Plan for FWON

- Review current assignments and APTs
  - Review Dictionaries and how to use them
  - Code and APT walk-through
  - Algorithms, searching, sorting?
- Toward understanding sorting
  - What are the algorithms for sorting?
  - What are the libraries for sorting?

ACM MidAtlantic Programming Contest

- Saturday, Nov 7
- 185 teams!
- Each team: 3 students, one computer
- 5 hours to solve 6-8 problems
- Need volunteers to help!
  - Tshirt, meals, snacks! Fun!
  - Deliver printouts to teams
- Signup here:

Answer Questions

http://bit.ly/101fall15-nov3-1

Clever, Snarky, Evil, Frustrating Hangman

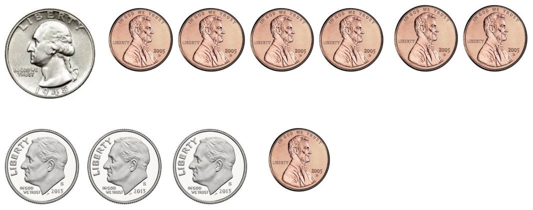
- Computer changes secret word every time player guesses to make it "hard" to guess
  - Must be consistent with all previous guesses
  - Idea: the more words there are, harder it is
    - Not always true!
- Example of greedy algorithm
  - Locally optimal decision leads to best solution
  - More words to choose from means more likely to be hung

Canonical Greedy Algorithm

- How do you give change with fewest number of coins?
  - Pay $1.00 for something that costs $0.43
  - Pick the largest coin you need, repeat

Greedy not always optimal

- What if you have no nickels?
  - Give $0.31 in change
  - Algorithms exist for this problem too, not greedy!



Clever Hangman

- When you guess a letter, you're really guessing a category (secret word "salty")

_ _ _ _ _ and user guesses 'a'

  - "gates", "cakes", "false" are all *the same*
  - "flats", "aorta", "straw", "spoon" are all *different*

- How can we help ensure player always has many words to distinguish between?

```
number of misses left: 8
secret so far: _ _ _ _ _ _ _ _
(word is catalyst )
# possible words: 7070
guess a letter: a
a__a___a 1
...
_a_______ 587
__aa_____ 1
...
__a______ 498
_________ 3475
___a_____ 406
...
____a___ 396
# keys = 48
```

Debugging Output

```
number of misses left: 7
letters not yet guessed:
bcdefghijklmnopqrstuvwxyz
...
(word is designed )
# possible words: 3475
guess a letter:
```

Debugging Output and Game Play

- Sometimes we want to see debugging output, and sometimes we don't
  - While using microsoft word, don't want to see the programmer's debugging statements
  - Release code and development code
- You'll approximate release/development using a global variable DEBUG
  - Initialize to False, set to True when debugging
  - Ship with DEBUG = False

Look at howto and function categorize

- Play a game with a list of possible words
  - Initially this is all words
  - List of possible words changes after each guess
- Given template "_ _ _ _", list of all words, and a letter, choose a secret word
  - Choose all equivalent secret words, not just one
  - Greedy algorithm, choose largest category

```
words = categorize(words, guess, letter)
```

Completing function categorize

- Loop over every string in words, each of which is consistent with guess (template)
  - This is important, also letter *cannot* be in guess
  - Put letter in template according to word
  - _ _ _ a _ t might become _ _ a n t
- How to re-use guess (template) make copy?
- How to create key in dictionary
  - Why can't key be a list?

Voterigging APT

- http://www.cs.duke.edu/csed/pythonapt/voterigging.html
- For example: [5, 10, 7, 3, 8] answer is 4, why?
  - If you steal a vote, who do you steal from? Why?
  - Why is this like coin problem? Clever Hang?
- How do you find who to steal from?
  - At least two approaches, functions or loop
    - Use max and index, or write a loop to find max
  - When are you done stealing?
    - This governs writing the APT

Answer Questions

http://bit.ly/101fall15-nov3-2

Python shortcuts you can ignore

- The zip function, tuples from two lists
- Does something right if lists have different sizes. Look it up

```
words  = ['dog',  'cat',  'fish',  'guava']
counts  = [3,  2,  1,  5]
cc  = zip(word,counts)
[('dog',  3),  ('cat',  2),  ('fish',  1),
 ('guava',  5)]
```

Python shortcuts you can ignore

- enumerate – the iterable
  - Sometimes you need an index, sometimes elt
  - `for elt in lst:` or
  - `for dex in range(len(lst)):`

```
for dex,elt in enumerate(['a', 'b', 'c]):
    print dex,elt

0 'a'
1 'b'
2 'c'
```

Python shortcuts you can ignore

- Default dictionaries
  - Typically we see if key in D before modifying
  - If initialization always same for new keys …

```
import collections
dd = collections.defaultdict(int)
dd['apple']
0
ee = {}
ee['apple']
Key error
```

Python functions you CANNOT ignore

- We know how to sort, we call sorted
  - Example from lab and class, sorting tuples
  - Function sorted returns a new list, original not changed

```
xx = [('dog', 3), ('cat', 2), ('fish', 1),
      ('guava', 2)]
yy = sorted(xx)
[('cat', 2), ('dog', 3), ('fish', 1),
 ('guava', 2)]
```

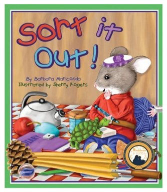
First use what you know

- You can re-organize data to sort it as you'd like, list comprehensions are your friend

```
xx = [('dog', 3), ('cat', 2), ('fish', 1),
      ('guava', 2)]
...
nlist = [(t[1],t[0]) for t in xx]
[(3, 'dog'), (2, 'cat'), (1, 'fish'),
 (2, 'guava')]
yy = sorted(nlist)
[(1, 'fish'), (2, 'cat'), (2, 'guava'),
 (3, 'dog')]
```

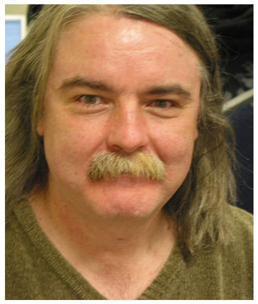
Many algorithms for sorting

- In some classes knowing these algorithms matters
  - Not in Compsci 101
  - Bogo, Bubble, Selection, Insertion, Quick, Merge, …
  - We'll use built-in, library sorts, all languages have some
- We will concentrate on *calling* or *using* these
  - How does API work?
  - What are characteristics of the sort?
  - How to use in a Pythonic way?



How do we sort? Ask Tim Peters!

- Sorting API
  - Sort lists (or arrays, …)
  - Backwards, forwards, …
  - Change comparison
    - First, Last, combo, …
- Sorting Algorithms
  - We'll use what's standard!



Best quote: *import this*

I've even been known to get Marmite *near* my mouth -- but never actually in it yet. Vegamite is right out