Discussion 8: Recursion II

Mystery Blocks
What do each of the blocks below do?

1. `+ mystery1 : let i :`
   - if empty? list
     - report false
   - else
     - if is item i of list a number?
       - report true
     - else
       - report `mystery1 all but first of list`

2. `+ mystery3 : num : num2 :`
   - if `num2 = 0`
     - report 1
   - else
     - report `num x mystery3 num num2 - 1`

3. `+ mystery2 : word : letter :`
   - if length of word = 0
     - report 0
   - else
     - if letter = letter 1 of word
       - report 1 + `mystery2 all but letter of word letter`
     - else
       - report 0 + `mystery2 all but first letter of word letter`

More Practice
a. Write a block that reports the index of the first occurrence of a letter in a word. You may assume the letter appears at least once in the word.

```plaintext
position of 3 in oski: 2
```

position of (letter) in (word):
  if (letter) = letter 1 of (word)
    report 1
  else
    report 1 + position of (letter) in (all but first letter of (word))

b. Write a block that counts the instances of an item in a list.

```plaintext
Count wow in list cool wow rad wow: 2
```

count (item) in (lst):

```plaintext
count : item : in : list : is
  if empty? list
    report 0
  else
    if item = item 1 of list
      report 1 + count item in (all but first of list)
    else
      report `count item in (all but first of list)`
```
c. Write a block that finds the maximum item in a list of numbers. You may find the following block useful:

```
maximum item in list [2, 5, -1]:
```

```
if [1] = length of list
report item [1] of list
else
report
max of item [1] of list and maximum item of all but first of list
```

d. Write a book that takes in two lists, and reports a version of the second list without any of the items in the first list. You may find the in front of block, shown below, useful.

```
don't keep these: [list never to people to]:
list [I never say hello to people]:
```

```
if empty? list
report list
else
if list1 contains item [1] of list2
report don't keep these: [list1 from all but first of list2]
else
report item [1] of list2 in front of
don't keep these: [list1 from all but first of list2]
```
Fractal
Write out the code to create the following fractal. The sprite starts in the bottom left corner, facing right.

Level 1

Level 2:

Level 3:

Level 4:

Fibonacci
The Fibonacci sequence is defined as follows: 1, 1, 2, 3, 5, etc., where each number is the sum of the two previous numbers in the sequence.
(a) Fill in the code below to find the nth Fibonacci number:

Fibonacci(n)
if n < 2:
    report 1
else
    report Fibonacci(n - 1) + Fibonacci(n - 2)
(b) Now, fill out the tree below to visualize the execution of Fibonacci(4)

(c) What is the runtime of Fibonacci? Exponential