CompSci 101
Introduction to Computer Science

Sept 20, 2016

Prof. Rodger

Announcements

- Reading and RQ7 due next time
- Assignment 3 due Thursday
- APT 2 due today, APT 3 out
- APT Quiz 1 – runs Sunday night-Tuesday night
  - Up for two days, you pick 3 hours to do it
- Today
  - Designing programs to draw with turtles
  - Functions, if, strings, lists

Lab This week

- Practice with lists and strings – splicing, etc
- More on processing data from files
  - Do reading for Thursday before attending lab
- Work on APT ScoreIt

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

Slide 5

Removing 's' at the end of words
bit.ly/101f16-0920-1

```python
def removePlurals(phrase):
    answer = ""
    alist = phrase.split()
    for word in alist:
        if word[-1] == "s":
            answer = word[:-1] + " "
        else:
            answer = word + " "
    return answer.strip()
```

Slide 6

Computer Science Alum

- Biology and CS
- Undergraduate Research - JFLAP
- Epic
- Now in Med School at Vanderbilt
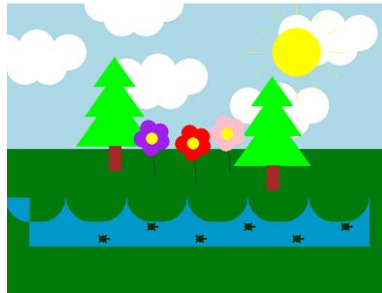
Slide 7

More Computer Science Duke Alums

Slide 8

Turtles: bit.ly/101f16-0920-2

```python
import turtle
wn = turtle.Screen()

def square (alex):
    alex.forward(100)
    alex.left(90)
    alex.forward(100)
    alex.left(90)
    alex.forward(100)
    alex.left(90)
    alex.forward(100)
    alex.left(90)

if __name__ == '__main__':
    timmy = turtle.Turtle()
    square(timmy)

    wn.exitonclick()
```

- 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
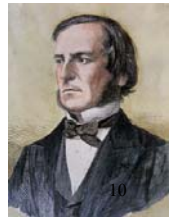 - Example - Find the largest earthquake

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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?
bit.ly/101f16-0920-3

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

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

D
```
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

Lynn Conway

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

- 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
```

What does this function do?
bit.ly/101f16-0920-4

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

From high- to low-level Python

```
def mystery(s):
  r = ""
  for ch in s:
    r = ch + r
  return r
```
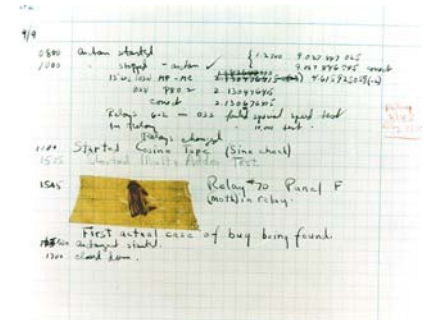
Create version on the
right using disassembler

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

```
7       0 LOAD_CONST     1 ('')
        3 STORE_FAST     1 (r)

8       6 SETUP_LOOP    24 (to 33)
        9 LOAD_FAST      0 (s)
       12 GET_ITER
    >> 13 FOR_ITER      16 (to 32)
       16 STORE_FAST     2 (ch)

9      19 LOAD_FAST      2 (ch)
       22 LOAD_FAST      1 (r)
       25 BINARY_ADD
       26 STORE_FAST     1 (r)
       29 JUMP_ABSOLUTE 13
    >> 32 POP_BLOCK

10  >> 33 LOAD_FAST      1 (r)
       36 RETURN_VALUE
```

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?

Work on APT?