Compsci 6: PFTW

- Problem solving and (Python) programming
  - What are the steps in solving an APT?
  - How do you get better at this?
  - How do you avoid getting frustrated? Cope with it?

- Practice selection, abstraction, looping
  - In the context of solving problems
  - El hombre bebe

- Get ready for first assignment
  - Difference between assignment and APTs?

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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

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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 7, not N
  - Fix one parameter, vary the other
  - Identify the cases and continue

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Three pancakes in a two-cake pan...

- Number of cakes in the system
  - First 5 minutes
  - 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](http://www.youtube.com/watch?v=W_gxLKSsSIE)
  - Is this computer science?
  - For longer, more complex robotic tasks
    - [http://www.youtube.com/watch?v=4usoE981e7I](http://www.youtube.com/watch?v=4usoE981e7I)

- Back to specifics:
  - Capacity = 7
  - Numcakes = 1, 2, ..., 7?
  - Numcakes = 8, 9, 10, 11, 12, 13, 14?
  - Numcakes = 15, 16, 17, 18, 19, 20?

- Is seven special? 6? 5? 3?

Eclipse Interlude

- Finishing the Pancake problem
  - Translating problem-solving ideas to code

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, ...
How do you solve a problem like …?

- **Translating English to Piglatin**
  - Why is this fascinating?
  - Is this like translating English to German?
  - Is it like translating Python to bytecode?

- “downplay their unique quiet strength”
  - “ownplayday eirthay uniqueway ietquay engthstray”
  - What are the rules for pig-latin? See APT

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`

```python
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
```

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

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

Piglatin, age-stay one-way

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

- Review from last lab: slicing, concatenation, index
  - Where does string-indexing start?
  - What does slice with a single parameter do?
Piglatin, age-stay o-tway

```python
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

```python
def convert(s):
    if s[0] == 'q':
        return s[2:]+"quay"
    if isvowel(s[0]):
        return s + "way"
    for index in range(1,len(s)):
        if isvowel(s[index]):
            return s[index:]+s[:index]+"ay"
```

What does this do?

```python
def changeup(s):
    rep = ""
    for ch in s:
        rep = rep + ch*2
    return rep
```

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