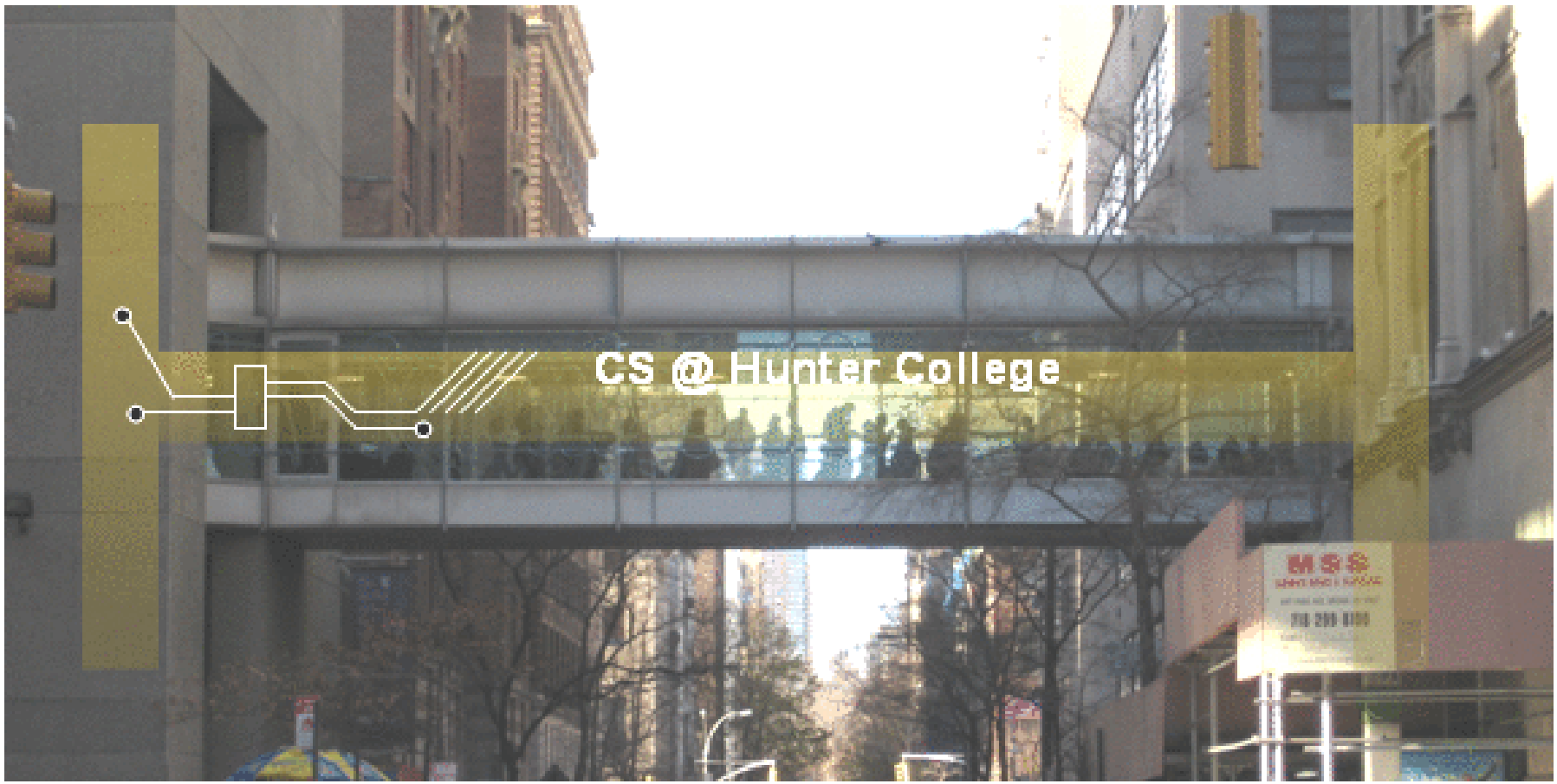
CSci 127: Introduction to Computer Science



hunter.cuny.edu/csci

Frequently Asked Questions

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  1) it's fundamental, and
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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).
- **I still don't get what is meant by input?**
  Input is data provided to a program each time it runs, it may change at each run. In this course we wrote programs that get input from the user via the input() function or by reading a file.

Today's Topics

- Recap: Logical Expressions & Circuits
- Design: Cropping Images
- Accessing Formatted Data

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- **Recap: Logical Expressions & Circuits**
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Recap: Logical Operators

and

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

Recap: Logical Operators

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

in1		in2	*returns:*
`False`	`or`	`False`	`False`
`False`	`or`	`True`	`True`
`True`	`or`	`False`	`True`
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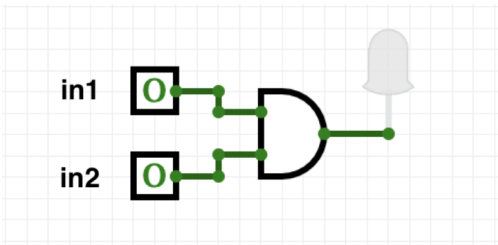
not

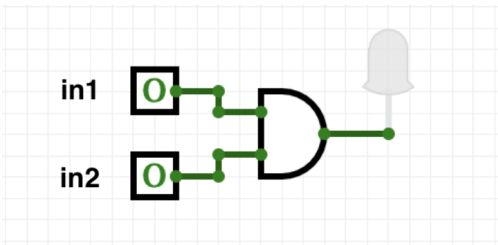
	in1	*returns:*
`not`	`False`	`True`
`not`	`True`	`False`

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`

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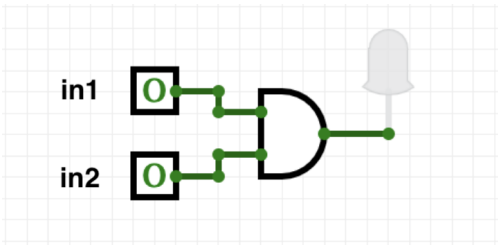
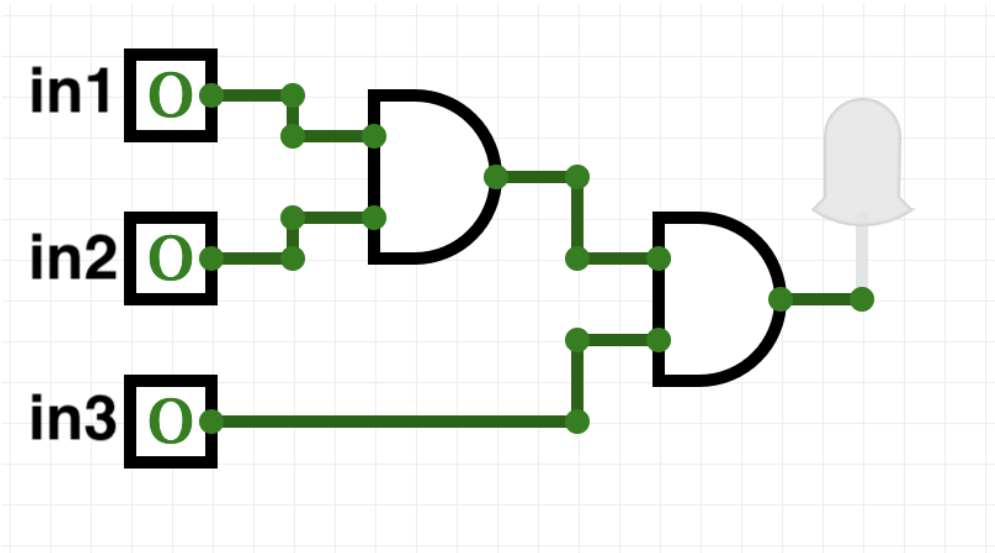


- Each logical operator (`and`, `or`, & `not`) can be used to join together expressions.

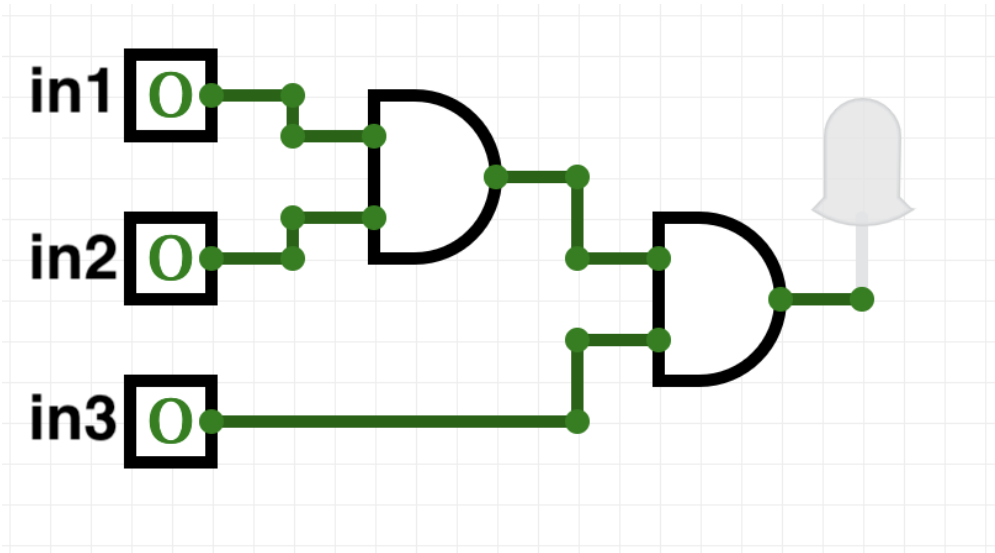
  Example: `in1 and in2`
- Each logical operator (`and`, `or`, & `not`) has a corresponding logical circuit that can be used to join together inputs.

Examples: Logical Circuit



link to CircuitVerse

Examples: Logical Circuit



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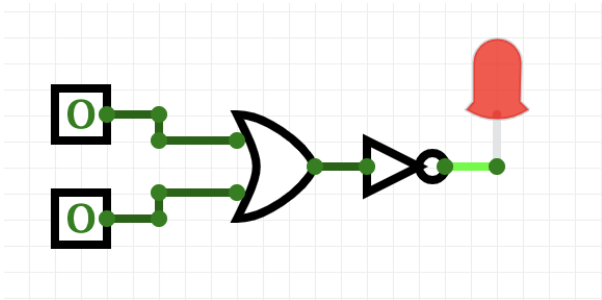
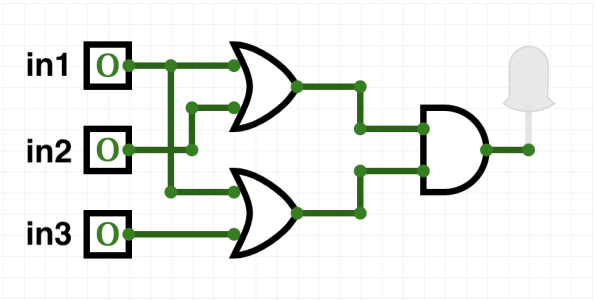
`(in1 and in2) and in3`

More Circuit Examples

Examples from last lecture:





Draw a circuit that corresponds to each logical expression:

- `not( in1 or in2 )`
- `(in1 or in2) and (in1 or in3)`
- `(not(in1 and not in2)) or (in1 and (in2 and in3))`

Challenge: *Predict what the code will do:*

code in PythonTutor

```
1 x = 6
2 y = x % 4
3 w = y**3
4 z = w // 2
5 print(x,y,w,z)
6 x,y = y,w
7 print(x,y,w,z)
8 x = y / 2
9 print(x,y,w,z)
```

String Challenge

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

code in PythonTutor

Today's Topics

- Recap: Logical Expressions & Circuits
- **Design: Cropping Images**
- Accessing Formatted Data
- CS Survey: Astrophysics and astropy

Challenge: Design Question

From Final Exam, Fall 2017, V4, #6.

Design an algorithm that reads in an image and displays the lower left corner of the image.

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Input:
Output:
Process: *(Brainstorm for a "To Do" list to accomplish this.)*

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  5. Make a new image that's half the height and half the width.

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In Pairs or Triples: Design Question

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inF = input('Enter file name: ')
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img = plt.imread(inF) #Read in image from inF
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The City Univers

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height = img.shape[0] #Get height
width = img.shape[1] #Get width
```

In Pairs of Triples: Design Question: II

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img2 = img[height//2:, :width//2] #Crop to lower
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```

6. Display the new image.

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

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- Design: Cropping Images
- **Accessing Formatted Data**
- CS Survey: Astrophysics and astropy

Structured Data

	Undergraduate		
College	Full-time	Part-time	Total
Baruch	11,288	3,922	15,210
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John Jay	9,831	2,843	12,674
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Structured Data

pandas

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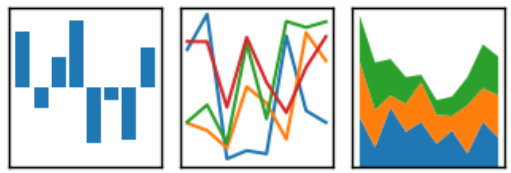

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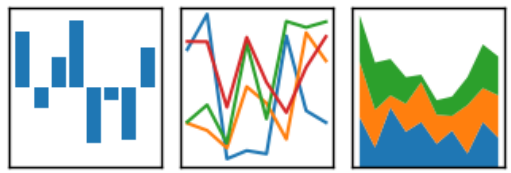

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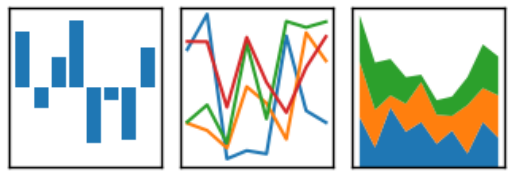

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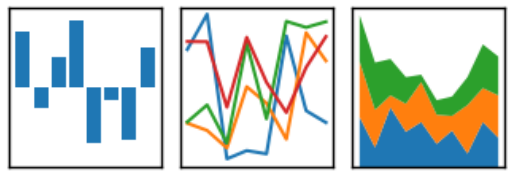

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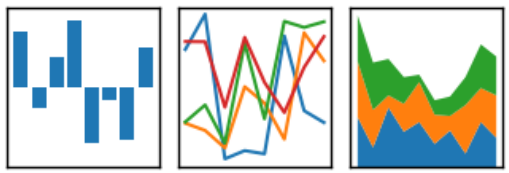

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- To use, add to the top of your program:

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import pandas as pd
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CSV Files

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York	5,066	3,192	8,258

- Excel .xls files have much extra formatting.
- The text file version is called **CSV** for comma separated values.
- Each row is a line in the file.

CSV Files

	Undergraduate		
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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
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nycHistPop.csv

Reading in CSV Files

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- It also has **Series**, that is perfect for holding a row or column of data.

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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In Lab 6

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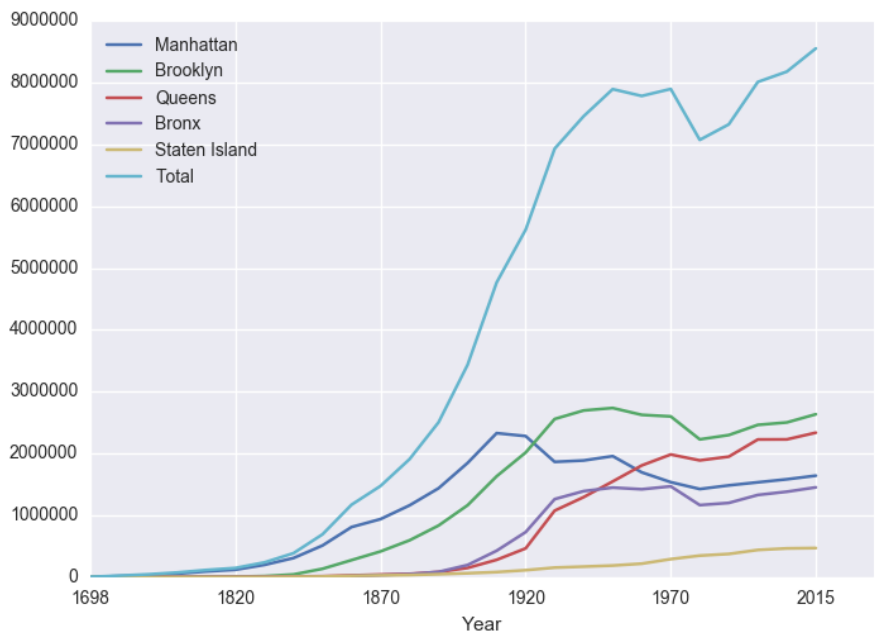
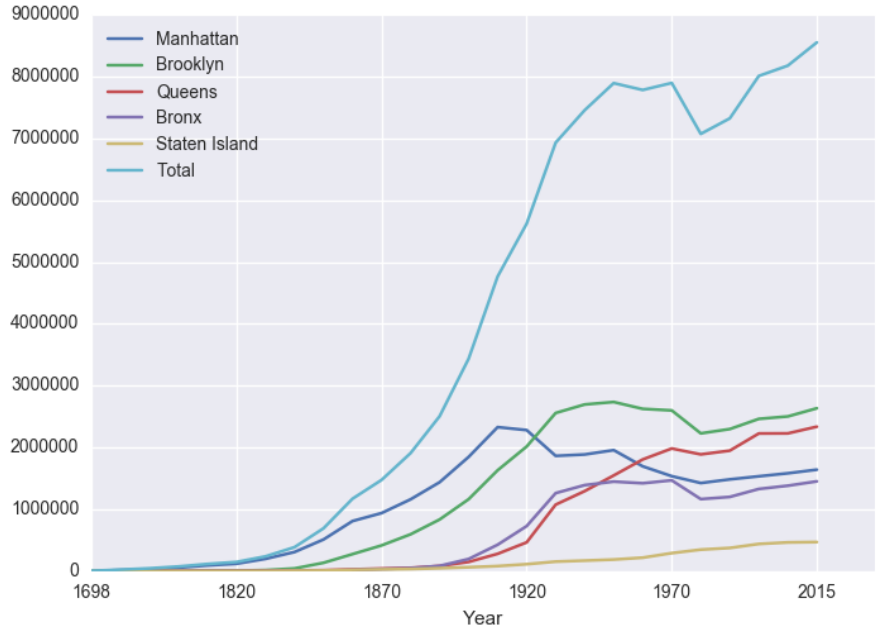
nycHistPop.csv

In Lab 6

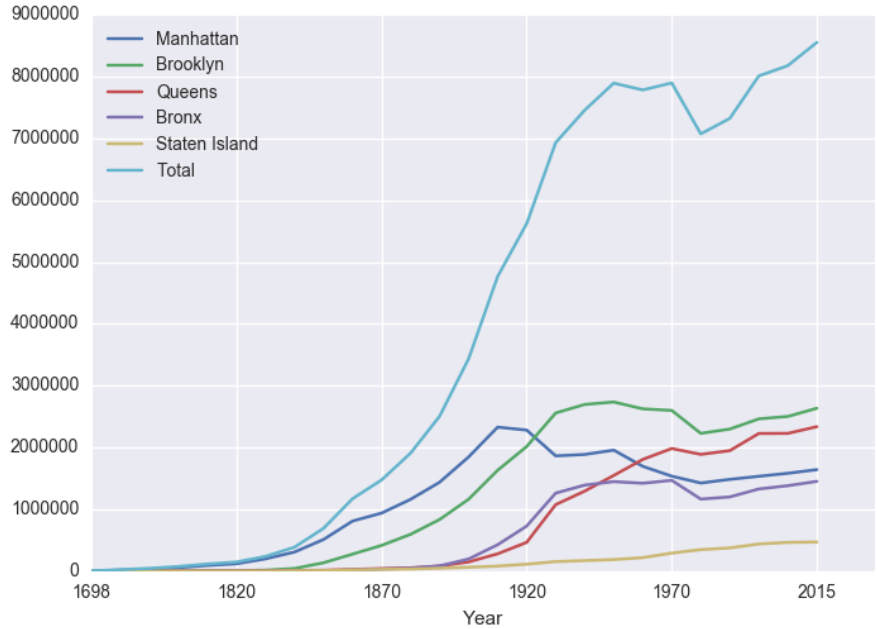


Series in Pandas



- 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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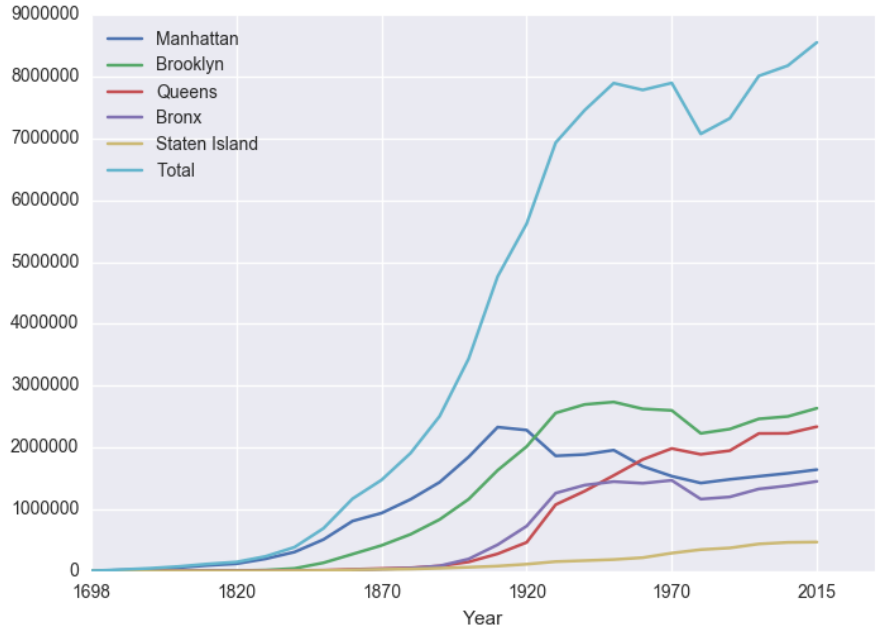
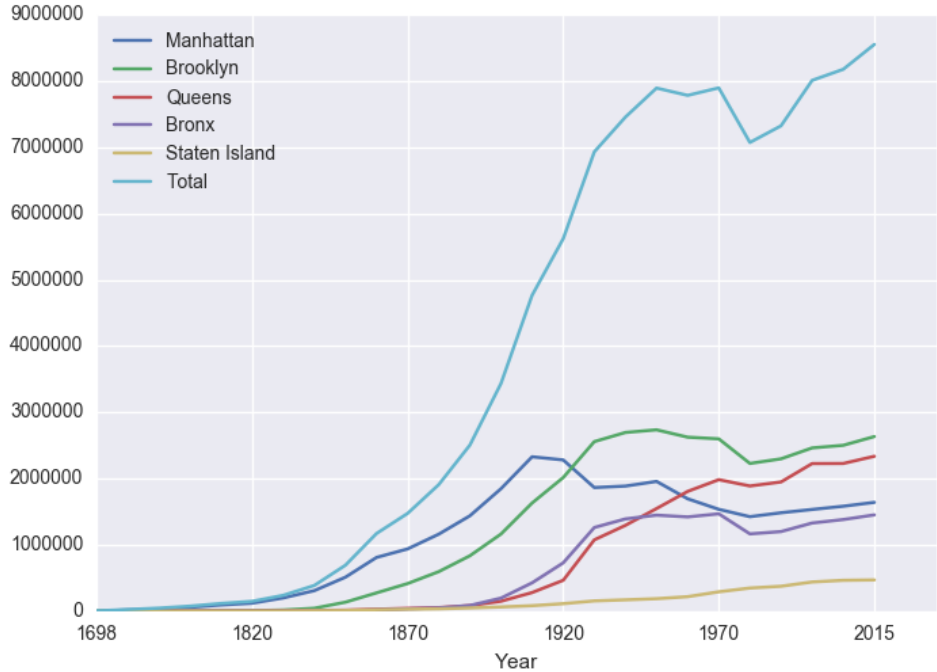


- Series can store a column or row of a DataFrame.
- Example: `pop["Manhattan"]` is the Series corresponding to the column of Manhattan data.
- Example:

```
print("The largest number living in the Bronx is",
pop["Bronx"].max())
```

Challenge:



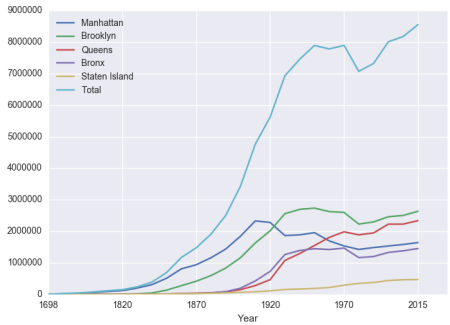
Predict what the following will do:

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

Solutions

Predict what the following will do:

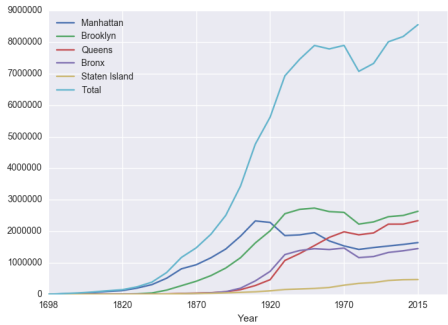
- `print("Queens:", pop["Queens"].min())`



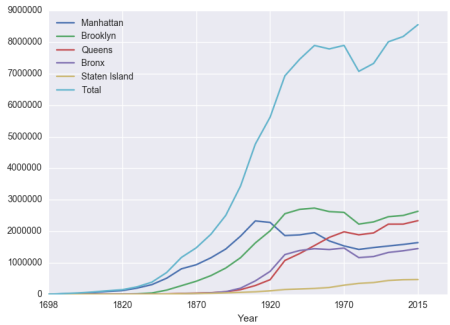
Solutions

Predict what the following will do:

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



Solutions



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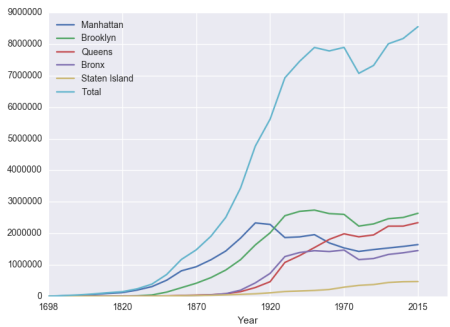
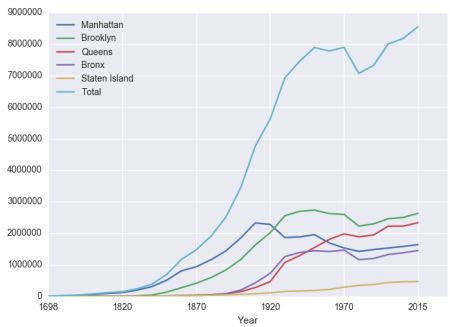


Predict what the following will do:

- `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".

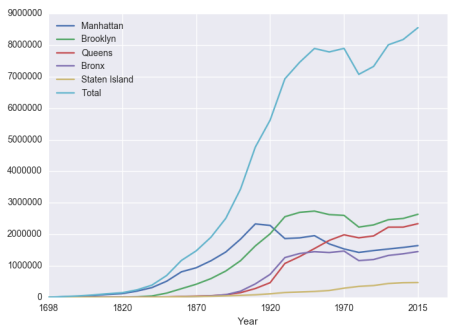
Solutions



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

Solutions



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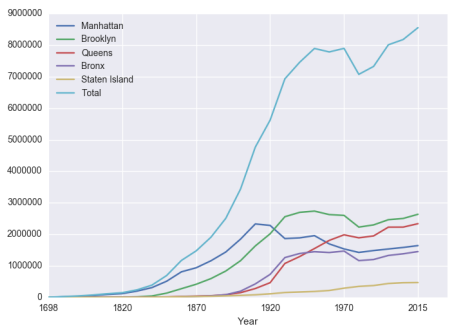
- `print("S I:", pop["Staten Island"].mean())`
  Average of values in the column "Staten Island".
- `print("S I :", pop["Staten Island"].std())`
  Standard deviation of values in the column "Staten Island".

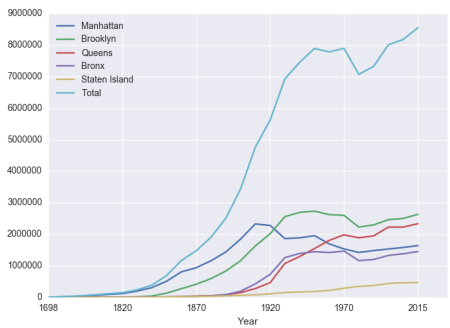
Solutions



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".
- `print("S I :", pop["Staten Island"].std())`
  Standard deviation of values in the column "Staten Island".
- `pop.plot.bar(x="Year")`

Solutions



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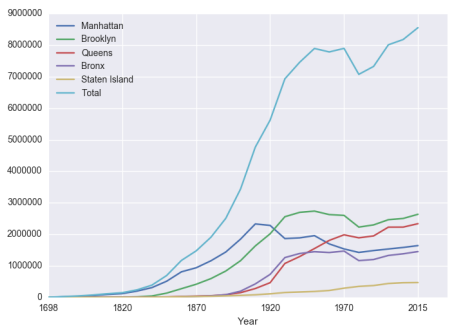
- `print("S I:", pop["Staten Island"].mean())`
  Average of values in the column "Staten Island".
- `print("S I :", pop["Staten Island"].std())`
  Standard deviation of values in the column "Staten Island".
- `pop.plot.bar(x="Year")`
  Bar chart with x-axis "Year".

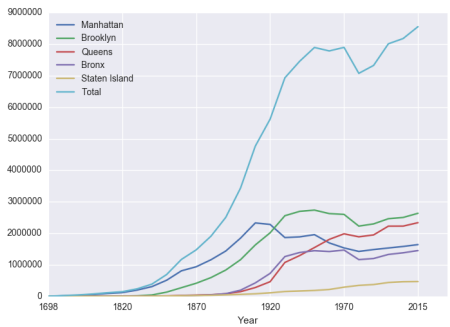
Solutions



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

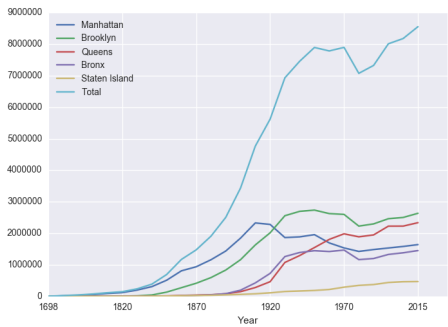
Solutions



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

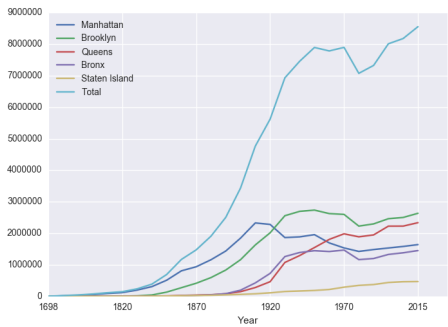
Solutions



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".
- `print("S I :", pop["Staten Island"].std())`
  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.
- `pop["Fraction"] = pop["Bronx"]/pop["Total"]`

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".
- `print("S I :", pop["Staten Island"].std())`
  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.
- `pop["Fraction"] = pop["Bronx"]/pop["Total"]`
  New column with the fraction of population that lives in the Bronx.

Challenge:

	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
Hunter	12,223	4,500	16,723
John Jay	9,831	2,843	12,674
Lehman	6,600	4,720	11,320
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Staten Island	9,584	2,948	12,532
York	5,066	3,192	8,258

`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.

Challenge:

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Baruch	11,288	3,922	15,210
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Solution:

1. *Include pandas & pyplot libraries.*

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Solution:

1. *Include pandas & pyplot libraries.*
2. *Read in the CSV file.*
3. *Set up a scatter plot.*
4. *Display plot.*

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Solution:

1. *Include pandas & pyplot libraries.*

```
import matplotlib.pyplot as plt
import pandas as pd
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import pandas as pd
```
2. *Read in the CSV file.*
```
pop=pd.read_csv('cunyF2016.csv',skiprows=1)
```

Challenge:

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import pandas as pd
```
2. *Read in the CSV file.*
```
pop=pd.read_csv('cunyF2016.csv',skiprows=1)
```
3. *Set up a scatter plot.*
```
pop.plot.scatter(x="Full-time",y="Part-time")
```

Challenge:

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```
4. *Display plot.*

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```
2. *Read in the CSV file.*
```
pop=pd.read_csv('cunyF2016.csv',skiprows=1)
```
3. *Set up a scatter plot.*
```
pop.plot.scatter(x="Full-time",y="Part-time")
```
4. *Display plot.*
```
plt.show()
```

groupby()

Sometimes you have **recurring values in a column** and you want to examine the data for a particular value.

Rain in Australia

Date	Location	MinTemp	MaxTemp	Rainfall
12/1/08	Albury	13.4	22.9	0.6
5/22/15	BadgerysCree	11	15.6	1.6
3/17/11	BadgerysCree	18.1	25.8	16.6
7/27/10	Cobar	5.3	17.2	0
9/5/10	Moree	12.1	19.8	23.4
1/23/12	CoffsHarbour	20	24.4	28
7/15/11	Moree	2.8	19	0
1/28/10	Newcastle	22.2	28	0
12/2/15	Moree	20.1	32	4.8
	...			

`AustraliaRain.csv`

groupby()

Sometimes you have **recurring values in a column** and you want to examine the data for a particular value.

For example, to **find the average rainfall at each location***:*

Rain in Australia				
Date	Location	MinTemp	MaxTemp	Rainfall
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1. *Import libraries.*
   ```
   import pandas as pd
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	...			

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For example, to **find the average rainfall at each location**:

1. *Import libraries.*
   ```
   import pandas as pd
   ```
2. *Read in the CSV file.*
   ```
   rain =
   pd.read_csv('AustraliaRain.csv',skiprows=1)
   ```

Rain in Australia				
Date	Location	MinTemp	MaxTemp	Rainfall
12/1/08	Albury	13.4	22.9	0.6
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	...			

`AustraliaRain.csv`

groupby()

Sometimes you have **recurring values in a column** and you want to examine the data for a particular value.

For example, to **find the average rainfall at each location***:*

1. *Import libraries.*
   `import pandas as pd`
2. *Read in the CSV file.*
   `rain = pd.read_csv('AustraliaRain.csv',skiprows=1)`
3. *Group the data by location.*
   `groupAvg = rain.`**`groupby('Location')`**

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Date	Location	MinTemp	MaxTemp	Rainfall
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12/2/15	Moree	20.1	32	4.8
	...			

`AustraliaRain.csv`

Sometimes you have **recurring values in a column** and you want to examine the data for a particular value.

For example, to **find the average rainfall at each location**:

1. *Import libraries.*
   ```
   import pandas as pd
   ```
2. *Read in the CSV file.*
   ```
   rain =
   pd.read_csv('AustraliaRain.csv',skiprows=1)
   ```
3. *Group the data by location.*
   ```
   groupAvg = rain.groupby('Location')
   ```
4. *Print the average rainfall at each location.*
   ```
   print(groupAvg['Rainfall'].mean())
   ```

groupby()

Rain in Australia				
Date	Location	MinTemp	MaxTemp	Rainfall
12/1/08	Albury	13.4	22.9	0.6
5/22/15	BadgerysCree	11	15.6	1.6
3/17/11	BadgerysCree	18.1	25.8	16.6
7/27/10	Cobar	5.3	17.2	0
9/5/10	Moree	12.1	19.8	23.4
1/23/12	CoffsHarbour	20	24.4	28
7/15/11	Moree	2.8	19	0
1/28/10	Newcastle	22.2	28	0
12/2/15	Moree	20.1	32	4.8
	...			

AustraliaRain.csv

```
Adelaide            1.572185
Albany              2.255073
Albury              1.925710
AliceSprings        0.869355
BadgerysCreek       2.207925
Ballarat            1.688830
Bendigo             1.621452
Brisbane            3.160536
Cairns              5.765317
Canberra            1.735038
Cobar               1.129262
CoffsHarbour        5.054592
Dartmoor            2.148554
```

Sometimes you have **recurring values in a column** and you want to examine the data for a particular value.

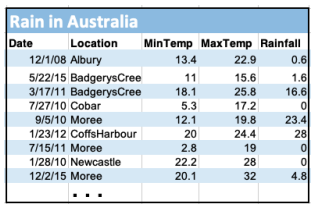
For example, to **find the average rainfall at each location**:

1. *Import libraries.*
   `import pandas as pd`
2. *Read in the CSV file.*
   `rain = pd.read_csv('AustraliaRain.csv',skiprows=1)`
3. *Group the data by location.*
   `groupAvg = rain.`**`groupby('Location')`**
4. *Print the average rainfall at each location.*
   `print(groupAvg['Rainfall'].mean())`

groupby()

Sometimes you have **recurring values in a column** and you want to examine the data for a particular value.

For example, to **find the average rainfall at one location, e.g. Albury***:*



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`AustraliaRain.csv`

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   import pandas as pd
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   ```
   rain =
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3. **Group the data by location get data for group Albury.**
   ```
   AlburyAvg =
   rain.groupby('Location').get_group('Albury')
   ```

groupby()

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`AustraliaRain.csv`

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   ```
   print(AlburyAvg['Rainfall'].mean())
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groupby()

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For example, to **find the average rainfall at one location, e.g. Albury**:

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1/28/10	Newcastle	22.2	28	0
12/2/15	Moree	20.1	32	4.8
	...			

AustraliaRain.csv

```
1.9257104647275156
```

1. *Import libraries.*
   ```
   import pandas as pd
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2. *Read in the CSV file.*
   ```
   rain =
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   AlburyAvg =
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   ```
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   print(AlburyAvg['Rainfall'].mean())
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Design Challenge

Stars						
Temperature (K)	Luminosity(L/Lo)	Radius(R/Ro)	Absolute magnitude(Mv)	Star type	Star color	Spectral Class
3068	0.0024	0.17	16.12	Brown Dwarf	Red	M
25000	0.056	0.0084	10.58	White Dwarf	Blue White	B
2650	0.00069	0.11	17.45	Brown Dwarf	Red	M
11790	0.00015	0.011	12.59	White Dwarf	Yellowish White	F
15276	1136	7.2	-1.97	Main Sequence	Blue-white	B
5800	0.81	0.9	5.05	Main Sequence	yellow-white	F
16500	0.013	0.014	11.89	White Dwarf	Blue White	B
3192	0.00362	0.1967	13.53	Red Dwarf	Red	M
6380	1.35	0.98	2.93	Main Sequence	yellow-white	F
3834	272000	1183	-9.2	Hypergiant	Red	M

- Design an algorithm that:
  - Prints the luminosity of the brightest star.
  - Prints the temperature of the coldest star.
  - Prints the average radius of a Hypergiant.

Design Challenge - Solution

Stars						
Temperature (K)	Luminosity(L/Lo)	Radius(R/Ro)	Absolute magnitude(Mv)	Star type	Star color	Spectral Class
3068	0.0024	0.17	16.12	Brown Dwarf	Red	M
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- **Libraries:** pandas

Design Challenge - Solution

Stars						
Temperature (K)	Luminosity(L/Lo)	Radius(R/Ro)	Absolute magnitude(Mv)	Star type	Star color	Spectral Class
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- **Libraries:** pandas
- **Process:**
  - Print **max** of **'Luminosity'** column

Design Challenge - Solution

Stars						
Temperature (K)	Luminosity(L/Lo)	Radius(R/Ro)	Absolute magnitude(Mv)	Star type	Star color	Spectral Class
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6380	1.35	0.98	2.93	Main Sequence	yellow-white	F
3834	272000	1183	-9.2	Hypergiant	Red	M

- **Libraries:** pandas
- **Process:**
  - Print **max** of **'Luminosity'** column
  - Print **min** of **'Temperature'** column

Design Challenge - Solution

Stars						
Temperature (K)	Luminosity(L/Lo)	Radius(R/Ro)	Absolute magnitude(Mv)	Star type	Star color	Spectral Class
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3834	272000	1183	-9.2	Hypergiant	Red	M

- **Libraries:** pandas
- **Process:**
  - Print **max** of **'Luminosity'** column
  - Print **min** of **'Temperature'** column
  - **groupby 'Star Type'** and take **averages**, then print **max of 'Radius'** column

Design Challenge - Solution

Stars						
Temperature (K)	Luminosity(L/Lo)	Radius(R/Ro)	Absolute magnitude(Mv)	Star type	Star color	Spectral Class
3068	0.0024	0.17	16.12	Brown Dwarf	Red	M
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- **Libraries:** pandas
- **Process:**
  - Print **max** of **'Luminosity'** column
  - Print **min** of **'Temperature'** column
  - **groupby 'Star Type'** and take **averages**, then print **max of 'Radius'** column
  - OR **groupby 'Star Type'** and **get group 'Hypergiant'** to print **average 'Radius'**

Design Challenge - Code

link to repl.it

- **Libraries:** pandas

Design Challenge - Code

link to repl.it

- **Libraries:** pandas

```
import pandas as pd
pd.read_csv('Stars.csv')
```

- **Process:**
  - Print **max** of **'Luminosity'** column

Design Challenge - Code

link to repl.it

- **Libraries:** pandas

```
import pandas as pd
pd.read_csv('Stars.csv')
```

- **Process:**
  - Print **max** of **'Luminosity'** column

```
print(stars['Luminosity(L/Lo)'].max())
```

  - Prints **min** of **'Temperature'** column and store it in temp variable

Design Challenge - Code

link to repl.it

- **Libraries:** pandas

```
import pandas as pd
pd.read_csv('Stars.csv')
```

- **Process:**
  - Print **max** of **'Luminosity'** column

```
print(stars['Luminosity(L/Lo)'].max())
```

  - Prints **min** of **'Temperature'** column and store it in temp variable

```
print( stars['Temperature (K)'].min())
```

  - OR **groupby 'Star Type'** and **get group 'Hypergiant'** to print **average 'Radius'**

Design Challenge - Code

link to repl.it

- **Libraries:** pandas

```
import pandas as pd
pd.read_csv('Stars.csv')
```

- **Process:**
  - Print **max** of **'Luminosity'** column

```
print(stars['Luminosity(L/Lo)'].max())
```

  - Prints **min** of **'Temperature'** column and store it in temp variable

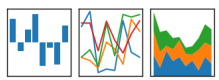
```
print( stars['Temperature (K)'].min())
```

  - OR **groupby 'Star Type'** and **get group 'Hypergiant'** to print **average 'Radius'**

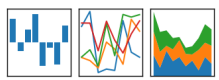
```
print(stars.groupby('Star type').get_group('
    Hypergiant')['Radius(R/Ro)'].mean())
```

Recap

- Recap: Logical Expressions & Circuits

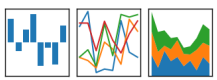
pandas 

Recap

pandas 

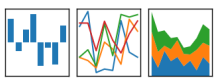
- Recap: Logical Expressions & Circuits
- Accessing Formatted Data:
  - Pandas library has elegant solutions for accessing & analyzing structured data.

Recap

pandas 

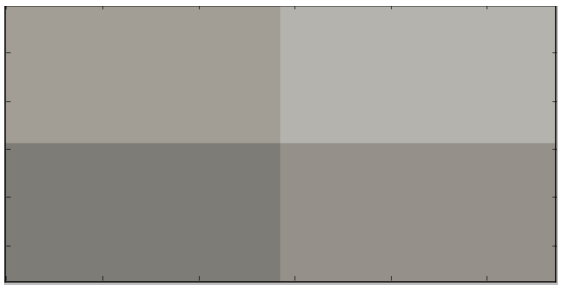
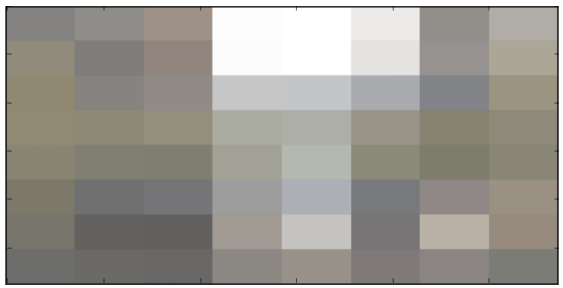
- Recap: Logical Expressions & Circuits
- Accessing Formatted Data:
  - Pandas library has elegant solutions for accessing & analyzing structured data.
  - Can manipulate individual columns or rows ('Series').

Recap

pandas 

- Recap: Logical Expressions & Circuits
- Accessing Formatted Data:
  - 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.

Practice Quiz & Final Questions


- Since you must pass the final exam to pass the course, we end every lecture with final exam review.
- Pull out something to write on (not to be turned in).
- 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).
- We're starting with Fall 2019, Version 2.

Weekly Reminders!

Before next lecture, don't forget to:

- Work on this week's Online Lab

Weekly Reminders!

Before next lecture, don't forget to:

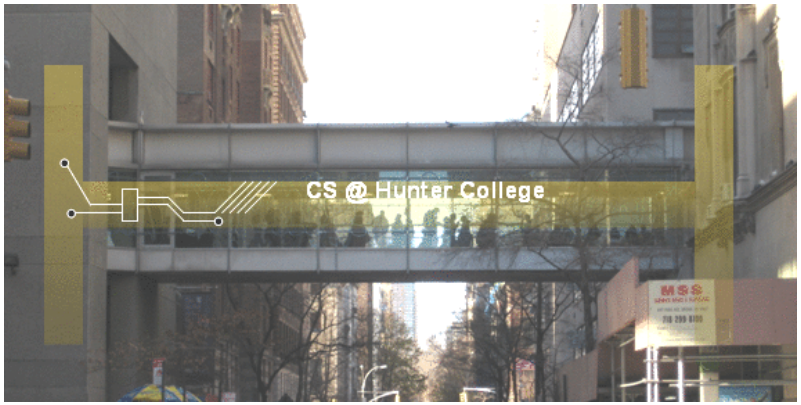
- Work on this week's Online Lab
- Schedule an appointment to take the Quiz in lab 1001G Hunter North

Weekly Reminders!

Before next lecture, don't forget to:

- Work on this week's Online Lab
- Schedule an appointment to take the Quiz in lab 1001G Hunter North
- If you haven't already, schedule an appointment to take the Code Review (**one every two weeks**) in lab 1001G Hunter North

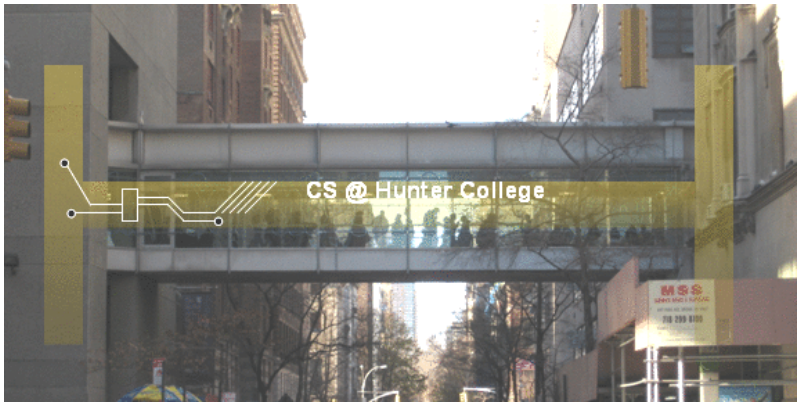
Weekly Reminders!



Before next lecture, don't forget to:

- Work on this week's Online Lab
- Schedule an appointment to take the Quiz in lab 1001G Hunter North
- If you haven't already, schedule an appointment to take the Code Review (**one every two weeks**) in lab 1001G Hunter North
- Submit this week's 5 programming assignments **(programs 26-30)**

Weekly Reminders!



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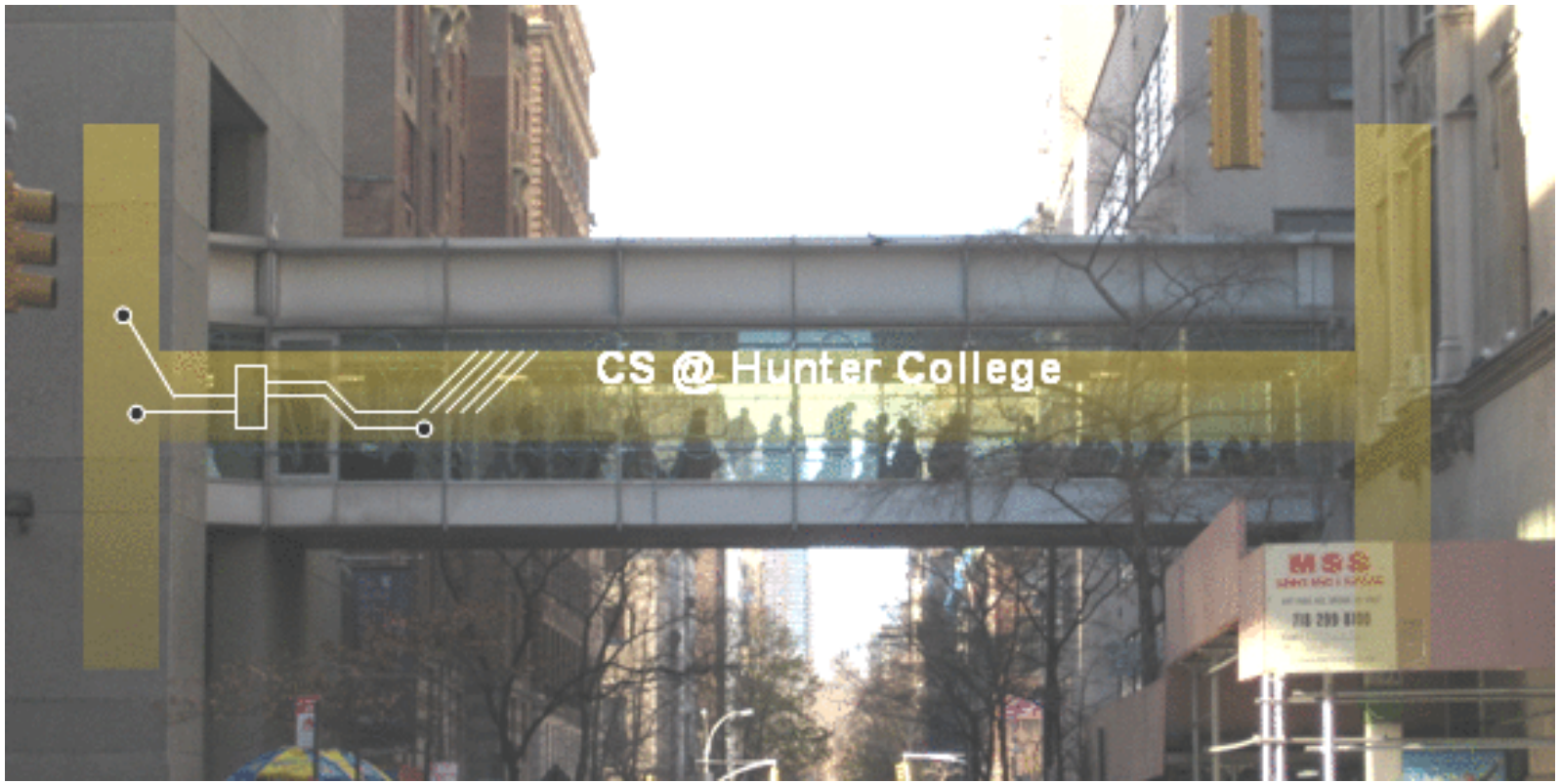
- Submit this week's 5 programming assignments **(programs 26-30)**
- If you need help, schedule an appointment for Tutoring in lab 1001G 11:30am-5:30pm

Weekly Reminders!

Before next lecture, don't forget to:

- Work on this week's Online Lab
- Schedule an appointment to take the Quiz in lab 1001G Hunter North
- If you haven't already, schedule an appointment to take the Code Review (**one every two weeks**) in lab 1001G Hunter North
- Submit this week's 5 programming assignments **(programs 26-30)**
- If you need help, schedule an appointment for Tutoring in lab 1001G 11:30am-5:30pm
- Take the Lecture Preview on Blackboard on Monday (or no later than 10am on Tuesday)

Lecture Slips & Writing Boards



- Hand your lecture slip to a UTA.
- Return writing boards as you leave.