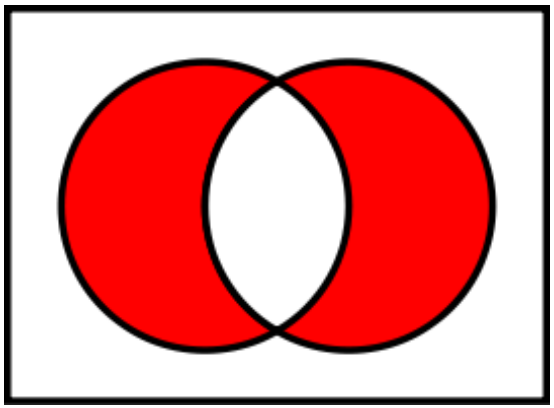
Compsci 101
Sets, Simple Sorting



Susan Rodger

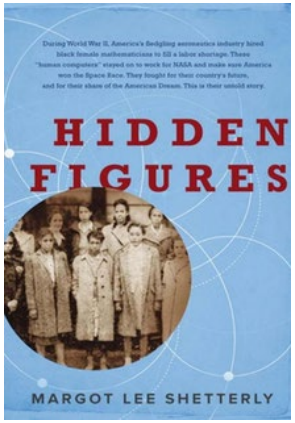
Feb 24, 2022

`M` is for …

- **Machine Learning**
  - Math, Stats, Compsci: learning at scale
- **Microsoft, Mozilla, Macintosh**
  - Software that changed the world?
- **Memory**
  - Storage space in the computer
  - From 64 Kilobytes to 16 Gigobytes!
- **Mouse, Mouse pad**
  - Easier to navigate

Margot Shetterly

- Writer, Author of Hidden Figures
- Black Women NASA Scientists
- Gave a talk at Duke in 2016



Katherine Johnson

Mary Jackson

Dorothy Vaughn

Christine Darden

Announcements

- APT-4 is out and due Thursday March 3
  - Already looked at one in Lab, one in Lecture!
- Assignment 3 due Tuesday, March 1

- Lab 7 Friday, there is a prelab available now!
- No lab on Friday, March 4

- Take APT Quiz 1 – Feb. 24-27
  - Two parts – each part 1.5 hours, 2 APTs
  - Start on Sakai under quizzes

PFTD

- Simple Sorting
- Sets and APTs

Let's sort lists with sorted() function

- **Want list elements in sorted order**
  - Example: have list [17 , 7, 13, 3]
  - Want list [3, 7, 13, 17], in order

- **Built-in function: sorted(*sequence*)**
  - Returns new list of sequence in sorted order
  - Sequence could be list, tuple, string

Example

```
lst = [6, 2, 9, 4, 3]
lsta = sorted(lst)
b = [‘ko’, ‘et’, ‘at’, ‘if’]
c = sorted(b)
b.remove(‘et’)
b.append(6)
b.insert(1,5)
c = sorted(b)
```

lst is [6, 2, 9, 4, 3]

Example

```
lst = (7, 4, 1, 8, 3, 2)
lsta = sorted(lst)
b = ('ko', 'et', 'at', 'if')
c = sorted(b)
d = "word"
e = sorted(d)
f = 'go far'
g = sorted(f)
f = 'go far'
h = sorted(f.split())
```

lst is (7, 4, 1, 8, 3, 2)

Now, sort lists with .sort() list method

- **Want to "change" list elements to sorted order**
  - lst is [17 , 7, 13, 3]
  - lst.sort()
  - Now **same** list lst is [3, 7, 13, 17], in order

- **List method: *list*.sort()**
  - List is **modified, now in sorted order**
  - There is NO return value
  - Only works with lists, can't modify strings, tuples

Compare sorted() with .sort()

```
lsta = [6, 2, 9, 4, 3]
lstb = sorted(lsta)

lsta.sort()
a = [7, 2, 9, 1]
b = a.sort()

c = (5, 6, 2, 1)
c.sort()
d = “word”
d.sort()
```

lsta is [6, 2, 9, 4, 3]

WOTO-1 Sorting
http://bit.ly/101s22-0224-1

Python Sets

- **Set – unordered collection of distinct items**
  - Unordered – can look at them one at a time, but cannot count on any order
  - Distinct - one copy of each

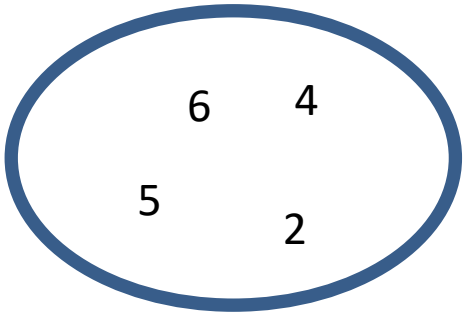
```
x = [5, 3, 4, 3, 5, 1]
y = set(x)

y.add(6)
y.add(4)
```

x is [5, 3, 4, 3, 5, 1]

List vs Set

- **List**
  - Ordered, 3rd item, can have duplicates
  - Example: `x =[4, 6, 2, 4, 5, 2, 4]`
- **Set**
  - No duplicates, no ordering
  - Example: `y = set(x)`
- **Both**
  - Add, remove elements
  - Iterate over all elements



Python Sets

- Can convert list to set, set to list
  - Great to get rid of duplicates in a list

```
a = [2, 3, 6, 3, 2, 7]
b = set(a)

c = list(b)
```

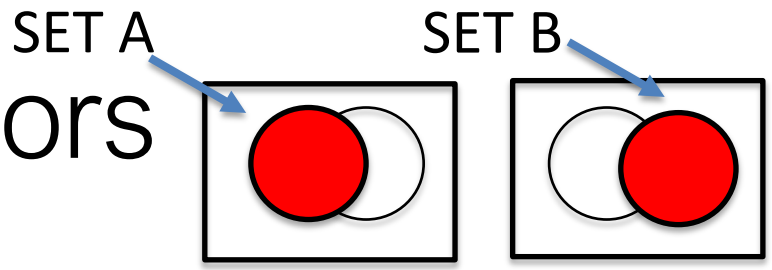
a is [2, 3, 6, 3, 2, 7]

Python Sets

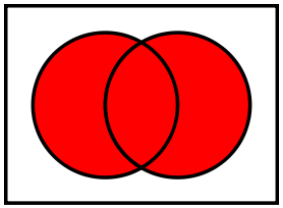
- **Operations on sets:**
  - Modify:
    - add a.add(7)
    - clear a.clear()
    - remove a.remove(5)
  - Create a new set: a = set([])

  - difference(-), intersection(&), union (|), symmetric_difference(^)
  - Boolean: issubset <=, issuperset >=

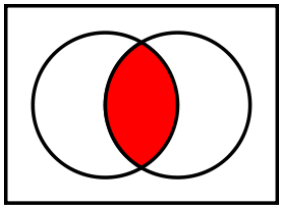
Python Set Operators



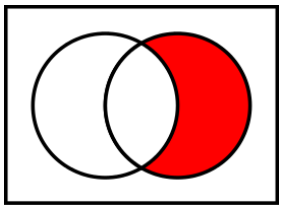
- Using sets and set operations often useful
- A | B, set union
  - Everything



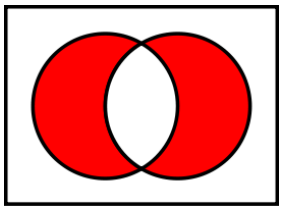
- A & B, set intersection
  - *Only* in both



- B – A, set difference
  - In B *and* not A



- A ^ B, symmetric diff
  - Only in A *or* only in B



List and Set, Similarities/Differences

	Function for List	Function for Set
Adding element	`x.append(elt)`	`x.add(elt)`
Size of collection	`len(x)`	`len(x)`
Combine collections	`x + y`	`x | y`
Iterate over	`for elt in x:`	`for elt in x:`
Element membership	`elt in x`	`elt in x`
Index of an element	`x.index(elt)`	`CANNOT DO THIS`

- Lists are ordered and indexed, e.g., has a first or last
- Sets are **not** ordered, very fast, e.g., **`if elt in x`**

Creating and changing a set

```
colorList = ['red', 'blue', 'red', 'red', 'green']
colorSet = set(colorList)
smallList = list(colorSet)
colorSet.clear()
colorSet.add("yellow")
colorSet.add("red")
colorSet.add("blue")
colorSet.add("yellow")
colorSet.add("purple")
colorSet.remove("yellow")
```

smallList is

Set Operations – Union and Intersection

```
UScolors = set(['red', 'white', 'blue'])
dukeColors = set(['blue', 'white', 'black'])

print(dukeColors | UScolors)
print(dukeColors & UScolors)
```

Set Operations - Difference

```
UScolors = set(['red', 'white', 'blue'])
dukeColors = set(['blue', 'white', 'black'])

print(dukeColors - UScolors)
print(UScolors - dukeColors)
```

Set Operations – Symmetric Difference

```
UScolors = set(['red', 'white', 'blue'])
dukeColors = set(['blue', 'white', 'black'])

print(dukeColors ^ UScolors)
print(UScolors ^ dukeColors)
```

Let's sort lists with sorted() function

- Built-in function: sorted(*sequence*)
  - Returns new list of sequence in sorted order
  - Sequence could be list, tuple, string
  - Sequence could be set!

```
a = set( [3, 5, 2, 1, 7, 2, 5)]
b = sorted(a)
```

WOTO-2 Sets
http://bit.ly/101s22-0224-2

APT Eating Good

APT: EatingGood

Problem Statement

We want to know how many different people have eaten at a restaurant this past week. The parameter `meals` has strings in the format `"name:restaurant"` for a period of time. Sometimes a person eats at the same restaurant often.

Return the number of different people who have eaten at the eating establishment specified by parameter `restaurant`.

For example, `"John Doe:Moes"` shows that John Doe ate one meal at Moes.

Specification

```
 filename: EatingGood.py

def howMany(meals, restaurant):
      """
      Parameter meals a list of strings with each in the format
      "name:place-ate". Parameter restaurant is a string
      return # unique name values where place-ate == restaurant
      """

      # you write code here
      return 0
```

Write function `howMany` that given `meals`, a list of strings in the format above indicating where each person ate a meal, and `restaurant`, the name of a restaurant, returns the number of people that ate at least one meal at that restaurant.

APT Eating Good Example

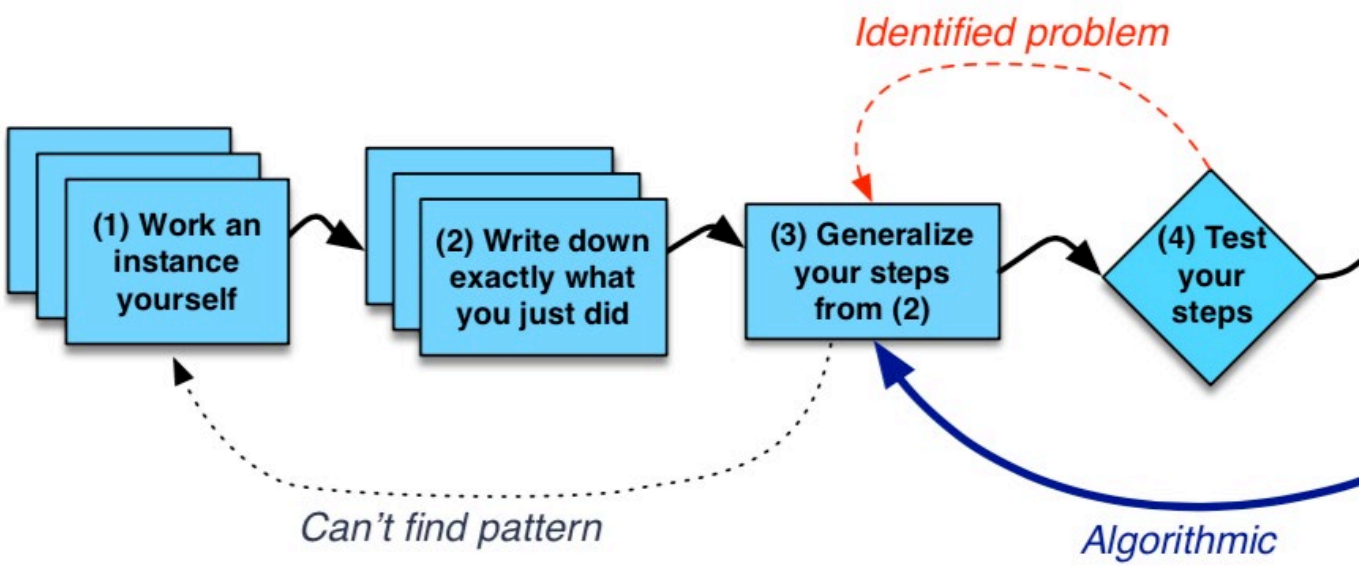
```
meals = ["Sue:Elmos", "Sue:Elmos", "Sue:Elmos"]

restaurant = "Elmos"

returns 1
```

WOTO-3: APT Eating Good
http://bit.ly/101s22-0224-3

- https://www2.cs.duke.edu/csed/pythonapt/eatinggood.html



APT Eating Code Idea