CompSci 101
Fall 2021

Lecture 18

Reminders

- APT Quiz 2
  - 11/12 (8am) -11/15 (11pm)

Key instructions

- Input ✔
- Output ✔
- Assignments* ✔
- Math/Logic ✔
- Conditionals ✔
- Repetition ✔

**not listed in book*

Python Data Types

- int, float, bool ✔
- Collections
  - Strings ✔
  - Lists ✔
  - Tuples ✔
  - Sets ✔
  - Dictionaries ✔

PFTD

- Clever Hangman –
  - How does it work? Greedy Algorithm
- Modules

KISS Principle

- Think of the non-computing context for any word/terms
- KISS model
  - Work smarter, not harder!!
- "Good programmers are simply good designers."
  - *-Dr. Washington*
- Design first and always!
- Importance of reusability
- *USE PyCharm/PythonTutor IF YOU HAVE QUESTIONS!*

People to Know: Matthew Yazzie

- BS, MS (Stanford)
- Organizational and behavioral scientist
- Strategic Director/Facilitator
  - Collective-A DEI Lab
- Navajo Nation

Sometimes there will be letters

- The letter “u” has been guessed and is the 2nd letter
  Ex: `_ u _ _ _` and user guesses ‘r’

- **`["ruddy", "rummy", "rungs", … "rusty"]`**
  - *5 words start with “ru” and no other “r” or “u”*
- **`["burch", "burly", "burns", … "turns"]`**
  - *17 words only ‘u' as second letter and only ‘r’ third letter*
- **`["bucks", "bucky", … "tufts"]`**
  - *98 words with only “u” second letter and no ‘r'*
- What should our secret word be? "ruddy" ,"burch" or "bucks“?

More Details on Game

- Pick 8-letter word at random: *catalyst*
  - User guesses 'a', what should computer do?
  - Print `_ a _ a _ _ _ _` and continue?

- Look at all groups of words and decide on a new word that is more likely to stump player
  - Why ***"designed"*** better choice than ***"tradeoff"***?
  - 3,475 words with no 'a', 498 with 'a' 3rd letter

Creating Groups/Categories

- For each of 7,070 words (8 letters), given word and ‘a’, find its group, represented by a template
- Use dictionary
  - Template is KEY, the VALUE is a list of matching words
- Choose biggest list
- Repeat
- # words smaller over time

Group/Template	Size of Group
_ a _ _ _ _ _ _	587
_ a _ a _ _ _ _	63
_ _ a _ _ _ _ _	498
_ _ _ a _ _ _ _	406
_ _ _ _ _ _ _ _	3,475

Changes to Regular Hangman

- List of words from which secret word chosen
  - Initially this is all words of specified length
    - User will specify the length of the word to guess
  - After each guess, word list is a new subset
- Keep some functions, modify some, write new ones
- *Changes go in another function* to minimize changes to working program
  - Minimizing changes helps minimize introducing bugs into a working program

Details from Assignment

- We've missed four times, what's happening?
  - "belted" is one of 20 words that fit guesses

```
letters not yet guessed:  bc  fgh jklmn pq  t vwxyz
misses remaining = 2
_ e _ _ e d
(word is belted)
# possible words: 20
letter> l
_e__ed : 10
_el_ed : 4
_elled : 5
le__ed : 1
# keys = 4
you missed: l not in word
```

Greedy Algorithms

- "Choosing largest group" -> *greedy algorithm*
  - Make a locally optimal decision that works in the long run
  - Choose largest group to make game last …

- Greed as in "it chooses the best current choice every time, which results in getting the best overall result"

- Canonical example? Change with coins
  - Minimize # coins given for change: 57 cents

Making change for 57 cents

- When choose next coin, always pick biggest
- With half-dollar coins

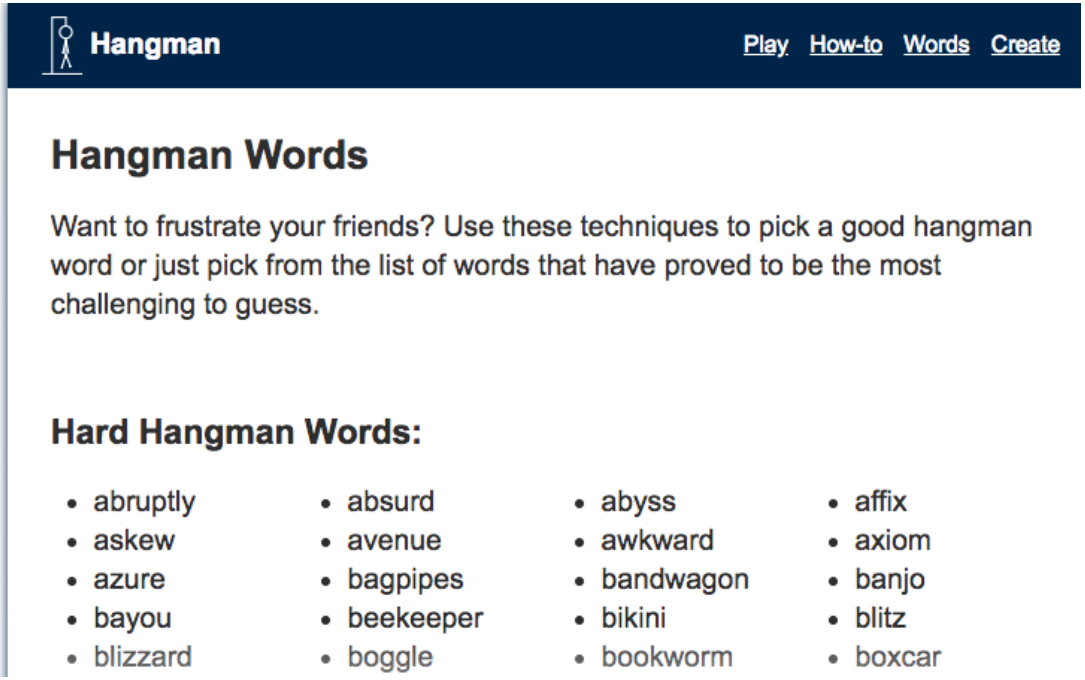
- With quarters and no half dollars

When greedy doesn't work

- What if no nickels? Making change for 31 cents:

- Can we do better? Yes!

Activity 1: https://bit.ly/101f21-11-11-1



Clever vs Plain Hangman

- Minor changes, though they require coding
  - Regular: show `‘a e t w'`
  - Clever: show `‘ bcd fghijklmnopqrs uv xyz’`
  - User inputs added – debug mode, length of word
  - `processUserGuessClever`
- Major changes
  - Debug mode
  - List of potential words changes at each turn
  - Function **`getNewWordList`** and **`createTemplate`**

Testing your code

- Alternative to lowerwords.txt? This is large!
  - Create your own file of words. Small file
  - Facilitates testing

- Call random.seed(…)
  - If seeded with same number
  - Same words/order every time you play
  - Reproduce errors more easily

Testing your methods

- CheckMyFunctions.py
  - Can you add anything to check/test things?

- Testing **`getNewWordlist(guess,letter,words)`**
  - From watching the debug game play?
  - Better: Test in isolation from game

- **`getNewWordList`** calls **`createTemplate(template,word,letter)`**
  - How we test one without the other?
  - Test `createTemplate` function first and separately

Edge Case

- Words left: [‘trim’, ‘trio’]
- Hangman template is: ‘tri_’
- Users guesses ‘m’
  - What should the secret word be? ‘trio’!
  - But the dictionary has a tie!
    - `‘tri_’ : [‘trio’] # length 1`
    - `‘trim’ : [‘trim’] # length 1`
  - `getNewWordList` should take this into account
    - Pick the template with most `‘_’`

Activity 2: https://bit.ly/101f21-11-11-2

Why use modules?

- Easier to organize code
- Easier to reuse code
- Easier to change code
  - As long as the “what” is the same, the “how” can change
    - Ex: sorted(…), one function many sorting algorithms

Reminders

- Work smarter, not harder
- Design first
- Try to identify where you are stuck
  - Identify resources to help solve problem
- Leverage your design and PythonTutor to understand program flow of control
  - http://pythontutor.com