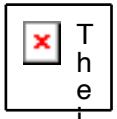
UC Berkeley EECS
Lecturer
Michael Ball

Computational Structures in Data Science

Week 4: Lists

News: "Social Media Shaming Your College"

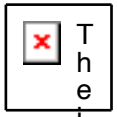


- https://www.nytimes.com/2020/09/10/technology/coronavirus-quarantines-college.html
- Students are using apps to shame their schools into better coronavirus plans.

- We've all seen social media used to shame people we disagree with. Those milliseconds of tsk-tsking might feel good, but I doubt they're helpful.
- College students are using TikTok, Twitter and other apps to embarrass their universities when they fail to care for people who have been isolated in special Covid-19 dorms or are in quarantine units because of a possible exposure.

Announcements

- This week:
  - Lists, Lists and HOFs on Wednesday
  - Videos are going to try to go a little faster. Let me know if it's not working.
- Practice Problems: Optional for lab 2 because the order was wrong. (Sorry!)
  - Remember, they're required but based on effort.
- Register to vote!
  - Vote.org
  - International Students: You can't donate, but you can volunteer if you'd like. ☺



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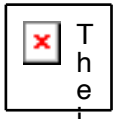
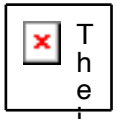
Lists

Learning Objectives



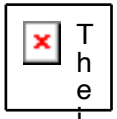
- Lists are a new data type in Python.
- Lists can store any kind of data and be any length.
- We start counting items of lists at 0.
- Lists are *mutable*. We can change their data!

Lists



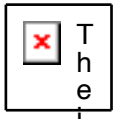
- A structure in Python that can hold many elements
  - Also referred to an an "array" in other programming languages.
- Lists are used to group similar items together.
  - A "contact list", a "list of courses", a "to do list"
- Python lists are *really* flexible!
  - Can contain any type of data
  - Can mix and match types!
  - Can add and delete items

Types We've Learned So Far



- Each *type* of data has a specific set of functions (methods) you can apply to them, and certain properties you can access.
- `ints` / Integers
  - `1, -1, 0,` …
- `floats` ("decimal numbers")
  - `1.0, 3.14159, 20.0`
- `strings`
  - `"Hello", "CS88"`
- `list` / Arrays
  - `['CS88', 'DATA8', 'POLSCI2', 'PHILR1B']`
- `functions`
  - `max(), min(), print(), your own functions!`

List Operations



- [] "square brackets": Used to access items in a list. We start at 0!
- len(): The number of items in a list
- +: We can add lists together
- min(), max(): Functions that take in a list and return some info.
- Converting between types: Strings and Lists:
  - <string>.split(<separator>) → List of string
    - » "I am taking CS88.".split(' ')
  - <string>.join(<list>) → String, with the items of a list joined together.
    - » " ".join(["I", "am", "taking", "CS88."])
- Lots more interesting tools!
  - https://docs.python.org/3.7/tutorial/datastructures.html

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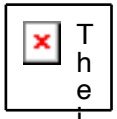
Lists, For Loops, and Sequences

Learning Objectives

- For Loops are a ”generic” way to iterate over data.
- `range` is a Python function that generates a sequence of numbers.



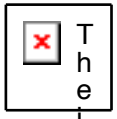
The image part with relationship ID rId14 was not fo...

for statement – iteration control

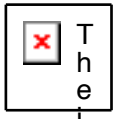
- Repeat a block of statements for a structured sequence of variable bindings

```
<initialization statements>
for <variables> in <sequence expression>:
  <body statements>

<rest of the program>
```



while statement – iteration control



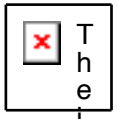
- Repeat a block of statements until a predicate expression is satisfied

```
<initialization statements>
while <predicate expression>:
    <body statements>

<rest of the program>


# Equivalent to a for loop:
index = 0
while index < len(my_list)
    item = my_list[index]
    …
    index += 1
```

range



- range() is a built in Python tool that generates a sequence of numbers.
  - It does not return a list unless we explicitly ask for one.
- It has many options: start, stop, and step.
- Range is *lazy!* It can be iterated over, but doesn't compute all its values at once.
  - We'll revisit this later.
- **GOTCHA:** Range is exclusive in the last value!
  - **`range(10)` is a sequence on 10 numbers from 0 to 9.**
- https://docs.python.org/3.7/library/stdtypes.html?highlight=range#range

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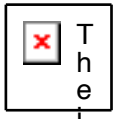
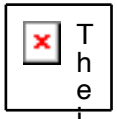
List Comprehensions

Learning Objectives

- List comprehensions let us build lists inline.
- We can easily "filter" the list using a conditional expression.



Data-driven iteration

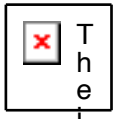


- describe an expression to perform on each item in a sequence
- let the data dictate the control
- In some ways, nothing more than a concise for loop.

```
[ <expr with loop var> for <loop var> in <sequence expr > ]
```

```
[ <expr with loop var> for <loop var> in <sequence expr >
if <conditional expression with loop var> ]
```

Control Structures Review

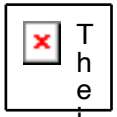


- **The result of** *list(range(0,10))* **is…**
-
- **A)** *[0, 1, 2, 3, 4, 5, 6, 7, 8, 9]*
- **B)** *[0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10]*
- **C)** *[1, 2, 3, 4, 5, 6, 7, 8, 9, 10]*
- **D)** *[1, 2, 3, 4, 5, 6, 7, 8, 9]*
- **E) an error**

- **http://bit.ly/88Lec3Q1**

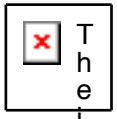
Solution:
A) *list(range(m,n))* **creates a list with elements from m to n-1.**

iClicker Question



- What is the value of thing after running:
  - thing = [print('I like '+ course) for course in courses]
  - Nothing
  - ["I like CS88", "I like DATA8", …]
  - []
  - [None, None, None, None]
  - Error

Control Structures Review

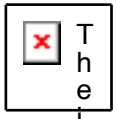


The result of *len([i for i in range(1,10) if i % 2 == 0])* **is…**

A) 5
B) 4
C) 3
D) 2
E) 1

Solution:
B) *len([2, 4, 6, 8]) == 4*

iClicker Question




```
>>> uni = 'The University of California at Berkeley'
>>> words = uni.split(' ')
>>> thing = [ w[0] for w in words ]
```

A) []
B) ['The', 'University', 'of', 'California', 'at', 'Berkeley']
C) 'TUoCaB'
D) ['T', 'U', 'o', 'C', 'a', 'B']
E) Error

Solution:
D)

Control Structures Review

- **The result of** *[i for i in range(3,9) if i % 2 == 1]* **is…**
-
- **A)** *[3, 4, 5, 6, 7, 8, 9]*
- **B)** *[3, 4, 5, 6, 7, 8]*
- **C)** *[1, 3, 5, 7, 9]*
- **D)** *[3, 5, 7, 9]*
- **E)** *[3, 5, 7]*
-
- ***http://bit.ly/88Lec3Q2***

Solution:
E) *[3, 5, 7]*