Recursion (part 2)

November 10, 2021

Administrative notes

Project 2

Exam 2

Recursion

The Fibonacci sequence, again

1, 1, 2, 3, 5, 8, 13,...

After the first two numbers, each number is the sum of the previous two numbers

That is, f(n) = f(n-1) + f(n-2)

Iterative

```
def fib(n):
   If n<= 3:
        return n
   Else:
        fib = [1,1]
        for i in range(2,n+1)
            fib.append(fib[i-1] + fib[i-2])
        return (fib[n])
```

Recursive

```
def fib(n):
   if n < 3:
      return 1
   else:
      return (fib(n-1) + fib(n-2))
```

Another visualization of recursion

https://recursion.vercel.app/

How do you solve a problem using recursion?

1. What is the base case? #there may be more than one
2. How do I describe a subproblem of my problem
    a. If I repeated making that subproblem, do I get a base case?
    b. At this point we should TRUST the recursive calls
3. Assuming I have the solution to the subproblem, ***HOW DO I SOLVE MY PROBLEM WITH IT?***
    a. I should be careful to make sure I'm returning the answer to MY PROBLEM

Palindromes

Calculate whether a string is a palindrome using recursion

What's the base case?

- A string that is zero characters long - an empty string - IS a palindrome
- A string that is one character long IS a palindrome
- A string where the first character is DIFFERENT from the last character is NOT a palindrome
    - "cat" is NOT a palindrome
-

Palindromes - recursive case

What about the recursive case?

- IF the first character is the SAME as the last character, the string IS a palindrome if what's left when you throw away the first and last characters is a palindrome

yay - remove first character; remove last character; look at what's left

- a - IS a palindrome

Pseudocode

x=yay IS a palindrome

First character equals last character

- Create the substring by throwing away the first and last character
  - x[1:-1] or (x[1:len(x)-1])
- A

y = tt

Throw away first and last character - we have nothing left - we have an empty string left

battab - atta - tt - empty string - IS a palindrome

Another example - sum a list of numbers

What are the base cases?

What’s the recursive case?

If we have time:

More on importing Python libraries - note, this will NOT be on Exam 2 next week