

Section 2

CSCI E-22

Will Begin Shortly

Recall: Recursive Problem Solving

When solving problems using recursion, we break the problem down into smaller subproblems.

Once we have broken down the problem into the smallest subproblem (one that we can solve), we have reached a base case.

Then, we can progressively build up the solutions to the subproblems until we have a solution for the overall problem.

$\text{sum}(n) =$

Practice with Recursion

The following Java method should use recursion to remove all vowels from a string. Some of the code has been omitted and we will need to fill it in:

```
public static String removeVowels(String s) {  
    if (s == null)  
        throw new IllegalArgumentException();  
  
    if (s.equals(""))  
        return "";  
  
    String removedFromRest = _____;  
  
    ...  
  
}
```

Recursive Problem Solving Approach

Before writing a recursive method, we can try to plan:

- What's the base case?
- What's the recursive subproblem?
- What work do we need to do before returning?

Practice with Recursion

The following Java method should use recursion to remove all vowels from a string. Some of the code has been omitted and we will need to fill it in:

How many calls of this method are needed when...

n is 0?

What is the general formula for the number of calls needed to process a string of length n?

The Fibonacci Sequence

The Fibonacci sequence is a well-known number series in which each number in the series is the sum of the two previous numbers.

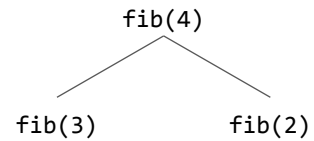
We define the first two numbers as $F_0 = 0$ and $F_1 = 1$, and all successive numbers as:

$$F_n = F_{n-1} + F_{n-2}$$

Since the sequence is defined recursively, using recursion to calculate Fibonacci numbers is natural. Finish the code below to write an algorithm that calculates the n th Fibonacci number.

The Fibonacci Sequence

Draw a diagram that shows the number of times `fib()` is called with an initial value of 4. It has been started for you:



How many times did we call `fib()` to find the fourth Fibonacci number?

Do you see a problem with this? What if we tried larger numbers, like 50?

The Fibonacci Sequence

Here is an example iterative solution:

```
public static long fib(int n) {
```

```
}
```