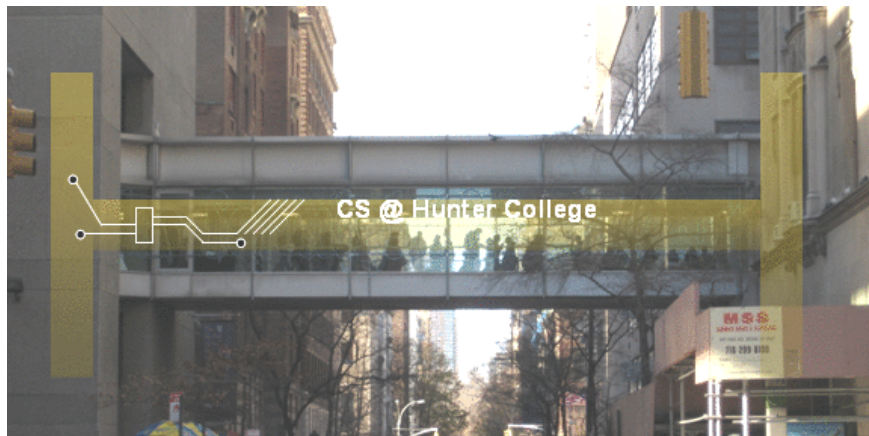


CSci 127: Introduction to Computer Science



hunter.cuny.edu/csci

- This lecture will be recorded

Frequently Asked Questions

From lecture slips & recitation sections.

- **When is the final?**

Frequently Asked Questions

From lecture slips & recitation sections.

- **When is the final?**
December, 14, 9am-11am, on Gradescope.

Frequently Asked Questions

From lecture slips & recitation sections.

- **When is the final?**
December, 14, 9am-11am, on Gradescope.
- **What is the format?**

Frequently Asked Questions

From lecture slips & recitation sections.

- **When is the final?**

December, 14, 9am-11am, on Gradescope.

- **What is the format?**

*Content will be similar to past paper exams. Format will be similar to Lab Quizzes on Gradescope: multiple choice, select all, short answer, fill in the blank. **Pay extra attention to question instructions***

Frequently Asked Questions

From lecture slips & recitation sections.

- **When is the final?**
December, 14, 9am-11am, on Gradescope.
- **What is the format?**
*Content will be similar to past paper exams. Format will be similar to Lab Quizzes on Gradescope: multiple choice, select all, short answer, fill in the blank. **Pay extra attention to question instructions***
- **I have another final then. What do I do?**

Frequently Asked Questions

From lecture slips & recitation sections.

- **When is the final?**

December, 14, 9am-11am, on Gradescope.

- **What is the format?**

*Content will be similar to past paper exams. Format will be similar to Lab Quizzes on Gradescope: multiple choice, select all, short answer, fill in the blank. **Pay extra attention to question instructions***

- **I have another final then. What do I do?**

We are arranging an alternative time (most likely reading day).

Frequently Asked Questions

From lecture slips & recitation sections.

- **When is the final?**
December, 14, 9am-11am, on Gradescope.
- **What is the format?**
*Content will be similar to past paper exams. Format will be similar to Lab Quizzes on Gradescope: multiple choice, select all, short answer, fill in the blank. **Pay extra attention to question instructions***
- **I have another final then. What do I do?**
We are arranging an alternative time (most likely reading day).
- **Do I have to take the final?**

Frequently Asked Questions

From lecture slips & recitation sections.

- **When is the final?**
December, 14, 9am-11am, on Gradescope.
- **What is the format?**
*Content will be similar to past paper exams. Format will be similar to Lab Quizzes on Gradescope: multiple choice, select all, short answer, fill in the blank. **Pay extra attention to question instructions***
- **I have another final then. What do I do?**
We are arranging an alternative time (most likely reading day).
- **Do I have to take the final?**
Yes, you have to pass the final (60 out of 100 points) to pass the class.

Frequently Asked Questions

From lecture slips & recitation sections.

- **When is the final?**
December, 14, 9am-11am, on Gradescope.
- **What is the format?**
*Content will be similar to past paper exams. Format will be similar to Lab Quizzes on Gradescope: multiple choice, select all, short answer, fill in the blank. **Pay extra attention to question instructions***
- **I have another final then. What do I do?**
We are arranging an alternative time (most likely reading day).
- **Do I have to take the final?**
Yes, you have to pass the final (60 out of 100 points) to pass the class.
- **Can I take the course No Credit/Credit?**

Frequently Asked Questions

From lecture slips & recitation sections.

- **When is the final?**
December, 14, 9am-11am, on Gradescope.
- **What is the format?**
*Content will be similar to past paper exams. Format will be similar to Lab Quizzes on Gradescope: multiple choice, select all, short answer, fill in the blank. **Pay extra attention to question instructions***
- **I have another final then. What do I do?**
We are arranging an alternative time (most likely reading day).
- **Do I have to take the final?**
Yes, you have to pass the final (60 out of 100 points) to pass the class.
- **Can I take the course No Credit/Credit?**
*Yes. you must complete and submit the [Credit/No Credit Request Form](#), made available by the Office of the Registrar.
You must submit the form by **25 November***

Announcements

- Please always read all Blackboard announcements

Announcements

- Please always read all Blackboard announcements
- Please make sure my emails and Blackboard emails are not going to junk mail. Add my address (tligorio@hunter.cuny.edu) to your contacts or 'allow list' on outlook

Announcements

- Please always read all Blackboard announcements
- Please make sure my emails and Blackboard emails are not going to junk mail. Add my address (tligorio@hunter.cuny.edu) to your contacts or 'allow list' on outlook
- Online help is available in multiple forms when school is in session:

Announcements

- Please always read all Blackboard announcements
- Please make sure my emails and Blackboard emails are not going to junk mail. Add my address (tligorio@hunter.cuny.edu) to your contacts or 'allow list' on outlook
- Online help is available in multiple forms when school is in session:
 - ▶ **Email:** huntercsci127help@gmail.com

Announcements

- Please always read all Blackboard announcements
- Please make sure my emails and Blackboard emails are not going to junk mail. Add my address (tligorio@hunter.cuny.edu) to your contacts or 'allow list' on outlook
- Online help is available in multiple forms when school is in session:
 - ▶ **Email:** huntercsci127help@gmail.com
 - ▶ **Discussion Board:** on Blackboard, link on purple menu bar

Announcements

- Please always read all Blackboard announcements
- Please make sure my emails and Blackboard emails are not going to junk mail. Add my address (tligorio@hunter.cuny.edu) to your contacts or 'allow list' on outlook
- Online help is available in multiple forms when school is in session:
 - ▶ **Email:** huntercsci127help@gmail.com
 - ▶ **Discussion Board:** on Blackboard, link on purple menu bar
 - ▶ **Drop-in tutoring (11am-5pm):**
[join the session here.](#)

Announcements

- Please always read all Blackboard announcements
- Please make sure my emails and Blackboard emails are not going to junk mail. Add my address (tligorio@hunter.cuny.edu) to your contacts or 'allow list' on outlook
- Online help is available in multiple forms when school is in session:
 - ▶ **Email:** huntercsci127help@gmail.com
 - ▶ **Discussion Board:** on Blackboard, link on purple menu bar
 - ▶ **Drop-in tutoring (11am-5pm):**
[join the session here.](#)
- **Group work** (with UTAs and other students) is a wonderful way to build community, share what you know, find out what you don't know and learn.

Recap: Parameters

- Program 40: Write a function that has a **list parameter** and uses its values to compute housing score.

Recap: Parameters

- Program 40: Write a function that has a **list parameter** and uses its values to compute housing score.
 - ▶ Current Freshman: 1 point
 - ▶ Current Sophomore: 2 points
 - ▶ Current Junior: 3 points
 - ▶ Current Senior: 4 points
 - ▶ 23+ Years of Age: 1 point
 - ▶ Full-Time: 1 point
 - ▶ Academic Probation: -1 point
 - ▶ 3.5+ GPA: 1 point

Recap: Parameters

- Program 40: Write a function that has a **list parameter** and uses its values to compute housing score.
 - ▶ Current Freshman: 1 point
 - ▶ Current Sophomore: 2 points
 - ▶ Current Junior: 3 points
 - ▶ Current Senior: 4 points
 - ▶ 23+ Years of Age: 1 point
 - ▶ Full-Time: 1 point
 - ▶ Academic Probation: -1 point
 - ▶ 3.5+ GPA: 1 point
- Demo in Python Tutor

Lecture Quiz

- Log-in to Gradescope
- Find LECTURE 10 Quiz
- Take the quiz
- **You have 3 minutes**

Today's Topics



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

Today's Topics



- **Recap: Folium**
- Indefinite 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

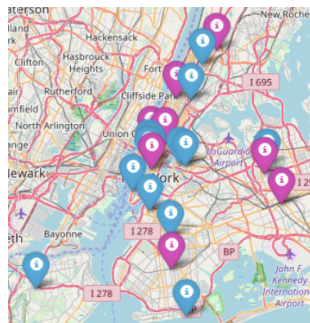
What does this code do?

```
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



Folium

Folium



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

Folium

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

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

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
- **Indefinite 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():  
    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.

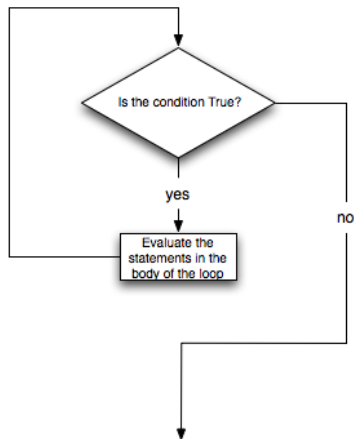
Indefinite Loops

```
#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
- Indefinite 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 different 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]

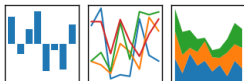
maxNum = 0
for n in nums:
    if n > maxNum:
        maxNum = n
print('The max is', maxNum)
```

- 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

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

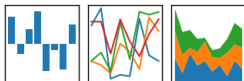


- In Pandas, lovely built-in functions:

Pandas: Minimum Values

pandas

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

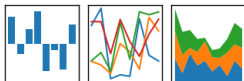


- In Pandas, lovely built-in functions:
 - ▶ `df.sort_values('First Name')` and
 - ▶ `df['First Name'].min()`

Pandas: Minimum Values

pandas

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

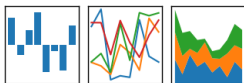


- In Pandas, lovely built-in functions:
 - ▶ `df.sort_values('First Name')` and
 - ▶ `df['First Name'].min()`
- What if you don't have a CSV and DataFrame, or data not ordered?

Design Question: Find first alphabetically

pandas

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

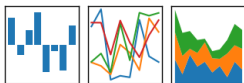


- What if you don't have a CSV and DataFrame, or data not ordered?

Design Question: Find first alphabetically

pandas

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

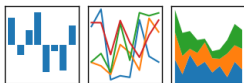


- What if you don't have a CSV and DataFrame, or data not ordered?
- Useful *Design Pattern*: min/max

Design Question: Find first alphabetically

pandas

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

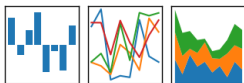


- What if you don't have a CSV and DataFrame, or data not ordered?
- Useful *Design Pattern*: min/max
 - ▶ Set a variable to worst value (i.e. `maxN = 0` or `first = "ZZ"`).

Design Question: Find first alphabetically

pandas

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

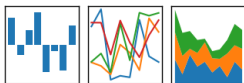


- What if you don't have a CSV and DataFrame, or data not ordered?
- Useful *Design Pattern*: min/max
 - ▶ Set a variable to worst value (i.e. `maxN = 0` or `first = "ZZ"`).
 - ▶ For each item, X, in the list:

Design Question: Find first alphabetically

pandas

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

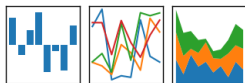


- What if you don't have a CSV and DataFrame, or data not ordered?
- Useful *Design Pattern*: min/max
 - ▶ Set a variable to worst value (i.e. `maxN = 0` or `first = "ZZ"`).
 - ▶ For each item, X, in the list:
 - ★ Compare X to your variable.

Design Question: Find first alphabetically

pandas

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

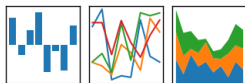


- What if you don't have a CSV and DataFrame, or data not ordered?
- Useful *Design Pattern*: min/max
 - ▶ Set a variable to worst value (i.e. `maxN = 0` or `first = "ZZ"`).
 - ▶ For each item, X, in the list:
 - ★ Compare X to your variable.
 - ★ If better, update your variable to be X.

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.
 - ★ If better, update your variable to be X.
 - ▶ Print/return X.

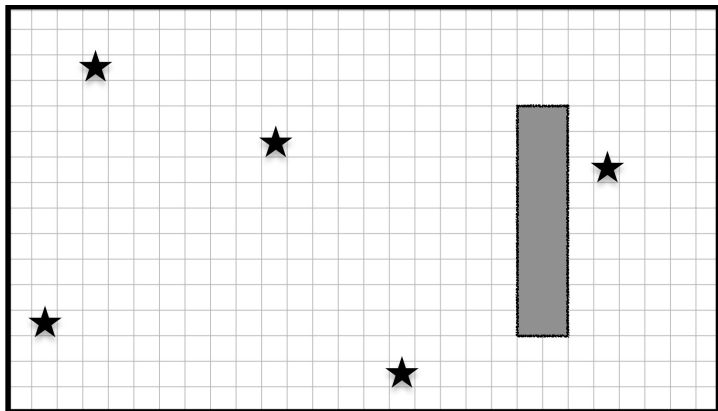
Today's Topics



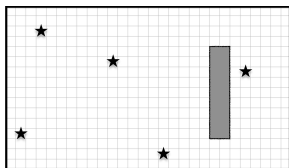
- Recap: Folium
- Indefinite loops
- Design Patterns: Max (Min)
- **Design Challenge**

Design Challenge

Collect all five stars (locations randomly generated):

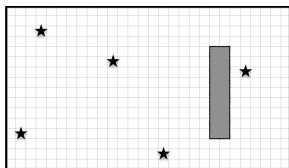


Design Challenge



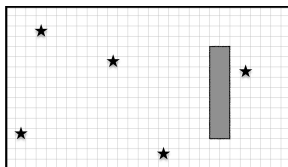
- Possible approaches:

Design Challenge



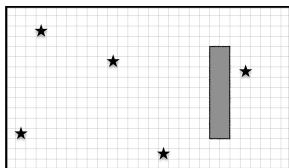
- Possible approaches:
 - ▶ Randomly wander until all 5 collected, or

Design Challenge



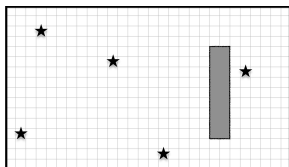
- Possible approaches:
 - ▶ Randomly wander until all 5 collected, or
 - ▶ Start in one corner, and systematically visit every point.

Design Challenge



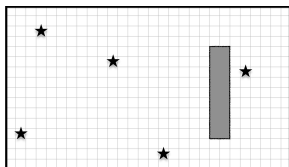
- Possible approaches:
 - ▶ Randomly wander until all 5 collected, or
 - ▶ Start in one corner, and systematically visit every point.
- **Input:** The map of the 'world.'

Design Challenge



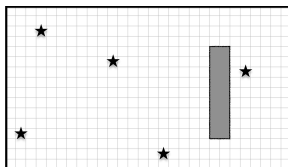
- Possible approaches:
 - ▶ Randomly wander until all 5 collected, or
 - ▶ Start in one corner, and systematically visit every point.
- **Input:** The map of the 'world.'
- **Output:** Time taken and/or locations of the 5 stars.

Design Challenge



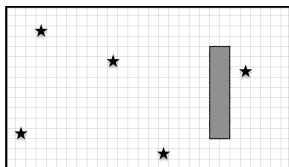
- Possible approaches:
 - ▶ Randomly wander until all 5 collected, or
 - ▶ Start in one corner, and systematically visit every point.
- **Input:** The map of the 'world.'
- **Output:** Time taken and/or locations of the 5 stars.
- How to store locations? Use numpy array with -1 everywhere.

Design Challenge



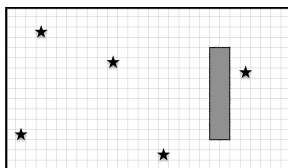
- Possible approaches:
 - ▶ Randomly wander until all 5 collected, or
 - ▶ Start in one corner, and systematically visit every point.
- **Input:** The map of the 'world.'
- **Output:** Time taken and/or locations of the 5 stars.
- How to store locations? Use numpy array with -1 everywhere.
- Possible algorithms: while numStars < 5:

Design Challenge



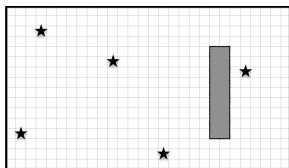
- Possible approaches:
 - ▶ Randomly wander until all 5 collected, or
 - ▶ Start in one corner, and systematically visit every point.
- **Input:** The map of the 'world.'
- **Output:** Time taken and/or locations of the 5 stars.
- How to store locations? Use numpy array with -1 everywhere.
- Possible algorithms: while numStars < 5:
 - ▶ Move forward.

Design Challenge



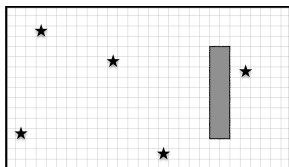
- Possible approaches:
 - ▶ Randomly wander until all 5 collected, or
 - ▶ Start in one corner, and systematically visit every point.
- **Input:** The map of the 'world.'
- **Output:** Time taken and/or locations of the 5 stars.
- How to store locations? Use numpy array with -1 everywhere.
- Possible 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 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 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



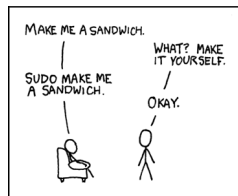
- Quick recap of a Python library, Folium for creating interactive HTML maps.
- More details on `while` loops for repeating commands for an indefinite number of times.

Recap



- Quick recap of a Python library, Folium for creating interactive HTML maps.
- More details on `while` loops for repeating commands for an indefinite number of times.
- Introduced the max design pattern.

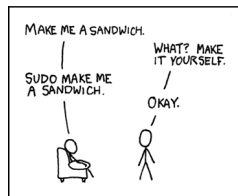
Final Exam Prep: UNIX



xkcd 149

- This course has three main themes:
 - ▶ Programming & Problem Solving

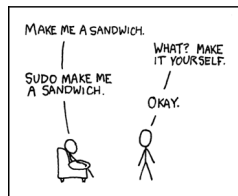
Final Exam Prep: UNIX



xkcd 149

- This course has three main themes:
 - ▶ Programming & Problem Solving
 - ▶ Organization of Hardware & Data

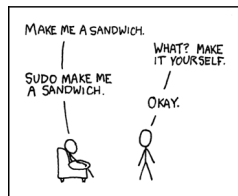
Final Exam Prep: UNIX



xkcd 149

- This course has three main themes:
 - ▶ Programming & Problem Solving
 - ▶ Organization of Hardware & Data
 - ▶ Design

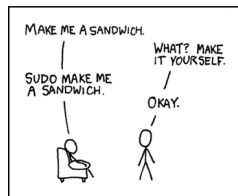
Final Exam Prep: UNIX



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.

Final Exam Prep: UNIX

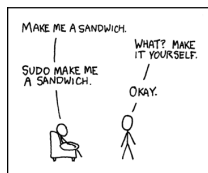


xkcd 149

- 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:

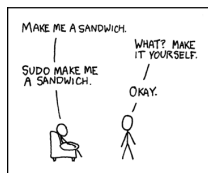


xkcd 149

Final Exam Prep: UNIX

Unix commands in the weekly on-line labs:

- *Lab 2:* pwd, ls, mkdir, cd

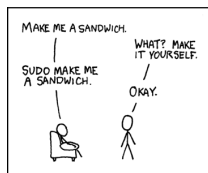


xkcd 149

Final Exam Prep: UNIX

Unix commands in the weekly on-line labs:

- *Lab 2:* `pwd`, `ls`, `mkdir`, `cd`
- *Lab 3:* `ls -l`, `cp`, `mv`

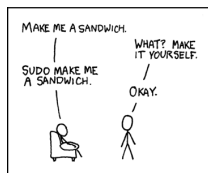


xkcd 149

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)

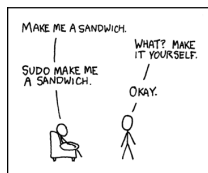


xkcd 149

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 ~`

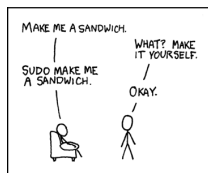


xkcd 149

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`

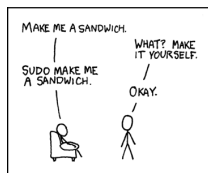


xkcd 149

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

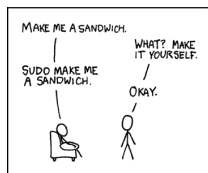


xkcd 149

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

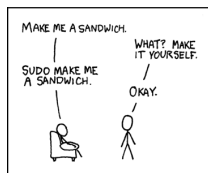


xkcd 149

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)

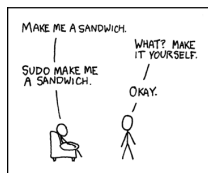


xkcd 149

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`

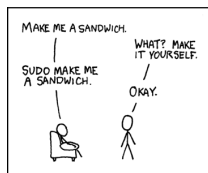


xkcd 149

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 | wc -c` (pipes), `grep`, `wc`

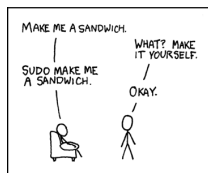


xkcd 149

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 | wc -c` (pipes), `grep`, `wc`
- *Lab 12:* `file`, `which`

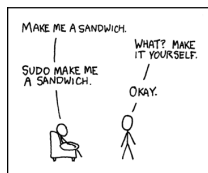


xkcd 149

Final Exam Prep: UNIX

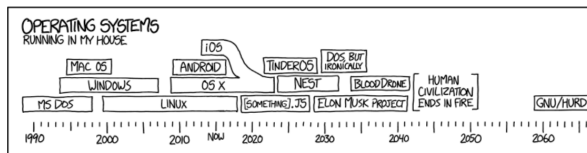
Unix commands in the weekly on-line labs:

- *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 | wc -c` (pipes), `grep`, `wc`
- *Lab 12:* `file`, `which`
- *Lab 13:* `man`, `more`, `w`



xkcd 149

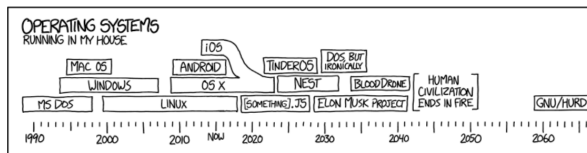
Practice Quiz & Final Questions



xkcd #1508

- Since you must pass the final exam to pass the course, we end every lecture with final exam review.

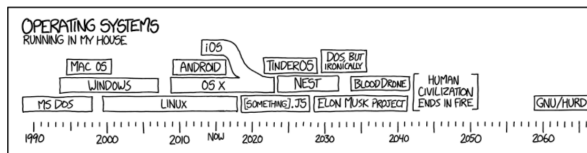
Practice Quiz & Final Questions



xkcd #1508

- 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.

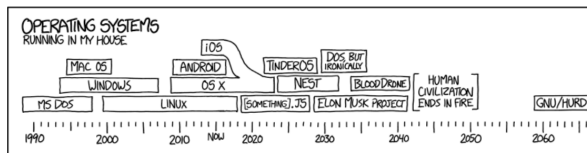
Practice Quiz & Final Questions



xkcd #1508

- 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](#)).

Practice Quiz & Final Questions



xkcd #1508

- 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](#)).
- Theme: Unix commands! (Spring 19 Version 3, #1.b)

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
- Optional - attend [live Lab Review on Wednesday 1-2:30pm](#)

Weekly Reminders!



Before next lecture, don't forget to:

- Work on this week's Online Lab
- Optional - attend [live Lab Review on Wednesday 1-2:30pm](#)
- Take the Lab Quiz on Gradescope by 6pm on Wednesday

Weekly Reminders!



Before next lecture, don't forget to:

- Work on this week's Online Lab
- Optional - attend [live Lab Review on Wednesday 1-2:30pm](#)
- Take the Lab Quiz on Gradescope by 6pm on Wednesday
- Submit this week's 5 programming assignments (programs 46-49)

Weekly Reminders!



Before next lecture, don't forget to:

- Work on this week's Online Lab
- Optional - attend [live Lab Review on Wednesday 1-2:30pm](#)
- Take the Lab Quiz on Gradescope by 6pm on Wednesday
- Submit this week's 5 programming assignments (programs 46-49)
- At any point, visit our [Drop-In Tutoring 11am-5pm](#) for help!!!

Weekly Reminders!



Before next lecture, don't forget to:

- Work on this week's Online Lab
- Optional - attend [live Lab Review on Wednesday 1-2:30pm](#)
- Take the Lab Quiz on Gradescope by 6pm on Wednesday
- Submit this week's 5 programming assignments (programs 46-49)
- At any point, visit our [Drop-In Tutoring 11am-5pm](#) for help!!!
- Take the Lecture Preview on Blackboard on Monday (or no later than 10am on Tuesday)