Quiz 3

1. The following method uses recursion to compute the factorial of a number. Derive the complexity of the algorithm. (2 points)

```java
public int factorial (int n) {
    if (n == 1)
        return 1;
    return n * factorial (n - 1);
}
```

\[ T(n) = O(1) + T(n-1) \]
\[ T(1) = 1 \]

2. What does the following method print out? (2 point)

```java
public void trivial(){
    Stack s = new Stack();
s.push("one");
s.push("two");
s.push("three");
s.pop();
System.out.println(s.peek());
s.pop();
s.push("four");
while(s.size() > 0){
    System.out.println(s.pop());
}
}
```

two
two
four
two
four
one
The Catalan numbers are a sequence of numbers that often appear in counting problems in combinatorics. The Catalan numbers are integers that satisfy:

\[ C_0 = 1 \] and \[ C_{n+1} = \frac{4n + 2}{n + 2} C_n \]

Complete the following method so it returns the \( n \)th Catalan number. (4 points)

```java
public int catalan(int n){
    if (n==0) return 1;
    int coefficient = (4*(n-1) + 2)/((n-1) + 2);
    return coefficient * catalan(n-1);
}
```

3. Which data structure is best described as “first-in-first-out?” (1 point)
   queue

4. Which data structure is best described as “first-in-last-out?” (1 point)
   stack