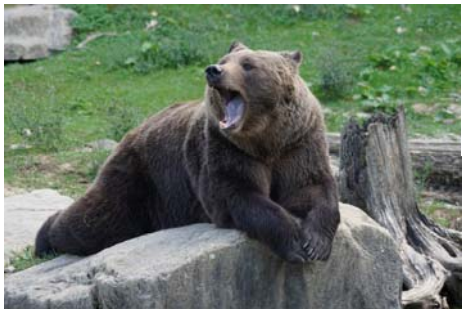
Programming Idioms and Ideas: PII

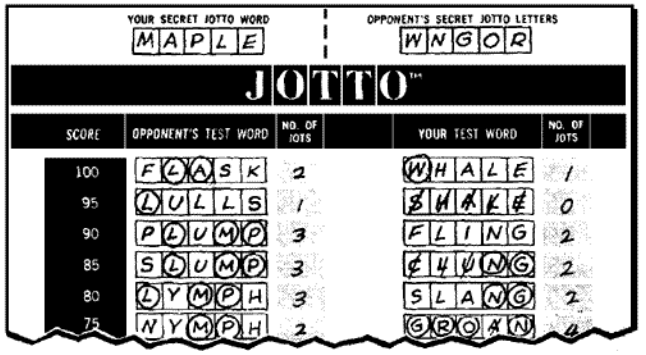
- Two kinds of loops: by-element, by-index
  - Underneath often by index, e.g., problems when removing from a list while iterating
- Two kinds of structured data: strings and lists
  - Soon to add sets, tuples, dictionaries
- Today: Strings, Lists, Sets, Oh My!





Solving Problems, Transforming Data

- Consider the Common APT, useful in the interactive game Jotto you'll write
  - `"seats", "tease" -> 4`
  - `"seats", "meaty" -> 3`
  - `"seats", "stats" -> 4`



- Ideas: loop over word1, cross out in word2
  - `'s', "*tats" 1` *does it matter which 's' ?*
  - `'e', "*tats" 1` *can you replace 's' with '*'?*
  - `'a', "*t*ts" 2`

Ideas into code: thinking about loops

- As you loop over 's', 't' ... find and "mark"
  - You can look up the 's' in word2, find index
  - You can use index in word1 and in word2

```
for ch in word1:
    dex = word2.find(ch)
    if dex != -1:
```

```
for k in range(len(word1)):
    dex = word2.find(word1[k])
    if dex != -1:
```

Using lists rather than strings

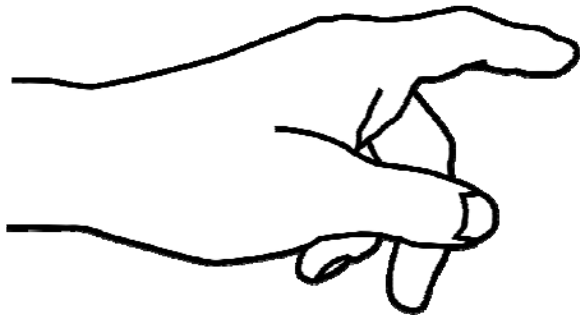
- **Strings are immutable, can create new ones, but cannot change, lists are mutable!**
  - **Using a list instead makes code easier,** *unfortunately list has no* ***`find`****, only* ***`index`***

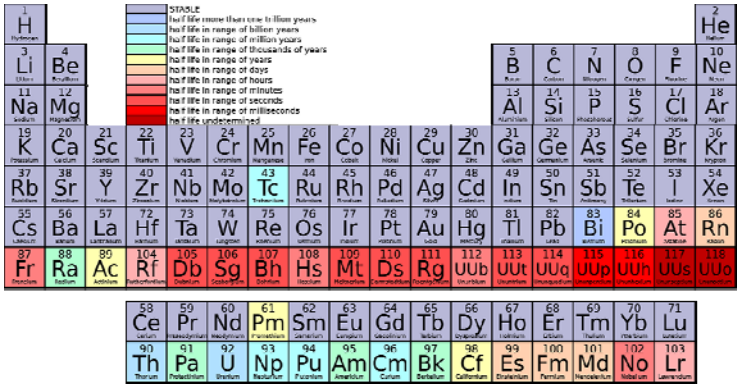
```
for ch in word1:
    dex = word2.find(ch)
    if dex != -1:
        word2 = word2[:dex] + '*' + word2[dex+1:]
```

```
for ch in list1:
    if ch in list2:
        dex = list2.index(ch)
        list2[dex] = '*'
```

Which loop is right? Index or Element?

- **It Depends! (always a good answer)**
  - If you're going to always use one loop, to avoid having to make a choice, which one to use?
  - Can you go simply from index to element?
  - Can you go simply from element to index?





Eating Well or Good Eating: APT

- http://www.cs.duke.edu/csed/pythonapt/eatinggood.html
- **First think about solving this by hand…**
  - **In translating to Python, what's easy? Harder?**
  - **Can we find diners who eat at Elmo's easily?**

- **Structure**
  - **Strings and lists**
  - **Using .split(…)**

Eliminating Duplicates

- Could process a list, avoid double counting by checking, but much easier solution: set!
  - Part of Python and many other languages
  - *Typically implemented to be very efficient in determining membership*

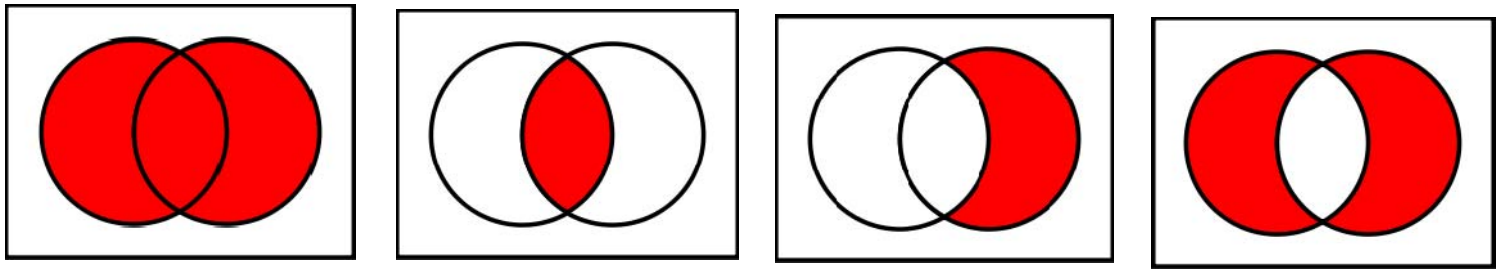
- Set – collection like list, but not indexable
  - Can `.add()`, `.remove()`,
  - Can iterate, cannot slice
  - Can `if foo in coll:` where coll is set or list

Thinking about sets

- Use `list.append(x)`, use `set.add(x)`
  - If already in set, nothing happens
- Can create set from a list all at once

```
uni = set([1,2,3,1,2,3,1,2,3,1,1,2,2,3,3])
```

- Later we'll see union `|`, intersection `&`, difference `-` and other operations `^` TBDiscussed



Question Interlude

http://bit.ly/101fall15-1008-1

Summary (from wikibooks)

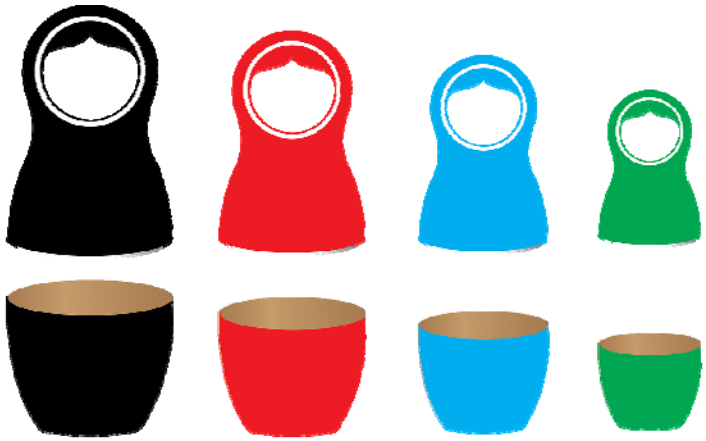
```
• set1 = set()                      # A new empty set
• set1.add("cat")                   # Add a single member
• set1.update(["dog", "mouse"])     # Add several members
• set1.remove("cat“)                # Remove a member – error not there

• for item in set1:                 # Iteration or “for each element”
• len(set1)                         # Length, size
• 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)
• Is Subset:    set1 <= set2        # Subset test
• Is Supeerset: set1 >= set2        # Superset test
• set7 = set1.copy()                # shallow copy (copies set, not elts)
• set8.clear()                      # Clear, empty, erase
```

Indexes within indexes, loop in loops

- **Very useful in solving two-dimensional and other problems**
  - **Lists are one-dimensional, for example**



List in a list and loop in a loop

- `z = [ [1,2,3], [4,5,6], [7,8,9] ]`
  - `for x in z: what is type of x?`
- Use one loop inside another to access both
  - Could be list of student info as well

```
for x in z:
    for y in x:
        #what type is y?
```

Looping with Indexes

- **How to understand a loop-in-a-loop?**
  - **What changes in the inner loop**

```
def doublenest(n):
    for i in range(n):
        for j in range(n):
            print i,j
```

```
def doublenest2(n):
    for i in range(n):
        for j in range(i+1,n):
            print i,j
```

Create "couples"

- Aname is fixed as the inner loop executes
  - See output to reinforce this idea

```
A = ['sam', 'lou', 'chris']
B = ['terry', 'brook', 'val']
for aname in A:
    for bname in B:
        print aname,",",bname
```

```
sam , terry
sam , brook
sam , val
lou , terry
lou , brook
lou , val
chris , terry
chris , brook
chris , val
```

Midterm and what it means

- **Working to succeed can lead to success**
  - **Your score isn't as important as why and where you lost points**
  - **We will provide a path and approach for those who want to rethink approach to 101**
- **Is it better to get 30% of everything, or 70% of 50% of what we cover?**

```
32 37 41 44 45 48 49 49
50 50 54 54 55 56 56 57 57 58 58 58 59
60 61 61 62 62 63 65 65 65 66 66 66 67 67 68 69 69
70 71 72 72 73 73 73 73 74 74 74 74 75 76 76 76 77 77 78 79 79 79 79
80 80 80 80 80 81 81 81 82 82 82 82 82 82 82 83 83 83 83 83 83 84 84 84 84 84 84 84 84 84 85 85 85 85 85 85 85
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