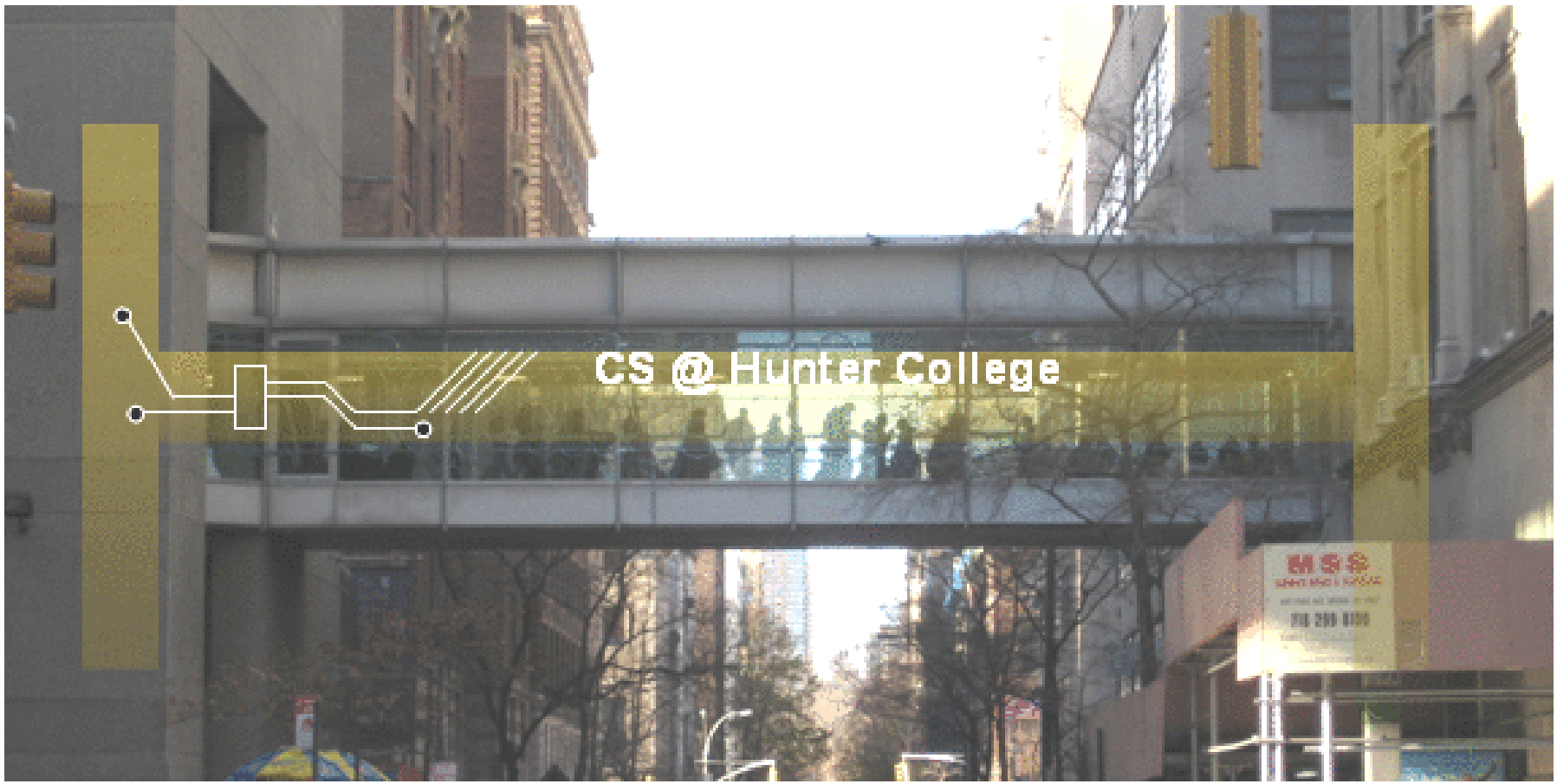
CSci 127: Introduction to Computer Science



hunter.cuny.edu/csci

Announcements

- Please always read all Blackboard announcements

Announcements

- Please always read all Blackboard announcements
- Online help is available in multiple forms:

Announcements

- Please always read all Blackboard announcements
- Online help is available in multiple forms:
  - **Email**

Announcements

- Please always read all Blackboard announcements
- Online help is available in multiple forms:
  - **Email**
  - **Discussion Board**: on Blackboard, link on purple menu bar

Announcements

- Please always read all Blackboard announcements
- Online help is available in multiple forms:
  - **Email**
  - **Discussion Board**: on Blackboard, link on purple menu bar
  - **Drop-in tutoring (Tu/W 1p - 2p)**

Today's Topics

- Recap: Folium
- Inde nite loops
- Design Patterns: Max (Min)
- Design Challenge

Today's Topics

- **Recap: Folium**
- Inde nite loops
- Design Patterns: Max (Min)
- Design Challenge

Challenge:

What does this code do?

```
import folium
import pandas as pd

cuny = pd.read_csv('cunyLocations.csv')
mapCUNY = folium.Map(location=[40.75, -74.125])

for index,row in cuny.iterrows():
    lat = row["Latitude"]
    lon = row["Longitude"]
    name = row["Campus"]
    if row["College or Institution Type"] == "Senior Colleges":
        collegeIcon = folium.Icon(color="purple")
    else:
        collegeIcon = folium.Icon(color="blue")
    newMarker = folium.Marker([lat, lon], popup=name, icon=collegeIcon)
    newMarker.add_to(mapCUNY)

mapCUNY.save(outfile='cunyLocationsSenior.html')
```

Folium example

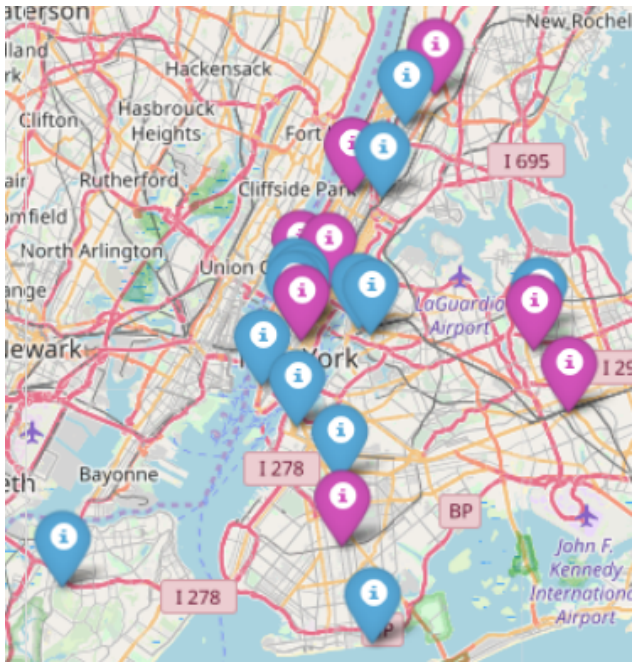
What does this code do?

```
import folium
import pandas as pd

cuny = pd.read_csv('cunyLocations.csv')
mapCUNY = folium.Map(location=[40.75, -74.125])

for index,row in cuny.iterrows():
    lat = row["Latitude"]
    lon = row["Longitude"]
    name = row["Campus"]
    if row["College or Institution Type"] == "Senior Colleges":
         collegeIcon = folium.Icon(color="purple")
    else:
         collegeIcon = folium.Icon(color="blue")
    newMarker = folium.Marker([lat, lon], popup=name, icon=collegeIcon)
    newMarker.add_to(mapCUNY)

mapCUNY.save(outfile='cunyLocationsSenior.html')
```

Folium example

What does this code do?

```
import folium
import pandas as pd

cuny = pd.read_csv('cunyLocations.csv')
mapCUNY = folium.Map(location=[40.75, -74.125])

for index,row in cuny.iterrows():
    lat = row["Latitude"]
    lon = row["Longitude"]
    name = row["Campus"]
    if row["College or Institution Type"] == "Senior Colleges":
         collegeIcon = folium.Icon(color="purple")
    else:
         collegeIcon = folium.Icon(color="blue")
    newMarker = folium.Marker([lat, lon], popup=name, icon=collegeIcon)
    newMarker.add_to(mapCUNY)

mapCUNY.save(outfile='cunyLocationsSenior.html')
```



Folium

- A module for making HTML maps.

Folium

- A module for making HTML maps.
- It's a Python interface to the popular `leaflet.js`.

Folium

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

Folium

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

Folium

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

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

Today's Topics

- Recap: Folium
- **Inde nite loops**
- Design Patterns: Max (Min)
- Design Challenge

Challenge:

- Write a function that asks a user for number after 2000 but before 2018. The function should repeatedly ask the user for a number until they enter one within the range and return the number.

Coding

- Write a function that asks a user for number after 2000 but before 2018. The function should repeatedly ask the user for a number until they enter one within the range and return the number..

Coding

- Write a function that asks a user for number after 2000 but before 2018. The function should repeatedly ask the user for a number until they enter one within the range and return the number.

```
def getYear():
```

Coding

- Write a function that asks a user for number after 2000 but before 2018. The function should repeatedly ask the user for a number until they enter one within the range and return the number.

```
def getYear():



    return(num)
```

Coding

- Write a function that asks a user for number after 2000 but before 2018. The function should repeatedly ask the user for a number until they enter one within the range and return the number.

```
def getYear():
    num = 0



    return(num)
```

Coding

- Write a function that asks a user for number after 2000 but before 2018. The function should repeatedly ask the user for a number until they enter one within the range and return the number.

```
def getYear():
    num = 0
    while num <= 2000 or num >= 2018:


    return(num)
```

Coding

- Write a function that asks a user for number after 2000 but before 2018. The function should repeatedly ask the user for a number until they enter one within the range and return the number.

```
def getYear():
    num = 0
    while num <= 2000 or num >= 2018:
        num = int(input('Enter a number > 2000 & < 2018'))

    return(num)
```

Indefinite Loops

```
#Spring 2012 Final Exam, #8

nums = [1,4,0,6,5,2,9,8,12]
print(nums)
i=0
while i < len(nums)-1:
    if nums[i] < nums[i+1]:
        nums[i], nums[i+1] = nums[i+1], nums[i]
    i=i+1

print(nums)
```

Indefinite Loops

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

```
#Spring 2012 Final Exam, #8

nums = [1,4,0,6,5,2,9,8,12]
print(nums)
i=0
while i < len(nums)-1:
    if nums[i] < nums[i+1]:
        nums[i], nums[i+1] = nums[i+1], nums[i]
    i=i+1

print(nums)
```

Indefinite Loops

```
#Spring 2012 Final Exam, #8

nums = [1,4,0,6,5,2,9,8,12]
print(nums)
i=0
while i < len(nums)-1:
    if nums[i] < nums[i+1]:
        nums[i], nums[i+1] = nums[i+1], nums[i]
    i=i+1

print(nums)
```

- Indefinite loops repeat as long as the condition is true.
- Could execute the body of the loop zero times, 10 times, infinite number of times.

Indefinite Loops

```
#Spring 2012 Final Exam, #8

nums = [1,4,0,6,5,2,9,8,12]
print(nums)
i=0
while i < len(nums)-1:
    if nums[i] < nums[i+1]:
        nums[i], nums[i+1] = nums[i+1], nums[i]
    i=i+1

print(nums)
```

- Indefinite loops repeat as long as the condition is true.
- Could execute the body of the loop zero times, 10 times, infinite number of times.
- The condition determines how many times.

Indefinite Loops

```
#Spring 2012 Final Exam, #8

nums = [1,4,0,6,5,2,9,8,12]
print(nums)
i=0
while i < len(nums)-1:
    if nums[i] < nums[i+1]:
        nums[i], nums[i+1] = nums[i+1], nums[i]
    i=i+1

print(nums)
```

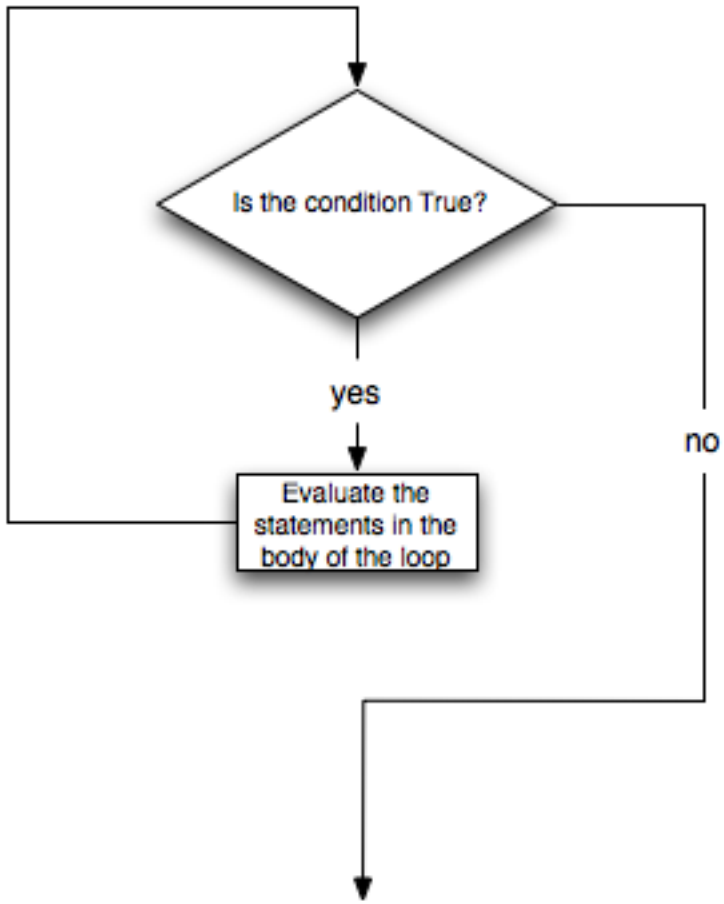
- Indefinite loops repeat as long as the condition is true.
- Could execute the body of the loop zero times, 10 times, infinite number of times.
- The condition determines how many times.
- Very useful for checking input, simulations, and games.

Indefinite Loops

```
#Spring 2012 Final Exam, #8

nums = [1,4,0,6,5,2,9,8,12]
print(nums)
i=0
while i < len(nums)-1:
    if nums[i] < nums[i+1]:
        nums[i], nums[i+1] = nums[i+1], nums[i]
    i=i+1

print(nums)
```

Indefinite Loops

```
#Spring 2012 Final Exam, #8

nums = [1,4,0,6,5,2,9,8,12]
print(nums)
i=0
while i < len(nums)-1:
    if nums[i] < nums[i+1]:
        nums[i], nums[i+1] = nums[i+1], nums[i]
    i=i+1

print(nums)
```



Challenge

Predict what this code does:

```
#Random search
import turtle
import random
tess = turtle.Turtle()
tess.color('steelBlue')
tess.shape('turtle')
tess.penup()
#Start off screen:
tess.goto(-250,-250)
#Remember:  abs(x) < 25 means absolute value: -25 < x < 25
while abs(tess.xcor()) > 25 or abs(tess.ycor()) > 25:
  x = random.randrange(-200,200)
  y = random.randrange(-200,200)
  tess.goto(x,y)
  tess.stamp()
  print(tess.xcor(), tess.ycor())
print('Found the center!')
```

Trinket Demo

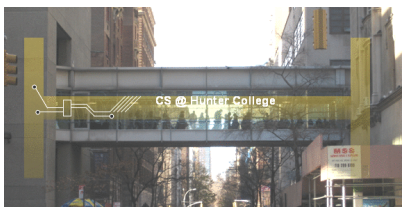
```
#Random search
import turtle
import random
tess = turtle.Turtle()
tess.color('steelBlue')
tess.shape('turtle')
tess.penup()
#Start off screen:
tess.goto(-250,-250)
#Remember:  abs(x) < 25 means absolute value: -25 < x < 25
while abs(tess.xcor()) > 25 or abs(tess.ycor()) > 25:
  x = random.randrange(-200,200)
  y = random.randrange(-200,200)
  tess.goto(x,y)
  tess.stamp()
  print(tess.xcor(), tess.ycor())
print('Found the center!')
```

(Demo with `trinket`)

Today's Topics

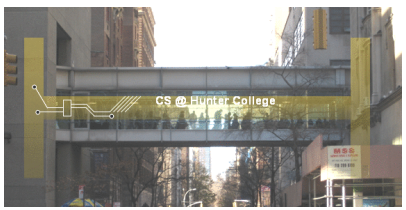
- Recap: Folium
- Inde nite loops
- **Design Patterns: Max (Min)**
- Design Challenge

Design Patterns



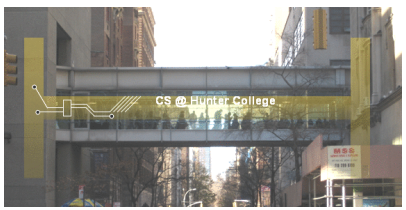
- A **design pattern** is a standard algorithm or approach for solving a common problem.

Design Patterns



- A **design pattern** is a standard algorithm or approach for solving a common problem.
- The pattern is independent of the programming language.

Design Patterns



- A **design pattern** is a standard algorithm or approach for solving a common problem.
- The pattern is independent of the programming language.
- Can think of as a master recipe, with variations for di erent situations.

Challenge:

Predict what the code will do:

```
nums = [1,4,10,6,5,42,9,8,12]

maxNum = 0
for n in nums:
    if n > maxNum:
        maxNum = n
print('The max is', maxNum)
```

Python Tutor

```
nums = [1,4,10,6,5,42,9,8,12]

maxNum = 0
for n in nums:
    if n > maxNum:
        maxNum = n
print('The max is', maxNum)
```

(Demo with pythonTutor)

Max Design Pattern

- Set a variable to the smallest value.

```
nums = [1,4,10,6,5,42,9,8,12]

maxNum = 0
for n in nums:
    if n > maxNum:
        maxNum = n
print('The max is', maxNum)
```

Max Design Pattern

```
nums = [1,4,10,6,5,42,9,8,12]

maxNum = 0
for n in nums:
    if n > maxNum:
        maxNum = n
print('The max is', maxNum)
```

- Set a variable to the smallest value.
- Loop through the list,

Max Design Pattern

```
nums = [1,4,10,6,5,42,9,8,12]

maxNum = 0
for n in nums:
    if n > maxNum:
        maxNum = n
print('The max is', maxNum)
```

- Set a variable to the smallest value.
- Loop through the list,
- If the current number is larger, update your variable.

Max Design Pattern

```
nums = [1,4,10,6,5,42,9,8,12]

maxNum = 0
for n in nums:
    if n > maxNum:
        maxNum = n
print('The max is', maxNum)
```

- Set a variable to the smallest value.
- Loop through the list,
- If the current number is larger, update your variable.
- Print/return the largest number found.

Max Design Pattern

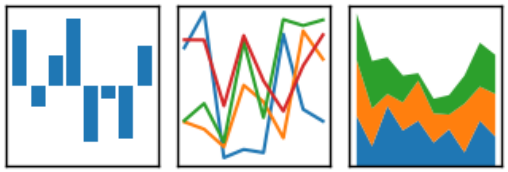
```
nums = [1,4,10,6,5,42,9,8,12]

maxNum = 0
for n in nums:
    if n > maxNum:
        maxNum = n
print('The max is', maxNum)
```

- Set a variable to the smallest value.
- Loop through the list,
- If the current number is larger, update your variable.
- Print/return the largest number found.
- Similar idea works for finding the minimum value.

Pandas: Minimum Values

pandas

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

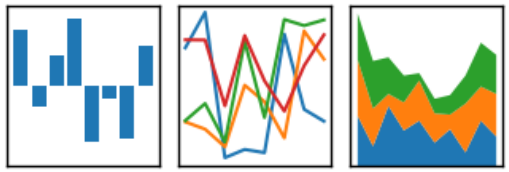


- In Pandas, lovely built-in functions:

Pandas: Minimum Values

pandas

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

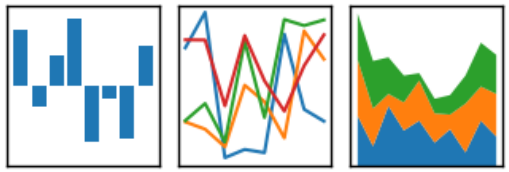


- In Pandas, lovely built-in functions:
  - `df.sort_values('First Name')` and
  - `df['First Name'].min()`

Pandas: Minimum Values

pandas

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

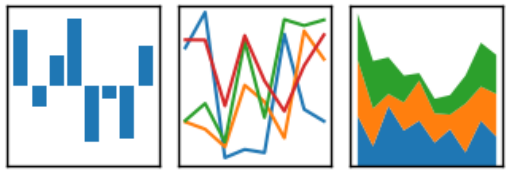


- In Pandas, lovely built-in functions:
  - `df.sort_values('First Name')` and
  - `df['First Name'].min()`
- What if you don't have a CSV and DataFrame, or data not ordered?

Design Question: Find first alphabetically

pandas

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

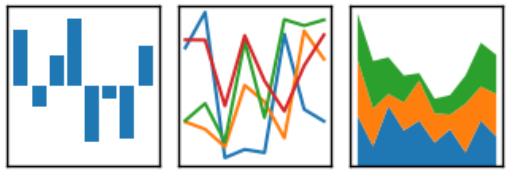


- What if you don't have a CSV and DataFrame, or data not ordered?

Design Question: Find first alphabetically

pandas

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

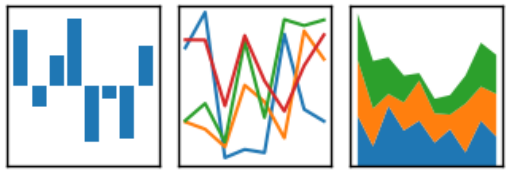


- What if you don't have a CSV and DataFrame, or data not ordered?
- Useful *Design Pattern*: min/max

Design Question: Find first alphabetically

pandas

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

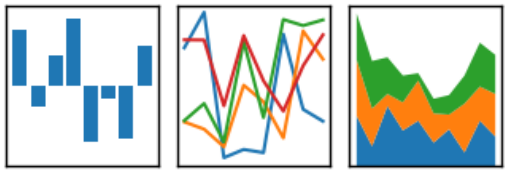


- What if you don't have a CSV and DataFrame, or data not ordered?
- Useful *Design Pattern*: min/max
  - Set a variable to worst value (i.e. `maxN = 0` or `first = "ZZ"`).

Design Question: Find first alphabetically

pandas

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

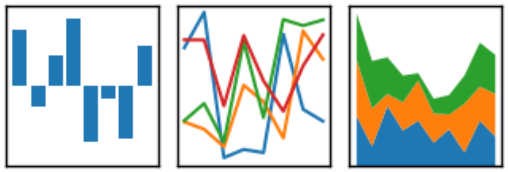


- What if you don't have a CSV and DataFrame, or data not ordered?
- Useful *Design Pattern*: min/max
  - Set a variable to worst value (i.e. `maxN = 0` or `first = "ZZ"`).
  - For each item, X, in the list:

Design Question: Find first alphabetically

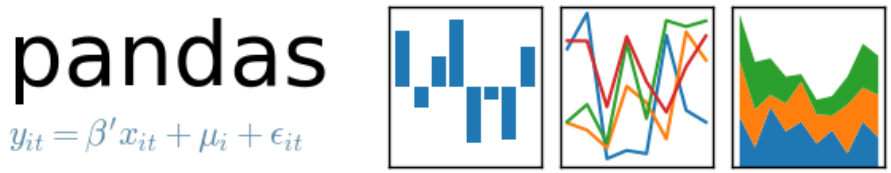
pandas

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



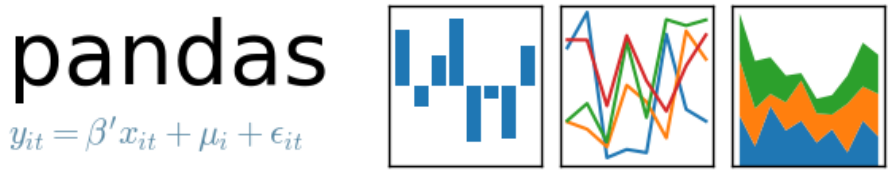
- What if you don't have a CSV and DataFrame, or data not ordered?
- Useful *Design Pattern*: min/max
  - Set a variable to worst value (i.e. `maxN = 0` or `first = "ZZ"`).
  - For each item, X, in the list:
    - Compare X to your variable.

Design Question: Find first alphabetically



- What if you don't have a CSV and DataFrame, or data not ordered?
- Useful *Design Pattern*: min/max
  - Set a variable to worst value (i.e. `maxN = 0` or `first = "ZZ"`).
  - For each item, X, in the list:
    - Compare X to your variable.
    - If better, update your variable to be X.

Design Question: Find first alphabetically



- What if you don't have a CSV and DataFrame, or data not ordered?
- Useful *Design Pattern*: min/max
  - Set a variable to worst value (i.e. `maxN = 0` or `first = "ZZ"`).
  - For each item, X, in the list:
    - Compare X to your variable.
    - If better, update your variable to be X.
  - Print/return X.

Today's Topics

- Recap: Folium
- Inde nite loops
- Design Patterns: Max (Min)
- **Design Challenge**

Design Challenge

Collect all ve stars (locations randomly generated):

Design Challenge

Possible approaches:

Design Challenge

Possible approaches:

- Randomly wander until all 5 collected, or

Design Challenge

Possible approaches:

- Randomly wander until all 5 collected, or
- Start in one corner, and systematically visit every point.

Design Challenge

Possible approaches:

- Randomly wander until all 5 collected, or
- Start in one corner, and systematically visit every point.

Input: The map of the `world.'

Design Challenge

Possible approaches:

- Randomly wander until all 5 collected, or
- Start in one corner, and systematically visit every point.

Input: The map of the `world.'

Output: Time taken and/or locations of the 5 stars.

Design Challenge

Possible approaches:

- Randomly wander until all 5 collected, or
- Start in one corner, and systematically visit every point.

Input: The map of the `world.'

Output: Time taken and/or locations of the 5 stars.

How to store locations? Use a numpy array with -1 everywhere.

Design Challenge

Possible approaches:

- Randomly wander until all 5 collected, or
- Start in one corner, and systematically visit every point.

Input: The map of the `world.'

Output: Time taken and/or locations of the 5 stars.

How to store locations? Use a numpy array with -1 everywhere.

Possible algorithms: while numStars < 5:

Design Challenge

Possible approaches:

- Randomly wander until all 5 collected, or
- Start in one corner, and systematically visit every point.

Input: The map of the `world.'

Output: Time taken and/or locations of the 5 stars.

How to store locations? Use a numpy array with -1 everywhere.

Possible algorithms: while numStars < 5:

- Move forward.

Design Challenge

Possible approaches:

- Randomly wander until all 5 collected, or
- Start in one corner, and systematically visit every point.

Input: The map of the `world.'

Output: Time taken and/or locations of the 5 stars.

How to store locations? Use a numpy array with -1 everywhere.

Possible algorithms: while numStars < 5:

- Move forward.
- If wall, mark 0 in map, randomly turn left or right.

Design Challenge

Possible approaches:

- Randomly wander until all 5 collected, or
- Start in one corner, and systematically visit every point.

Input: The map of the `world.'

Output: Time taken and/or locations of the 5 stars.

How to store locations? Use a numpy array with -1 everywhere.

Possible algorithms: while numStars < 5:

- Move forward.
- If wall, mark 0 in map, randomly turn left or right.
- If star, mark 1 in map and add 1 to numStars.

Design Challenge

Possible approaches:

- Randomly wander until all 5 collected, or
- Start in one corner, and systematically visit every point.

Input: The map of the `world.'

Output: Time taken and/or locations of the 5 stars.

How to store locations? Use a numpy array with -1 everywhere.

Possible algorithms: while numStars < 5:

- Move forward.
- If wall, mark 0 in map, randomly turn left or right.
- If star, mark 1 in map and add 1 to numStars.
- Otherwise, mark 2 in map that it's an empty square.

Recap

Quick recap of a Python library,Folium for creating interactive HTML maps.

Recap

Quick recap of a Python library,Folium for creating interactive HTML maps.

More details onwhile loops for repeating commands for an inde nite number of times.

Recap

Quick recap of a Python library,Folium for creating interactive HTML maps.

More details onwhile loops for repeating commands for an inde nite number of times.

Introduced the max design pattern.

Final Exam Prep: UNIX

This course has three main themes:

- Programming & Problem Solving

xkcd 149

Final Exam Prep: UNIX

This course has three main themes:

- Programming & Problem Solving
- Organization of Hardware & Data

xkcd 149

Final Exam Prep: UNIX

This course has three main themes:

- Programming & Problem Solving
- Organization of Hardware & Data
- Design

xkcd 149

Final Exam Prep: UNIX

This course has three main themes:

- Programming & Problem Solving
- Organization of Hardware & Data
- Design

The operating system, Unix, is part of the second theme.

xkcd 149

Final Exam Prep: UNIX

xkcd 149

This course has three main themes:

- Programming & Problem Solving
- Organization of Hardware & Data
- Design

The operating system, Unix, is part of the second theme.

Unix commands in the weekly on-line labs

Final Exam Prep: UNIX

Unix commands in the weekly on-line labs:

xkcd 149

Final Exam Prep: UNIX

Unix commands in the weekly on-line labs:

Lab 2: pwd, ls , mkdir , cd

xkcd 149

Final Exam Prep: UNIX

Unix commands in the weekly on-line labs:

Lab 2: pwd, ls , mkdir , cd

Lab 3: ls -l , cp, mv

xkcd 149

Final Exam Prep: UNIX

Unix commands in the weekly on-line labs:

- Lab 2: pwd, ls , mkdir , cd
- Lab 3: ls -l , cp, mv
- Lab 4: cd ../ (relative paths)

xkcd 149

Final Exam Prep: UNIX

Unix commands in the weekly on-line labs:

- Lab 2: pwd, ls , mkdir , cd
- Lab 3: ls -l , cp, mv
- Lab 4: cd ../ (relative paths)
- Lab 5: cd /usr/bin (absolute paths),cd

xkcd 149

Final Exam Prep: UNIX

Unix commands in the weekly on-line labs:

- Lab 2: pwd, ls , mkdir , cd
- Lab 3: ls -l , cp, mv
- Lab 4: cd ../ (relative paths)
- Lab 5: cd /usr/bin (absolute paths),cd
- Lab 6: Scripts, chmod

xkcd 149

Final Exam Prep: UNIX

Unix commands in the weekly on-line labs:

- Lab 2: pwd, ls , mkdir , cd
- Lab 3: ls -l , cp, mv
- Lab 4: cd ../ (relative paths)
- Lab 5: cd /usr/bin (absolute paths),cd
- Lab 6: Scripts, chmod
- Lab 7: Running Python from the command line

xkcd 149

Final Exam Prep: UNIX

Unix commands in the weekly on-line labs:

- Lab 2: pwd, ls , mkdir , cd
- Lab 3: ls -l , cp, mv
- Lab 4: cd ../ (relative paths)
- Lab 5: cd /usr/bin (absolute paths),cd
- Lab 6: Scripts, chmod
- Lab 7: Running Python from the command line
- Lab 8: git from the command line

xkcd 149

Final Exam Prep: UNIX

Unix commands in the weekly on-line labs:

- Lab 2: pwd, ls , mkdir , cd
- Lab 3: ls -l , cp, mv
- Lab 4: cd ../ (relative paths)
- Lab 5: cd /usr/bin (absolute paths),cd
- Lab 6: Scripts, chmod
- Lab 7: Running Python from the command line
- Lab 8: git from the command line
- Lab 9: ls *.py (wildcards)

xkcd 149

Final Exam Prep: UNIX

Unix commands in the weekly on-line labs:

- Lab 2: pwd, ls , mkdir , cd
- Lab 3: ls -l , cp, mv
- Lab 4: cd ../ (relative paths)
- Lab 5: cd /usr/bin (absolute paths),cd
- Lab 6: Scripts, chmod
- Lab 7: Running Python from the command line
- Lab 8: git from the command line
- Lab 9: ls *.py (wildcards)
- Lab 10: More on scripts,vim

xkcd 149

Final Exam Prep: UNIX

Unix commands in the weekly on-line labs:

- Lab 2: pwd, ls , mkdir , cd
- Lab 3: ls -l , cp, mv
- Lab 4: cd ../ (relative paths)
- Lab 5: cd /usr/bin (absolute paths),cd
- Lab 6: Scripts, chmod
- Lab 7: Running Python from the command line
- Lab 8: git from the command line
- Lab 9: ls *.py (wildcards)
- Lab 10: More on scripts,vim
- Lab 11: ls j wc -c (pipes), grep , wc

xkcd 149

Final Exam Prep: UNIX

Unix commands in the weekly on-line labs:

- Lab 2: pwd, ls , mkdir , cd
- Lab 3: ls -l , cp, mv
- Lab 4: cd ../ (relative paths)
- Lab 5: cd /usr/bin (absolute paths),cd
- Lab 6: Scripts, chmod
- Lab 7: Running Python from the command line
- Lab 8: git from the command line
- Lab 9: ls *.py (wildcards)
- Lab 10: More on scripts,vim
- Lab 11: ls j wc -c (pipes), grep , wc
- Lab 12: file , which

xkcd 149

Final Exam Prep: UNIX

Unix commands in the weekly on-line labs:

- *Lab 2:* `pwd`, `ls`, `mkdir`, `cd`
- *Lab 3:* `ls -l`, `cp`, `mv`
- *Lab 4:* `cd ../` (relative paths)
- *Lab 5:* `cd /usr/bin` (absolute paths), `cd`
- *Lab 6:* Scripts, `chmod`
- *Lab 7:* Running Python from the command line
- *Lab 8:* git from the command line
- *Lab 9:* ls *.py (wildcards)
- *Lab 10:* More on scripts, `vim`
- *Lab 11:* `ls` *j* `wc -c` (pipes), `grep`, `wc`
- *Lab 12:* `file`, `which`
- *Lab 13:* `man`, `more`, `w`

`xkcd 149`