Compsci 06/101: PFTW, Feb 28-March 4

- **Algorithms and Data Structures**
  - Sets and how they are used in Python (data structure)
  - Algorithms, solving problems, understanding trade-offs

- **Transforms and modules**
  - Transforming data and then untransforming it
  - How do you send a .jpg via email, text, copy/paste
  - How do you write programs in more than one .py file?

- **Writing code and understanding "costs"**
  - Cost of calling a function? It depends!

### Algorithm

- **What, where, when, who, why?**
  - From Euclid to Google?

- **Instructions, rules, list**
  - task, function, ...
  - effective, finite, mechanizable?

- **Choose the best website for 'teaching python'**
  - How does this work?

- **How to search a list of strings...**

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**Programming Equations**

- **Algorithms + Data Structures = Programs**
  - Niklaus Wirth, old view of programming and compsci
  - Different view: functional, object-oriented, extreme/agile

- **How old are algorithms?**
  - Euclid: find greatest common divisor, GCD (56, 217)
  - Who cares? You do!

- **A few basic idioms and algorithms go a long way**
  - log one-million much less than one-million (binary search)
  - Don’t do the same thing more than once

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**Tim Peters: Zen of Python**

- Beautiful is better than ugly.
- Explicit is better than implicit.
- Simple is better than complex.
- Complex is better than complicated.
- Flat is better than nested.
- Readability counts.
- Special cases aren't special enough to break the rules.
- In the face of ambiguity, refuse the temptation to guess.
  - [http://www.python.org/dev/peps/pep-0020/](http://www.python.org/dev/peps/pep-0020/)
Designing Algorithms and Programs

- Designing algorithms to be correct and efficient
  - The most important of these is _______________
  - When do we need to worry about efficiency?
  - Example: finding a number between 1 and 1000
    - High, Low, Correct: how many guesses?
    - Same algorithm can find an element in a sorted list

- Python searching in dictionary, set, list
  - How can we find an element?
  - How long does it take?
  - if x in collection

Comparing Algorithms

- Searching a list of N elements for a specific value
  - Worst case is ....

- Doing binary search (guess a number), sorted list
  - Worst case is ...

- Finding the most frequently occurring element:
  - Strings? ints? does it matter? (toward Python dictionary)

- Where do proteins occur in a genome?
  - Leveraging a previously solved APT

Revisiting cgratio APT

- 'cost' of finding likely sources of protein in DNA
  
```python
def cgratio(strand):
    cg = 0
    for nuc in strand:
        if nuc == 'c' or nuc == 'g':
            cg += 1
    return cg

def maxIndex(strand, windowSize):
    index, max = 0, 0
    for i in range(0, len(strand) - windowSize + 1):
        cg = cgratio(strand[i:i+windowSize])
        if cg > max:
            max, index = cg, i
    return index
```

- 'cost' of finding likely sources of protein in DNA
  
```python
def runningMax(strand, windowSize):
    gc, counters = 0, []
    for nuc in strand:
        counters.append(gc)
        if nuc == 'c' or nuc == 'g':
            gc += 1
        counters.append(gc)
    index, max = 0, 0
    for i in range(windowSize, len(strand) + 1):
        diff = counters[i] - counters[i-windowSize]
        if diff > max:
            max, index = diff, i
    return index - windowSize
```