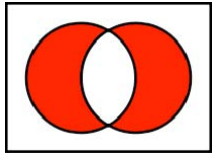


CompSci 101

Introduction to Computer Science



Oct 18, 2016

Prof. Rodger

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Announcements

- Reading and RQ due next time
- Assignment 5 out today
- APT 4 due today, APT 5 out
- Lab 6 this week
 - Read APT Anagramfree and Assignment 5 before going to lab!
- Today:
 - Focus on problem solving with sets, list comprehensions

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Richard Stallman

- MacArthur Fellowship (Genious grant)
- ACM Grace Murray Hopper award
- Started GNU – Free Software Foundation (1983)
 - GNU Compiler Collection
 - GNU Emacs



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Solving problems – APT MorseLikeCode

- Compare find vs index
 - find with string – returns -1 when not found
 - index with list – CRASHES if not there!
 - You can't say: `pos = alist.index("...")`
 - Instead: if `"..."` in `alist`:
`pos = alist.index("...")`
- How to get started?

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List Comprehension

- Take advantage of patterns, make a new list based on per element calculations of another list

- Format:

[<expression with variable> for <variable> in <old list>]

- Example:

```
nums = [8, 3, 5, 4, 1]
sqnums = [v*v for v in nums]
```

These result in the same list!

```
nums = [8, 3, 5, 4, 1]
```

```
1) sqnums = []
   for v in nums:
       sqnums.append(v*v)
```

```
2) sqnums = [v*v for v in nums]
```

Examples of List Comprehensions

bit.ly/101f16-1018-1

```
nums = [4, 3, 8]
[v for v in nums]
[2 for v in nums]
sum([v*2 for v in nums])
[v+5 for v in nums][1]
```

Creating a list with just the even numbers

```
nums = [8, 3, 5, 4, 1]
evennums = []
for v in nums:
    if v % 2 == 0:
        evennums.append(v)
print evennums
```

```
[8, 4]
```

List Comprehension with Filtering

- Create list and use “if” to filter out elements to the list
- Format:
[<expression with variable> for <variable> in <old list> if <filter with variable>]
- Example: `nums = [8, 3, 5, 4, 1]`
`evennums =`
`[v for v in nums if v%2==0]`

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More on List Comprehensions

www.bit.ly/101f16-1018-2

`names = ["Bo", "Moe", "Mary", "Aaron", "Joe"]`

- What is the list for the following:

- 1) `[w for w in names if w.endswith("e")]`
- 2) `[w for w in names if w.lower()[0] > 'c']`
- 3) `[j+1 for j in range(20) if (j%3) == 0]`
- 4) `[i*2 for i in [j+1 for j in range(20) if (j%3) == 0] if i*i > 19]`

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More on List Comprehensions

bit.ly/101sp16-1018-3

- Problem: Given a list of strings, return the longest string. If there are more than one of that length, return the first such one.
`['kiwi', 'plum', 'orange', 'lemon', 'banana']`
Write a list comprehension for this problem

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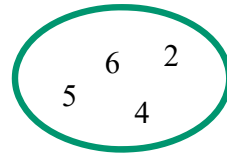
Python Sets

- 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
- Operations on sets:
 - Modify: add, clear, remove
 - Create a new set: difference(-), intersection(&), union (|), symmetric_difference(^)
 - Boolean: issubset <=, issuperset >=
- Can convert list to set, set to list
 - Great to get rid of duplicates in a list

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List vs Set

- List
 - Ordered, 3rd item, can have duplicates
 - Example: [4, 6, 2, 4, 5, 2, 4]
- Set
 - No duplicates, no ordering
 - Example:
- Both
 - Add, remove elements
 - Iterate over all elements



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Summary (from wikibooks)

```
• set1 = set()           # A new empty set
• set1.add("cat")        # Add a single member
• set1.update(["dog", "mouse"]) # Add several members
• set1.remove("cat")     # Remove a member - error if not
                        # there

• print set1
• for item in set1:      # Iteration or "for each element"
    print item
• print "Item count:", len(set1) # Length, size, item count
• isempty = len(set1) == 0     # Test for emptiness
• set1 = set(["cat", "dog"])   # Initialize set from a list
• set3 = set1 & set2           # Intersection
• set4 = set1 | set2          # Union
• set5 = set1 - set3          # Set difference
• set6 = set1 ^ set2          # Symmetric difference (elements in
                        # either set but not both)

• issubset = set1 <= set2     # Subset test
• issuperset = set1 >= set2   # Superset test
• set7 = set1.copy()          # A shallow copy (copies the set, not
                        # the elements)
• set8.clear()               # Clear, empty, erase
```

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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")
```

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Set Operations

```
UScolors = set(["red", "white", "blue"])
dukeColors = set(["blue", "white"])
print dukeColors.union(UScolors)
print dukeColors | UScolors
print dukeColors.intersection(UScolors)
print dukeColors & UScolors
print dukeColors.difference(UScolors)
print dukeColors - UScolors
print UScolors - dukeColors
print dukeColors ^ UScolors
print UScolors ^ dukeColors
```

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Set Examples

bit.ly/101f16-1018-4

```
poloClub = set(['Mary', 'Laura', 'Dell'])
```

```
rugbyClub = set(['Fred', 'Sue', 'Mary'])
```

Questions:

```
print [w for w in poloClub.intersection(rugbyClub)]
```

```
print poloClub.intersection(rugbyClub)
```

```
print [w for w in poloClub.union(rugbyClub)]
```

```
print poloClub.union(rugbyClub)
```

Set Examples (cont)

```
lista = ['apple', 'pear', 'fig', 'orange', 'strawberry']
```

```
listb = ['pear', 'lemon', 'grapefruit', 'orange']
```

```
listc = [x for x in lista if x in listb]
```

```
listd = list(set(lista)|set(listb))
```

Assignment 5 - Hangman

- Guess a word given the number of letters.
 - Guess a letter
 - see if it is in the word and where.
- Demo
- Will start in lab

APT AnagramFree

```
words = ["creation", "sentence", "reaction", "sneak", "star", "rats", "snake"]
```

Returns: 4

```
"star" "rats"      → both have letters: a r t s
"snake" "sneak"
"creation" "reaction"
"sentence"
```

Problem

- Given two books:
 - How many words in each book?
 - How many unique words in each book?
 - What words that start with “r” are in one book and not the other book?

Process Exam Scores bit.ly/101f16-1018-5

- Calculate
 - total number of scores
 - Average score
 - Median score
- Print a visualization of the grades
- Get snarf file