Week 9 worksheet: Recursion

Total points: 10

Out: March 25 (Tuesday)

Due: March 31 (Monday end of day [2359 CDT according to D2L])

## What to submit?

Upload only one Word or PDF file to the designated ***Worksheet 9*** D2L folder.

# Exercise 1: What is printed by the recursive methods?

[6 pts] What is printed by each of these recursive pseudocoded functions?

I strongly suggest that you do these without using your computer for help, since there will very likely be problems exactly like this on the final exam, and you won’t have a compiler to bail you out. I always provide you at least enough lines, so the one(s) at the bottom may be blank.

For all these problems, n and k are integers. Also, I want English language descriptions of what the meethods do, not computer-generated output for a given value of n. You may choose to code this up to see what it does (and that’s a great idea of you’re unsure), but I’m looking for general answers, not speciic examples.

1. **f(n)**

public static void f( int n ) {

System.out.println( n );

if ( n > 1 ) {

f(n-1);

}

}

In words, what does method f(n) print when the parameter n is a positive integer?

It prints the number below it so if n is 5 it will print 5,4,3,2,1

In words, what does method f(n) print when the parameter n is a negative integer?

It will print the negative integer and it breaks since negative is not > than 1

1. **g(n)**

public static void g( int n ) {

if ( n > 1 ) {

g(n-1);

}

System.out.println( n );

}

In words, what does method g(n) print when the parameter n is a positive integer?

It prints the number after the recursion is over so if n is 5 it will print 1,2,3,4,5

In words, what does method g(n) print when the parameter n is a negative integer?

it breaks since negative is not > than 1 and It will print the negative integer

1. **h(n)**

public static void h( int n ) {

f(n);

}

public static void f( int n ) {

System.out.println( n );

if ( n > 1 ) {

g(n-1);

}

}

public static void g( int n ) {

if ( n > 1 ) {

f(n-1);



}

System.out.println( n );

}

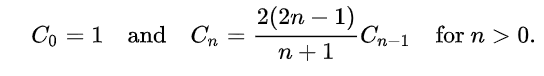
In words, what does method h(n) print when the parameter n is a positive integer?

It prints all the corresponding even or odd number and once it reaches 1 it prints the opposite so if n is 10 it will print 🡪 10,8,6,4,2,1,3,5,7,9

In words, what does method h(n) print when the parameter n is a negative integer?

If it’s a negative integer it will only print the negative integer

# Exercise 2: Catalan Numbers

The *n*th Catalan number is given by the formula: 

(2 pts) Write a recursive method **public static int catalan1( int n )** that recursively computes the nth Catalan number using the above formula. This should be about 5 lines.

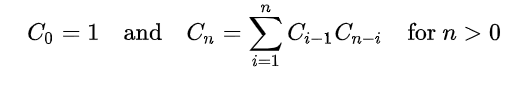
public static int catalan1(int n) {

if (n == 0) return 1; // Base case

return (2 \* (2 \* n - 1) / (n + 1) \* catalan1(n - 1)) ; // Recursive calculation

}

(2 pts) An alternative formula for the Catalan numbers is given by:



Write a recursive method **public static int catalan2( int n )** that recursively computes the nth Catalan number using the above formula. This should be under 10 lines.

public static int catalan2(int n) {

if (n == 0) return 1; // Base case

int result = 0;

for (int i = 0; i < n; i++) {

result += catalan1(i-1) \* catalan1(n - i); // Recursive calculation

}

return result;

}