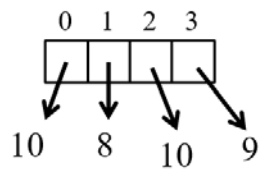
CompSci 101
Introduction to Computer Science

score = [10,8,10,9]



Sep 21, 2017

Prof. Rodger

Announcements

- Reading and RQ8 due next time
- Assignment 3 due tonight
  - Assignment 4 out, due Oct. 3
- APT 3 is due on Tuesday
- APT Quiz 1 take Sunday-Wednesday 11:59pm
  - practice APT quiz available

- Today
  - Breaking apart and putting back together.
  - Thinking about solving assignments, apts

Assignment 4 out today, due Oct 3

- **Transform 1** – PigLatin.

The angry bear climbed the tree.

e-thay angry-way ear-bay imbed-clay e- thay ee.-tray

→ The angry bear climbed the tree.

- **Transform 2** – Caesar Cipher encryption

The angry bear climbed the tree.

Aol hunyf ilhy jsptilk aol ayll.

→ The angry bear climbed the tree.

Getting help

- Consider a peer tutor – one hour of one on one help a week.
  - Many take advantage of this
  - contact peer tutoring center

- Are you getting too much help?
  - After solving APT
  - Can you solve again with a blank sheet of paper or blank file and no help?

- Are you using 7 step process to solve?

Are you Learning How to Debug?

- Do a little bit at a time, make sure it works!
- Print is your friend!
- Create variables!
- Isolate the problem
  - Comment out sections until you can isolate where the problem is
- Python Tutor – trace
  - Doesn't work with files but comment out file and create variable with sample input

Incremental + : numbers and strings

- Wtht vwls cn y stll rd ths sntnc?
  - Create a no-vowel version of word
  - Examine each character, if it's not a vowel …
  - Pattern of building a string

```
def noVowels(word):
    ret = ""
    for ch in word:
        if not isVowel(ch):
            ret = ret + ch
    return ret
```

Counting vowels in a string

- Accumulating a count in an int is similar to accumulating characters in a string

```
def vowelCount(word):
    value = 0
    for ch in word:
        if isVowel(ch):
            value = value + 1
    return value
```

- Alternative version of adding:

```
value += 1
```

Assignment 3 Questions
bit.ly/101f17-0921-1

Filtering data

- List of all the earthquakes
- FILTER – those magnitude 2.0 or greater
  → List of earthquakes 2.0 or greater
- FILTER – those earthquakes in Alaska
  → List of earthquakes from Alaska 2.0 or greater

- NOTE you still have a list

String Functions – What is output?

```
name = "VVDarth Vater Darth VaterVVV"
nm = name.strip("V")

phrase = "mississippi"
phrase = phrase.replace("ss","pp")

last  = "Darth Vater or Darth Vater"
last = last.replace("a","o").replace("or","es")

b = "the end is near oh dear"
a = b.endswith('s')
```

String Functions – What is output?

```
name = "VVDarth Vater Darth VaterVVV"
nm = name.strip("V")
```

Darth Vater Darth Vater

```
phrase = "mississippi"
phrase = phrase.replace("ss","pp")
```

mippippippi

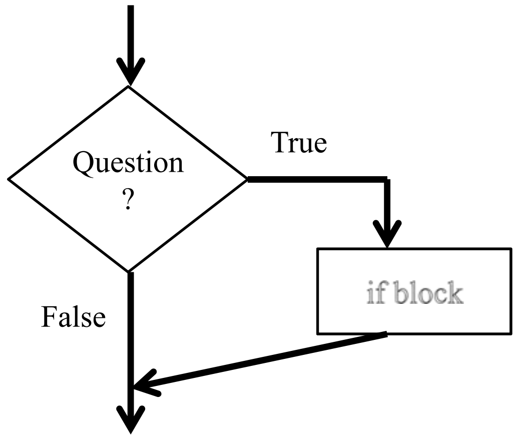
```
last  = "Darth Vater or Darth Vater"
last = last.replace("a","o").replace("or","es")
```

Desth Voter es Desth Voter

```
b = "the end is near oh dear"
a = b.endswith('s')
```

False

Making Decisions



Making Decisions in Python

if *condition1*:

  Block of code to do if condition is true

elif *condition2*:

  Block of code to do if condition1 false, condition2 is true

else:

  Block of code to do if other conditions false

- Can have many elifs, leave out elif, leave out else

Making Decisions tools

- Boolean values: True, False
- Boolean operators: and, or, not

X	Y	X and Y	X or Y
True	True	True	True
True	False	False	True
False	True	False	True
False	False	False	False

- Relational operators: <, <=, >, >=
- Equality operators: ==, !=

bit.ly/101f17-0921-2

```
def isVowel(letter):
    answer = False
    if letter == 'a':
        answer = True
    elif letter == 'e':
        answer = True
    elif letter == 'i':
        answer = True
    elif letter == 'o':
        answer = True
    elif letter == 'u':
        answer = True
    return answer

def isVowel2(letter):
    answer = False
    if letter == 'a':
        answer = True
    if letter == 'e':
        answer = True
    if letter == 'i':
        answer = True
    if letter == 'o':
        answer = True
    if letter == 'u':
        answer = True
    return answer
```

```
def isVowel3(letter):
    if letter == 'a':
        return True
    else:
        return False
    if letter == 'e':
        return True
    else:
        return False
    if letter == 'i':
        return True
    else:
        return False
    if letter == 'o':
        return True
    else:
        return False
    if letter == 'u':
        return True
    else:
        return False
```

```
def isVowel4(letter):
    answer = False
    if letter == 'a':
        answer = True
    else:
        answer = False
    if letter == 'e':
        answer = True
    else:
        answer = False
    if letter == 'i':
        answer = True
    else:
        answer = False
    if letter == 'o':
        answer = True
    else:
        answer = False
    if letter == 'u':
        answer = True
    else:
        answer = False
    return answer
```

Lists

- A list is a collection of objects

```
scores = [99, 78, 91, 84]
allAboutMe = [“Mo”,25, “934-1234”]
club=[‘Mo’,‘Jo’,‘Po’, ‘Flo’, ‘Bo’]
```

- Lists are *mutable* – use [num] to change a value
- Lists are indexed starting at 0, or -1 from the end
- Functions: max, min, len, sum
- Slice lists [:]

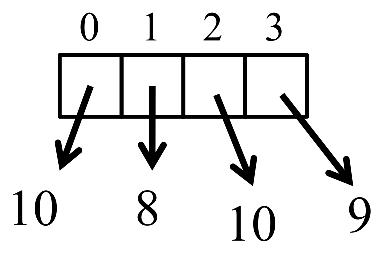
List Examples

```
scores = [10, 8, 10, 9]
print scores
scores[2] = 5
print scores
print max(scores), len(scores)
print sum(scores)
print scores[1:]
print scores[1], scores[-1]
scores.append(4)
scores += [5]
print scores
```

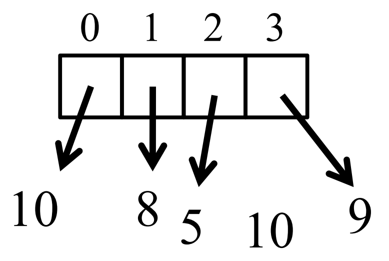
List Examples

```
scores = [10, 8, 10, 9]
print scores                        [10, 8, 10, 9]
scores[2] = 5
print scores                        [10, 8, 5, 9]
print max(scores), len(scores)      10, 4
print sum(scores)                   32
print scores[1:]                    [8, 5, 9]
print scores[1], scores[-1]         8, 9
scores.append(4)
scores += [5]
print scores                        [10, 8, 5, 9, 4, 5]
```

List before/after modification



score = [10,8,10,9]



score [2] = 5

More List Examples

- phrase = "earthquake, 1.3, 81km SSW of Kobuk, Alaska"
- phrase.split(" ,") vs phrase.split() vs phrase.split("a")
- phrase = "Duke will beat UNC"
- alist = phrase.split()
- ' '.join(alist) vs '+'.join(alist) vs "YES".join(alist)
- append vs += [item]

Design pattern of accumulation *for item in something*

- Summing to tally a count
  value += 1
- Building a new string by concatenating
  str += ch
- Building a new list by appending
  lst.append(element)
  OR
  lst += [element]

Design pattern of accumulation *for item in something*

- Summing to tally a count
  value += 1
- Building a new string by concatenating
  str += ch
- Building a new list by appending
  lst.append(element) Note no "=" here
  OR
  lst += [element] Note the brackets!
  lst = lst + [element]

Processing List Items

- Process all the items in a list, one item at a time
- Format: `for` variable `in` list:
  process variable
- Example:

```
sum = 0
nums = [6, 7, 3, 1, 2]
for value in nums:
    sum = sum + value
print sum
```

Learn list functions

```
nums = [6, 7, 3, 1, 2]
print sum(nums)
```

Problem: Sum up even numbers in list of numbers

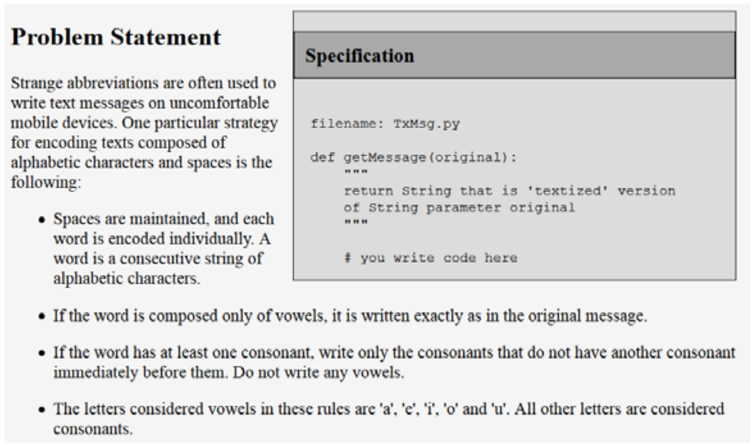
- Could do it similar to two slides back
- OR Build a list of the correct numbers, then sum

How to build list of evens and sum? bit.ly/101f17-0921-3

```
def sumUpEven(nums):
    answer = question1
    for item in nums:
        if question2:
            question3
    return question4
```

From APT 3 - TxMsg

http://www.cs.duke.edu/csed/pythonapt/txmsg.html



Problem Statement

Strange abbreviations are often used to write text messages on uncomfortable mobile devices. One particular strategy for encoding texts composed of alphabetic characters and spaces is the following:

- Spaces are maintained, and each word is encoded individually. A word is a consecutive string of alphabetic characters.
- If the word is composed only of vowels, it is written exactly as in the original message.
- If the word has at least one consonant, write only the consonants that do not have another consonant immediately before them. Do not write any vowels.
- The letters considered vowels in these rules are 'a', 'e', 'i', 'o' and 'u'. All other letters are considered consonants.

Specification

```
filename: TxMsg.py

def getMessage(original):
    """
    return String that is 'textized' version
    of String parameter original
    """

    # you write code here
```

Examples

- Do one by hand?
- Explain to partner?
- Identify Pythonic/programming challenges?

1. "text message"

   Returns "tx msg"

2. "ps i love u"

   Returns: "p i lv u"

3. "please please me"

   Returns: "ps ps m"

4. "back to the ussr"

   Returns "bc t t s"

5. "aeiou bcdfghjklmnpqrstvwxyz"

   Returns: "aeiou b"

Debugging APTs: Going green

- TxMsg APT: from ideas to code to green
  - What are the main parts of solving this problem?
  - Transform words in original string
    - Abstract that away at first
  - Finding words in original string
    - How do we do this?

```
def getMessage(original):
    ret = ""

        ret = ret + " " + transform(word)
    return ret   #initial space?
```

Debugging APTs: Going green

- TxMsg APT: from ideas to code to green
  - What are the main parts of solving this problem?
  - Transform words in original string
    - Abstract that away at first
  - Finding words in original string
    - How do we do this?

```
def getMessage(original):
    ret = ""
    for word in original.split():
        ret = ret + " " + transform(word)
    return ret   #initial space?
```

Write helper function *transform*

- How?
- Use seven steps
- Work an example by hand

Transform word - Step 1: work small example by hand

- Word is “please”
- Letter is ‘p’, YES
- answer is “p”
- Letter is ‘l’, NO
- Letter is ‘e’, NO
- Letter is ‘a’, NO
- Letter is ‘s’, YES
- answer is “ps”
- Letter is ‘e’, NO

Step 2: Describe what you did

- Word is “please”, create an empty answer
- Letter is ‘p’, consonant, no letter before, YES
- Add ‘p’ to answer
- Letter is ‘l’, consonant, letter before “p”, NO
- Letter is ‘e’, vowel, letter before ‘l’, NO
- Letter is ‘a’, vowel, letter before ‘e’, NO
- Letter is ‘s’, consonant, letter before ‘a’, YES
- Add ‘s’ to answer
- Letter is ‘e’, vowel, letter before ‘s’, NO
- Answer is “ps”

Step 3: Find Pattern and generalize

```
Need letter before, pick “a”
answer is empty
for each letter in word
    If it is a consonant, and the letter before is a
    vowel, then add the letter to the answer
    This letter is now the letter before
return answer
```

Step 4 – Work another example

- Word is message
- Letter is ‘m’, before is ‘a’, add ‘m’ to answer
- Letter is ‘e’, before is ‘m’, NO
- Letter is ‘s’, before is ‘e’, add ‘s’ to answer
- Letter is ‘s’, before is ‘s’, NO
- Letter is ‘a’, before is ‘s’, NO
- Letter is ‘g’, before is ‘a’, add ‘g’ to answer
- Letter is ‘e’, before is ‘g’, NO
- Answer is “msg” WORKS!!

Step 5: Translate to Code

```
# Letter before is “a”      # start with a vowel

# answer is empty

# for each letter in word
```

Step 5: Translate to Code

```
# Letter before is "a"        # start with a vowel
before = 'a'
# answer is empty
answer = ''
# for each letter in word
for ch in word:
```

Step 5: Translate to Code (code)

```
    #If it is a consonant, and the letter before is a
    #vowel, then add the letter to the answer


    #This letter is now the letter before

# return answer
```

Step 5: Translate to Code (code)

```
    #If it is a consonant, and the letter before is a
    #vowel, then add the letter to the answer
    if !(isVowel(ch)) and isVowel(before):
        answer += ch
    #This letter is now the letter before
    before = ch
# return answer
return answer
```

Will our program work for?

STRING	GET	SHOULD GET
green		
apple		
a		
aeiuo		
grrr		

Will our program work for?

STRING	GET	SHOULD GET
green	gn	YES
apple	p	YES
a		a
aeiuo		aeiou
grrr	g	YES

Handle special cases first, maybe write a function for some?

Why use helper function 'transform'?

- Structure of code is easier to reason about
  - Harder to develop this way at the beginning
  - Similar to accumulate loop, build on what we know
- We can debug pieces independently
  - What if transform returns "" for every string?
  - Can we test transform independently of `getMessage`?

Python via Problem Solving

In the loop for TxMsg we saw:

```
ret = ret + " " + transform(word)
```

- Why does this leave "extra" space at front?
- Eliminate with `ret.strip()`

Alternate: collect transform words in list, use join to return

Rather than construct string via accumulation and concatenation, construct list with append