Announcements

- Reading and RQ7 due next time
- Assignment 3 due Tuesday
- APT 2 due today, APT 3 out
- APT Quiz 1 – can practice
  - Get two hours from 6pm Sun – 10pm Tues

- Today:
  - Designing programs to draw with turtles
  - Functions, if, strings, lists

Problem Solving to Code

7 Step Process

1. Work small example by hand
2. Write down what you did in words (algorithm)
3. Find Patterns (generalize algorithm)
4. Work another example by hand (does your algorithm work? If not, go back to 2)
5. Translate to code
6. Test several cases
7. Debug failed test cases

Turtles: bit.ly/101sp16-0202-4

- Run in eclipse
- Make square with different sizes?
- Make a rectangle?
- Where is the repetition?
- New commands:
  - up(), down(), position(), goto()
Assignment 3

- Turtles
  - Creative

- Earthquakes
  - Data from last 30 days around the world
  - Example - Find the largest earthquake

Python if statements and Booleans

- In python we have if: else: elif:
  - Used to guard or select block of code
  - If guard is True then code block, else other

- What type of expression used in if/elif tests?
  - ==, <=, <, >, >=, !=, and, or, not, in
  - Value of expression must be either True or False
  - Type is bool - George Boole, Boolean,

- Examples with if
  - String starts with vowel (useful for APT Emphasize)

Four versions of isVowel?

A

```python
def isVowel(ch):
    if ch == 'e':
        return True
    if ch == 'a':
        return True
    if ch == 'i':
        return True
    if ch == 'o':
        return True
    if ch == 'u':
        return True
    return False
```

B

```python
def isVowel(ch):
    c = "aeiou".count(ch)
    if c > 0:
        return True
```

C

```python
def isVowel(ch):
    return "aeiou".count(ch) > 0
```

D

```python
def isVowel(ch):
    if ch in "aeiou":
        return True
    else:
        return False
```

Anatomy of a Python String

- String is a sequence of characters
  - Functions we can apply to sequences: len, slice [:], others
  - Methods applied to strings [specific to strings]
    - st.split(), st.startswith(), st.strip(), st.lower(), …
    - st.find(), st.count()

- Strings are immutable sequences
  - Characters are actually length-one strings
  - Cannot change a string, can only create new one
    - What does upper do?
      - See resources for functions/methods on strings

- *Iterable*: Can loop over it, *Indexable*: can slice it
See Wikipedia and lynnconway.com

- Joined Xerox Parc in 1973
  - Revolutionized VLSI design with Carver Mead
- Joined U. Michigan 1985
  - Professor and Dean, retired '98
- NAE '89, IEEE Pioneer '09
- Helped invent dynamic scheduling early '60s IBM
- Transgender, fired in '68

Incremental + : numbers and strings

- Wht 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 ! 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`

What does this function do?

```
def mystery(s):
    r = 
    for ch in s:
        r = ch + r
    return r
```
From high- to low-level Python

```python
def mystery(s):
    r = 
    for ch in s:
        r = ch + r
    return r
```

Create version on the right using disassembler

```python
import dis
# mystery here
dis.dis(mystery)
```

Bug and Debug

- **software 'bug'**
- **Start small**
  - Easier to cope
  - Simplest input?
- **Judicious 'print'**
  - Debugger too
- **Python tutor**
  - Visualizes data
  - step through
- **Verify the approach being taken, test small, test frequently**
  - How do you 'prove' your code works?

APT Emphasize