Lesson 22:

1. Infinite Power

Infinite Power with procedures!

1. Quiz: Long Words

What’s the longest word in the English language?

None of the above! Jen use to say antidisestablishmentarianism.

1. Counter

Counter-counter-word.

1. Quiz: Counter Quiz

None, circular definition can never stop!

1. Quiz: Expanding Our Grammar

Infinitely many words with recursive definitions.

1. Recursive Definitions

Two parts:

1. Base case = starting point

Not defined in terms of itself.

1. Recursive case

Defined with itself.

1. Quiz: Ancestors

Ancestor->Parent

Ancestor->Parent of Ancestor

1. Recursive Procedures

Factorial(0) = 1

Factorial(n) = n \* factorial(n-1)

1. Quiz: Recursive Factorial

def factorial(n):

return 1 if n == 0 else n \* factorial(n - 1)

1. Quiz: Palindromes

def is\_palindrome(s):

if s == '':

return True

else:

if s[0] == s[-1]:

return is\_palindrome(s[1:-1])

else:

return False

1. Recursive Vs Iterative

Recursive calls are expensive in Python. They are easy to understand but take the most time.

1. Quiz: Bunnies

# Fibonacci Numbers! Rabbits NEVER die in this model. 1, 2, 3, 5 pairs etc.

def fibonacci(n):

if n < 1:

return 0

elif n == 1:

return 1

else:

return fibonacci(n - 1) + fibonacci(n - 2)

1. Divide and Be Conquered

Don’t redo work or make the computer do the math more than once!

1. Quiz: Counting Calls

13 times, it follows the Fibonacci pattern!

1. Quiz: Faster Fibonacci

def fibonacci(n):

if n == 0:

return 0

elif n == 1:

return 1

else:

old\_fib, result\_fib = 1, 1

while n > 2:

old\_fib, result\_fib = result\_fib, result\_fib + old\_fib

n -= 1

return result\_fib

1. Ranking Web Pages

Have to figure out how to make the most likely desirable links at the top of the search results.

1. Popularity

Friends do not make you popular, you should be friends with people with lots of friends.

Popularity = # of people who are friends with p

Popularity = summation of friend popularities

1. Quiz: Good Definitions

No, it is not a recursive definition since there is no base case.

1. Quiz: Circular Definitions

Alice’s popularity is one.

Not enough to consider it a good definition.

1. Quiz: Relaxation

Start with a guess, while not done, make the guess better.

1. Page Rank

Good definition because it will always terminate.

1. Quiz: Altavista

Altavista was the most popular web search engine in 1998.

Google PageRank was better that Altavista’s and less prone to spamming.

1. Urank

Need a directed graph.

Dictionary of nodes, and a list of all the nodes they are connected to.

1. Quiz: Implementing Urank

graph[page] = outlinks

1. Computing Page Rank

rank(0, url) = 1 / n pages

rank(t, url) = (1 – d) n pages + summation{@p in links to url} d \* rank(t-1, p) / # of outlinks from p

1. Formal Calculations
2. Computer Ranks
3. Quiz: Finishing Urank

for node in graph:

if page in graph[node]:

newrank += d \* (ranks[node] / len(graph[node]))

1. Search Engine

Web crawler, index, ranking!

End Unit 6.