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

Richard Stallman

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

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?
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:
  \[
  \{\text{<expression with variable>} \text{ for } \text{<variable>} \text{ in } \text{<old list>} \text{ if } \text{<filter with variable>} \}
  \]

- Example: \(\text{nums} = [8, 3, 5, 4, 1]\)
  \(\text{evennums} = [v \text{ for } v \text{ in } \text{nums} \text{ if } v\%2==0]\)

More on List Comprehensions

\(\text{names} = [\text{“Bo”, “Moe”, “Mary”, “Aaron”, “Joe”}]\)

- What is the list for the following:
  1) \([w \text{ for } w \text{ in } \text{names} \text{ if } w\text{.endswith(“e”)}]\)
  2) \([w \text{ for } w \text{ in } \text{names} \text{ if } w\text{.lower()[0]} > ‘c’]\)
  3) \([j+1 \text{ for } j \text{ in } \text{range}(20) \text{ if } (j\%3) == 0]\)
  4) \([i*2 \text{ for } i \text{ in } [j+1 \text{ for } j \text{ in } \text{range}(20) \text{ if } (j\%3) == 0] \text{ if } i*i > 19]\)

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
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

Summary (from wikibooks)

- set1 = set()
- set1.add("cat")
- set1.update(["dog", "mouse"])
- set1.remove("cat")
- print set1
- for item in set1:
  print item
- print "Item count":, len(set1)
- isempty = len(set1) == 0
- set3 = set1 & set2
- set4 = set1 | set2
- set5 = set1 - set3
- set6 = set1 ^ set2
- issubset = set1 <= set2
- issuperset = set1 >= set2
- set7 = set1.copy()
- set8.clear()

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")

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 UScolors ^ UScolors
print UScolors ^ dukeColors
Set Examples

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)

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