Compsci 6/101: PFTW

- Review how APTs and Python work, run
  - Good, Bad, Ugly: getting better, avoid frustration, …
  - How do you run/test APT code, other Python code
- Control flow in Python
  - Changing order in which Python statements execute
  - Loops and if statements
  - *Essential* for writing *real* programs
- Get ready for first assignment
  - Difference between assignment and APTs?

BMI for everyone

- How do we get at the data in a Google form?
  - Why would we use a Google form?
  - Advantages of data in the cloud? Shared data?
- How do we find BMI for one person
  - Must do this before we do it for 100 people
  - What do we do about dirty data?
- Looping and accumulating values
  - The programming idiom of `v = v + 55`
  - Generalized: `total += value`

Accumulating a value

- Variables in Python: name, type, value
  - The name is a label on an "object", "box", value
  - What does v = v + 52 do?
- Executing the assignment statement
  - Evaluate expression on right hand side
  - When done store the value of expression with label on left
  - Can this result in changing the value of the variable?
  - Does this change the name of the variable?
- Advantages of `x += 1`, or `cool_value += 1`

How to solve an APT

- Two very, very, very important steps
  1. How to solve the problem with Paper, Pencil, (Calculator)
  2. How to translate problem-solving to Python
- Both steps can be hard, vocabulary and language are initially a real barrier
  - The more experience you have with Python, the easier step 2 will get
  - The more you understand the idioms and power of the language the more you can let step 2 influence step 1
- Step 1 is key, without it you won't get anywhere

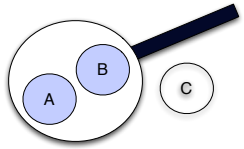
APT Pancake

- How do you solve this problem?
  - First steps: are there simple cases that can be solved immediately?
    - What are these for the pancake problem?
    - How will you identify with Python?
  - Sometimes it helps to know if you are on track, use Python to check your paper and pencil work

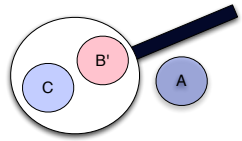
- Get specific, solve for 5, not N
  - Fix one parameter, vary the other
  - Identify the cases and continue

Three pancakes in a two-cake pan…

- Number of cakes in the system
  - First 5 minutes

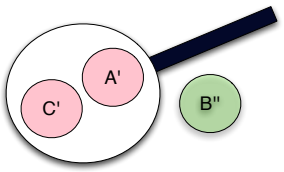


- Number of cakes in the system
  - Second 5 minutes

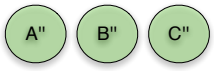


Three pancakes in a two-cake pan…

- Number of cakes in the system
  - Third 5 minutes



- How many minutes to cook all three pancakes?



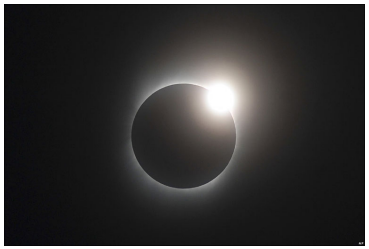
How to teach pancake flipping

- http://www.youtube.com/watch?v=W_gxLKSsSIE
  - Is this computer science? http://bit.ly/zykOrh
  - For longer, more complex robotic tasks
    - http://www.youtube.com/watch?v=4usoE981e7I

- Back to specifics:
  - Capacity = 5
  - Numcakes = 1,2,…5?
  - Numcakes = 6,7,8,9,10?
  - Numcakes = 11,12,13,14,15?
- Is five special? 4? 3? 2?

Eclipse Interlude

- Finishing the Pancake problem
  - Translating problem-solving ideas to code
  - Control with if/elif: arithmetic with / and %



Lessons: special cases, abstractions

- There are special cases in many, many problems
  - Identifying them is important
  - Abstracting them away when possible is important
  - Example: SilverDistance APT
    - Instead of four quadrants/cases, reducible to two?
    - Instead of (x,y) and (z,w) translate to (0,0) and (z-x,w-y)
- Translating ideas into (Python) code
  - How do we create interesting "heads", "totem poles" ?
  - How do create software for identikit?
  - How do we create Facebook, Foursquare, …

What years are leap years?

- 2000, 2004, 2008, …
  - But not 1900, not 2100, yes 2400!
  - Yes if divisible by 4, but not if divisible by 100 unless divisible by 400! (what?)

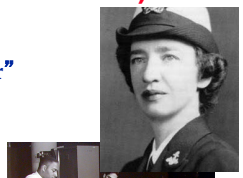
```
def is_leap_year(year):
    if year % 400 == 0:
        return True
    if year % 100 == 0:
        return False
    if year % 4 == 0:
        return True
    return False
```

- There is more than one way to skin a cat, but we need at least one way

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, 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 == bool, George Boole, Boolean,
- Examples with if
  - String starts with vowel
  - Rock, paper, scissors (!aka Rochambeau) winner

Grace Murray Hopper (1906-1992)



- "third programmer on world's first large-scale digital computer"
  - US Navy: Admiral

"It's better to show that something can be done and apologize for not asking permission, than to try to persuade the powers that be at the beginning"

- ACM Hopper award given for contributions before 35
  - 2004: Jennifer Rexford
  - 2008: Dawson Engler
  - 2010: Craig Gentry: http://www.youtube.com/watch?v=qe-zmHoPW30

How do you solve a problem like …?

- Translating English to Piglatin
  - Why is this fascinating?
  - http://www.google.com/webhp?hl=xx-piglatin
  - Is this like translating English to German?
  - Is it like translating Python to bytecode?
- "downplay their unique quiet strength"
  - "ownplay-day eir-thay unique-way iet-quay ength-stray"
  - What are the rules for pig-latin? See APT

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APT Piglatin

- How do you solve this problem?
  - First steps: are there simple cases that can be solved immediately?
    - What are these for the piglatin problem?
    - How will you identify with Python?
  - Words that begin with …
    - Vowel
    - Foods that begin with the letter 'q' for 200 Alex
- Translation to Python
  - First 'q', then vowels

Three versions of is_vowel

```
def is_vowel(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
```

```
def is_vowel(ch):
    c = "aeiou".count(ch)
    if c > 0:
        return True
    else
        return False
```

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

Piglatin, age-stay one-way

```
def convert(s):
    if s[0] == 'q':
        return s[2:]+"-quay"
    if is_vowel(s[0]):
        return s+"-way"
```

- Preview of next lab: slicing, concatenation, index
  - Where does string-indexing start?
  - What does slice with a single parameter do?

Piglatin, age-stay o-tway

```
def convert(s):
    if s[0] == 'q':
        return s[2:]+"-quay"
    if is_vowel(s[0]):
        return s+"-way"
    if is_vowel(s[1]):
        return s[1:]+"-"+s[0]+"ay"
    if is_vowel(s[2]):
        return s[2:]+"-"+s[:2]+"ay"
    if is_vowel(s[3]):
        return s[3:]+"-"+s[:3]+"ay"
    if is_vowel(s[4]):
        return s[4:]+"-"+s[:4]+"ay"
```

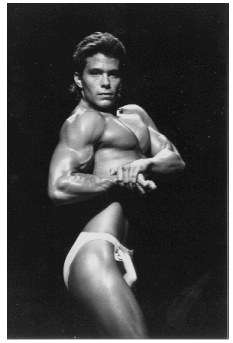

Piglatin, age-stay ee-threay

```
def convert(s):
    if s[0] == 'q':
        return s[2:]+"-quay"
    if is_vowel(s[0]):
        return s + "-way"

    for index in range(1,len(s)):
        if is_vowel(s[index]):
            return s[index:]+"-"+s[:index]+"ay"
```

- Generalize/parameterize by what varies
  - What does a loop do? it repeats!

Dawson Engler



- ACM Hopper Award 2008

"In his papers on automated program checking, Dawson Engler introduces and develops powerful techniques and tools for practical program analysis for finding errors in code."

- Started coverity.com
  - Very successful startup to find errors in code

- http://myvideos.stanford.edu/player/slplayer.aspx?course=CS240&p=true