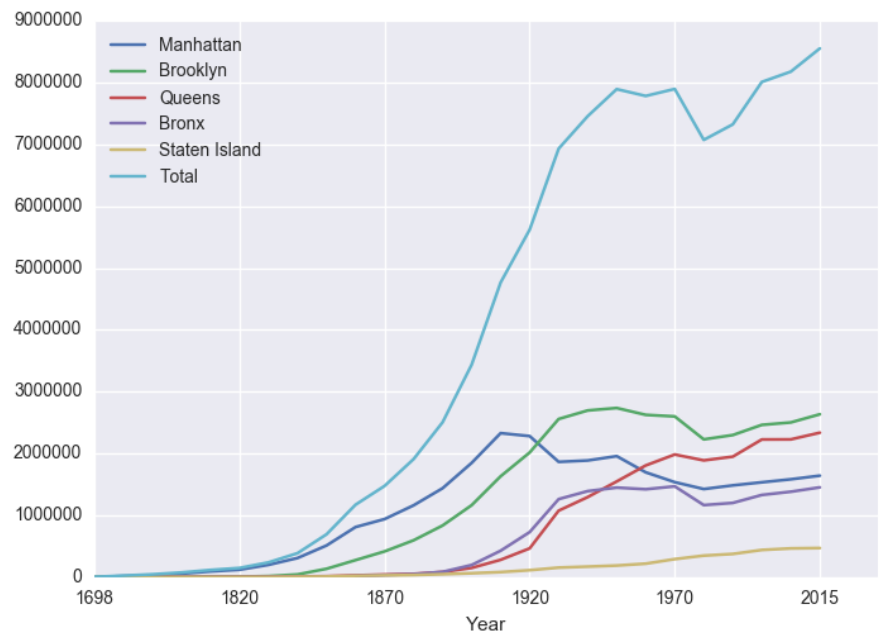
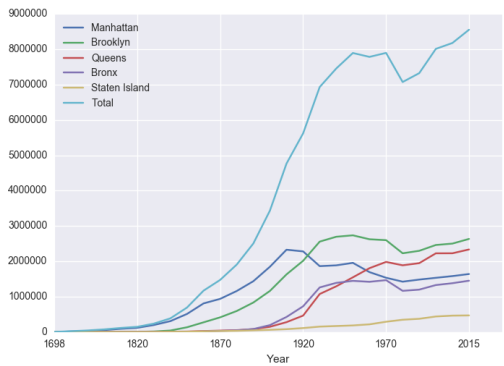
nycHistPop.csv

In Lab 6

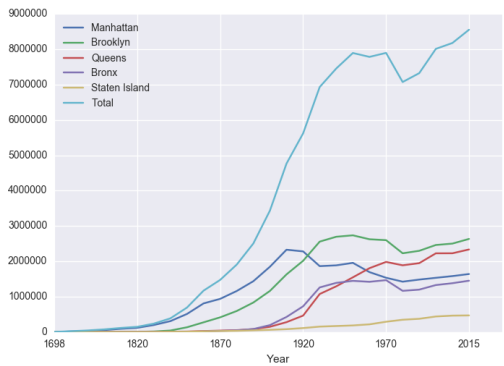


Series in Pandas



- Series can store a column or row of a DataFrame.

Series in Pandas



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- Example: `pop["Manhattan"]` is the Series corresponding to the column of Manhattan data.

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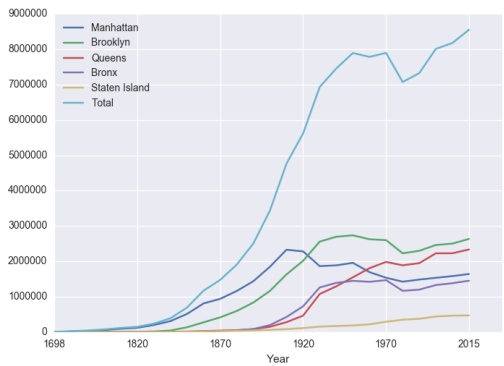
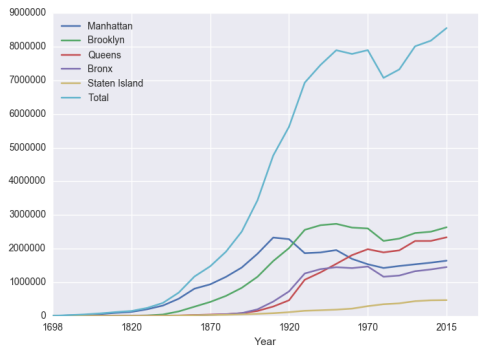


- Series can store a column or row of a DataFrame.
- Example: `pop["Manhattan"]` is the Series corresponding to the column of Manhattan data.
- Example:
```
print("The largest number living in the Bronx is", pop["Bronx"].max())
```

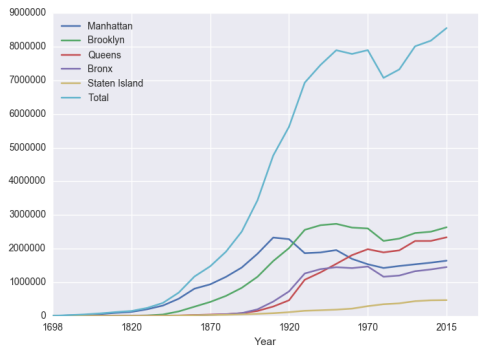
In Pairs or Triples



Predict what the following will do:

- `print("Queens:", pop["Queens"].min())`

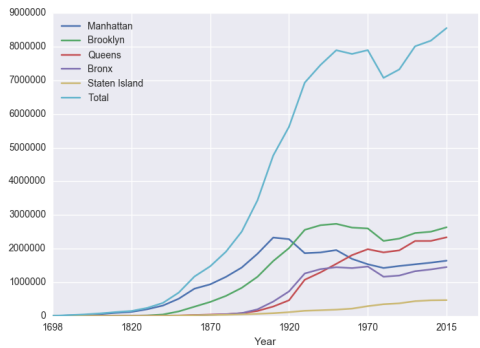
In Pairs or Triples



Predict what the following will do:

- `print("Queens:", pop["Queens"].min())`
- `print("S I:", pop["Staten Island"].mean())`

In Pairs or Triples



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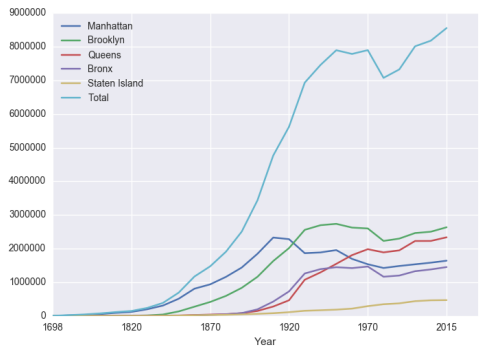

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- `print("Queens:", pop["Queens"].min())`
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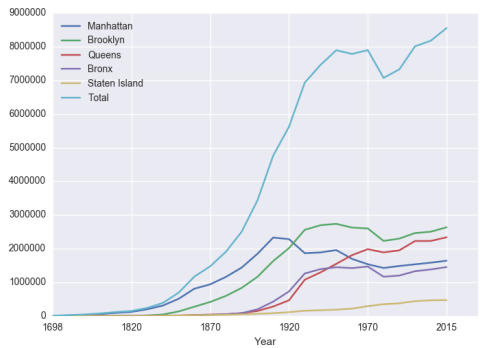
- `print("S I:", pop["Staten Island"].std())`
- `pop.plot.bar(x="Year")`

In Pairs or Triples



Predict what the following will do:

- `print("Queens:", pop["Queens"].min())`
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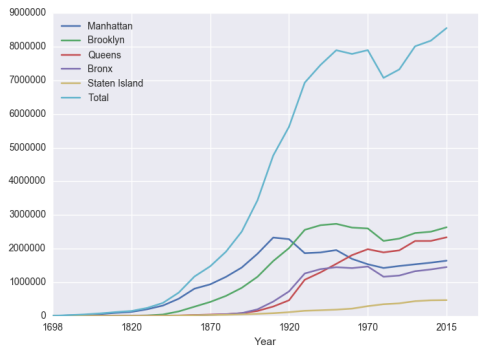
- `pop.plot.bar(x="Year")`
- `pop.plot.scatter(x="Brooklyn", y="Total")`

In Pairs or Triples



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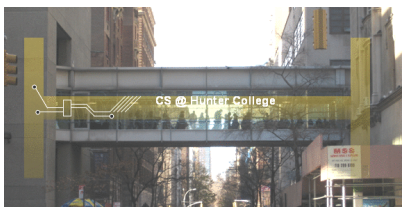
- `print("S I:", pop["Staten Island"].mean())`
- `print("S I:", pop["Staten Island"].std())`
- `pop.plot.bar(x="Year")`
- `pop.plot.scatter(x="Brooklyn", y="Total")`
- `pop["Fraction"] = pop["Bronx"]/pop["Total"]`

CS Survey Talk

Prof. Raffi Khatchadourian

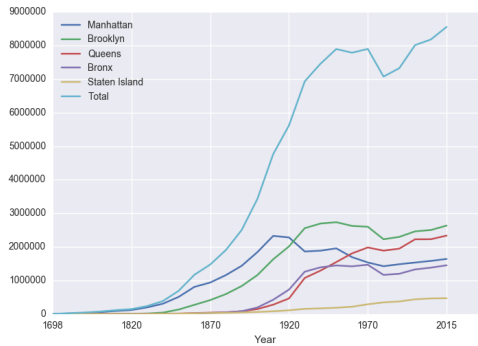


Department of Computer Science
Hunter College & the Graduate Center
Software Engineering

Solutions

Predict what the following will do:

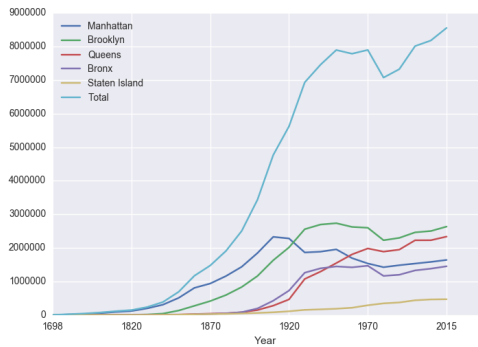
- `print("Queens:", pop["Queens"].min())`



Solutions

Predict what the following will do:

- `print("Queens:", pop["Queens"].min())`
  Minimum value in the column with label "Queens".



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Predict what the following will do:

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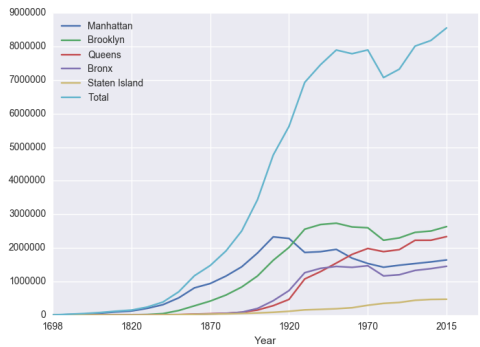
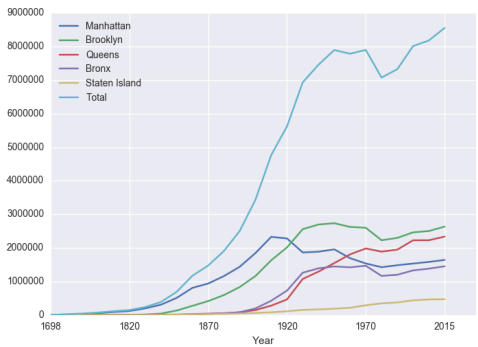
  Minimum value in the column with label "Queens".
- `print("S I:", pop["Staten Island"].mean())`



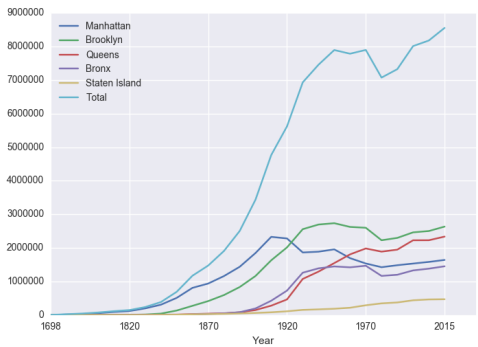
Solutions



Predict what the following will do:

- `print("Queens:", pop["Queens"].min())`
  Minimum value in the column with label "Queens".
- `print("S I:", pop["Staten Island"].mean())`
  Average of values in the column "Staten Island".

Solutions



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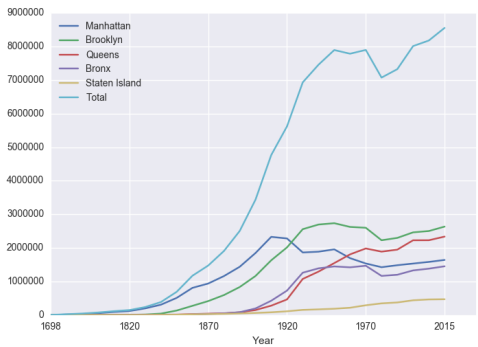
  Average of values in the column "Staten Island".
- `print("S I :", pop["Staten Island"].std())`

Solutions



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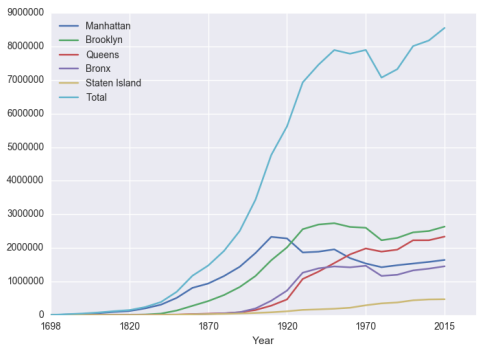
  Standard deviation of values in the column "Staten Island".

Solutions



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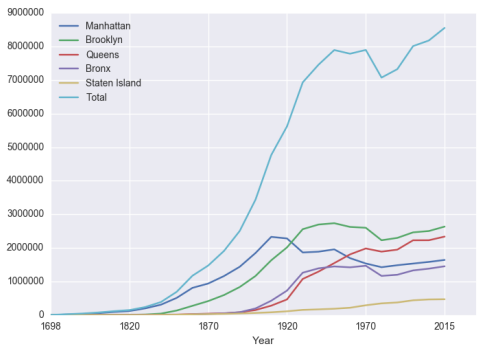
  Standard deviation of values in the column "Staten Island".
- `pop.plot.bar(x="Year")`

Solutions



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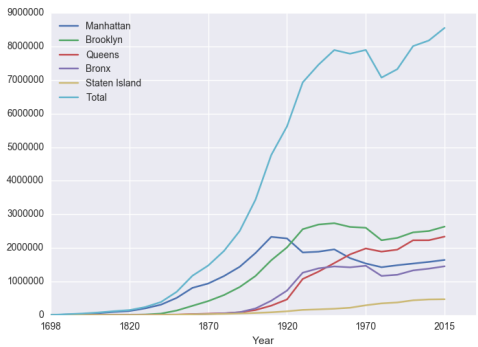
- `pop.plot.bar(x="Year")`
  Bar chart with x-axis "Year".

Solutions



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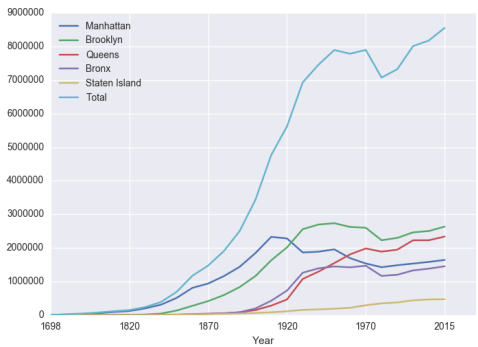
  Standard deviation of values in the column "Staten Island".
- `pop.plot.bar(x="Year")`
  Bar chart with x-axis "Year".
- `pop.plot.scatter(x="Brooklyn", y="Total")`

Solutions



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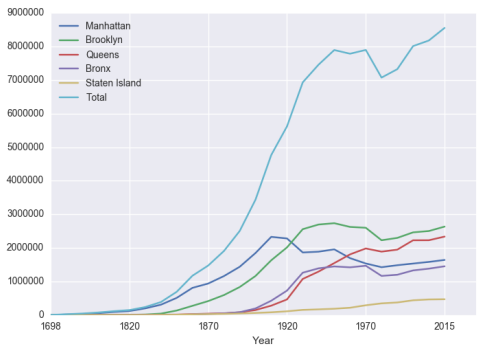
  Standard deviation of values in the column "Staten Island".
- `pop.plot.bar(x="Year")`
  Bar chart with x-axis "Year".
- `pop.plot.scatter(x="Brooklyn", y="Total")`
  Scatter plot of Brooklyn versus Total values.

Solutions



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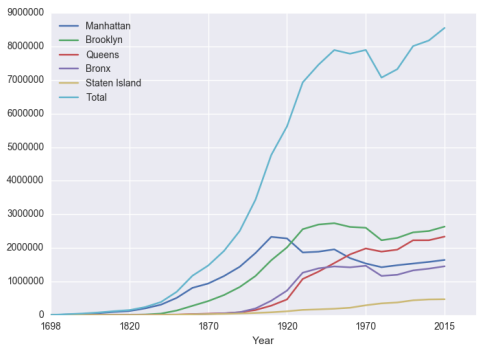
- `pop.plot.bar(x="Year")`
  Bar chart with x-axis "Year".
- `pop.plot.scatter(x="Brooklyn", y="Total")`
  Scatter plot of Brooklyn versus Total values.
- `pop["Fraction"] = pop["Bronx"]/pop["Total"]`

Solutions



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- `pop.plot.bar(x="Year")`
  Bar chart with x-axis "Year".
- `pop.plot.scatter(x="Brooklyn", y="Total")`
  Scatter plot of Brooklyn versus Total values.
- `pop["Fraction"] = pop["Bronx"]/pop["Total"]`
  New column with the fraction of population that lives in the Bronx.

In Pairs or Triples

	Undergraduate		
College	Full-time	Part-time	Total
Baruch	11,288	3,922	15,210
Brooklyn	10,198	4,208	14,406
City	10,067	3,250	13,317
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`cunyF2016.csv`

Write a complete Python program that reads in the file, `cunyF2016.csv`, and produces a scatter plot of full-time versus part-time enrollment.

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Solution:

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3. *Set up a scatter plot.*
4. *Display plot.*

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3. *Set up a scatter plot.*

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```
pop.plot(x="Full-time",y="Part-time")
```
4. *Display plot.*

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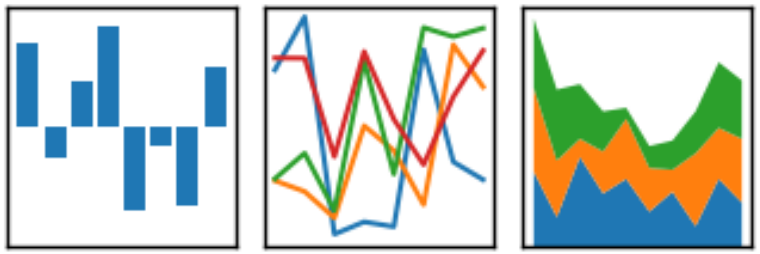
```
3. *Set up a scatter plot.*
```
pop.plot(x="Full-time",y="Part-time")
```
4. *Display plot.*
```
plt.show()
```

Recap

pandas

$$y_{it} = \beta' x_{it} + \mu_i + \epsilon_{it}$$



- Pandas library has elegant solutions for accessing & analyzing structured data.

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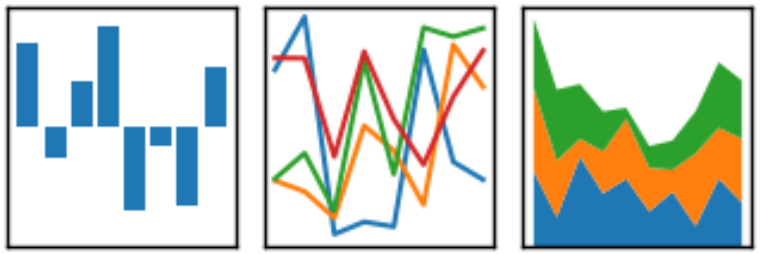

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- Can manipulate individual columns or rows ('Series').

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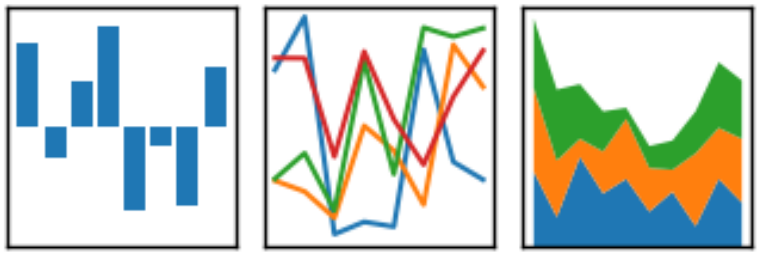
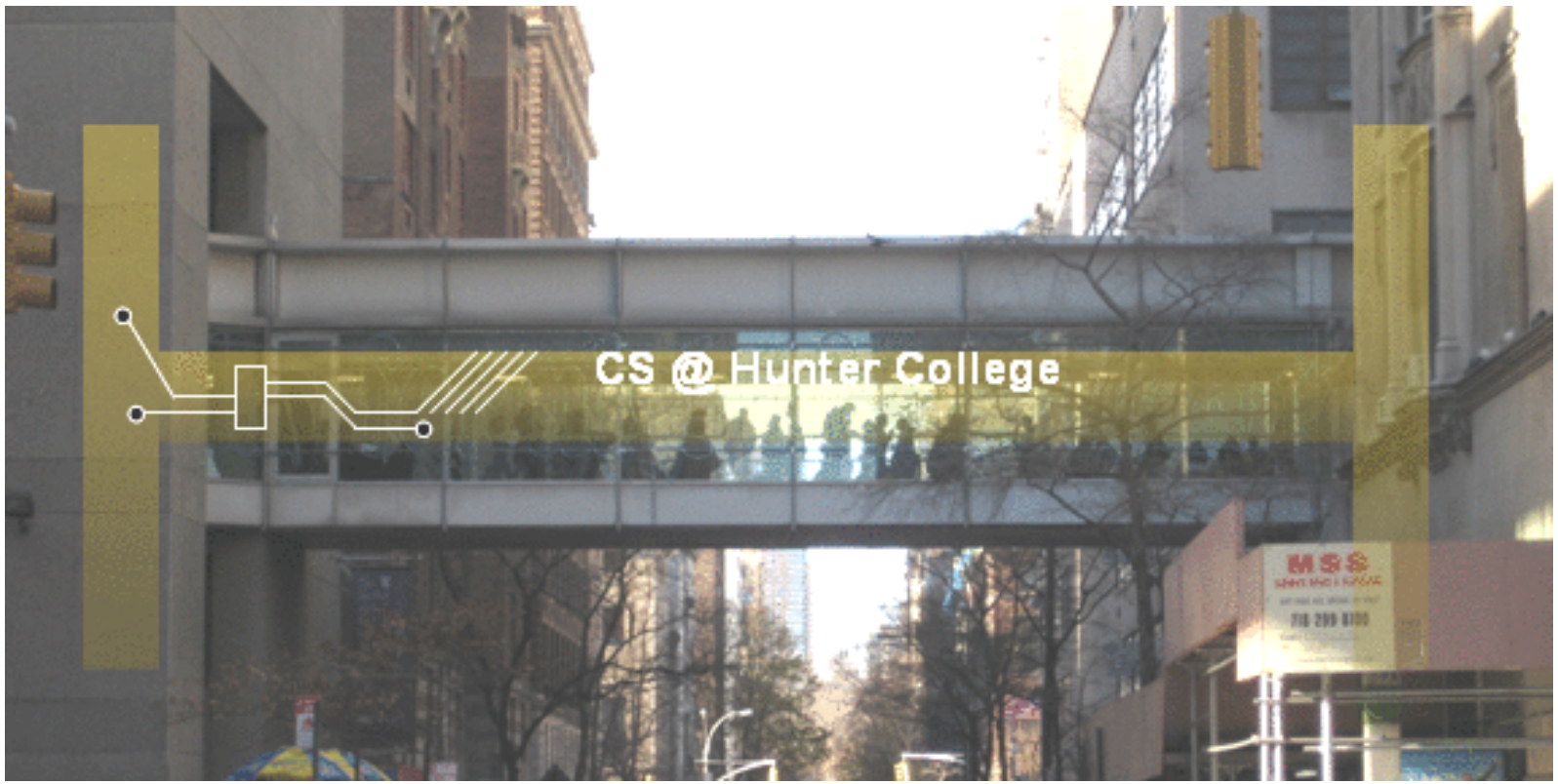


- Pandas library has elegant solutions for accessing & analyzing structured data.
- Can manipulate individual columns or rows ('Series').
- Has useful functions for the entire sheet ('DataFrame') such as plotting.

Lecture Slips



- On-line lecture slips: `tinyurl.com/yc6j6ubr`

Final Prep

- Starting today, the last 5 minutes of lecture will be on mock final exam questions.

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- Will discuss solutions next lecture.