Assg 05: Fibonacci Series

CSci 515 Spring 2015

2015-02-11

Dates:

Due: Wednesday February 24, by Midnight

Objectives

- More practice writing C functions

- Learn about implementing algorithms using iteration and recursion.

- Practice writing a recursive function.

- Become more familiar with implementing mathematical series on a computer.

Description

In this assignment we will write two versions of functions that will compute the Fibonacci series. The Fibonacci series is a well studied series that displays exponential growth. You may have run across this series before, the initial values in the Fibonacci series are:

$$0, 1, 1, 2, 3, 5, 8, 13, 21, ...$$

where each value is the sum of the proceeding two values in the series (and the first two values represent the base cases). Mathematically we can represent the series as a recursive relationship:

$$x_n = x_{n-1} + x_{n-2}, \quad x_0 = 0, \quad x_1 = 1$$

This recursive expression basically says that we can calculate the nth value of the Fibonacci series by adding the $n-1$ and $n-2$ values in the sequence together, and that the base cases are when $n=0$ then the value of the series is 0 and when $n=1$ the value of the series is 1.

In this assignment you need to write two functions that calculate and return the nth value of the Fibonacci series. The functions will take a single integer parameter n as input. If n is 0, you should return 0, and if n is 1 you should return 1. For all other values of $n>1$ you should calculate the value to return as given above and return it. Your functions will return a single integer as their result, which will be the nth Fibonacci number they were asked to calculate.

Perform the following tasks:

1. Write a function called `nthFibonacciIterative()`. This version of the function takes a single integer as input, and returns an integer as its result, as already mentioned. You should implement this function using a loop (when needed) to calculate the nth Fibonacci number.

2. Write a second function that will also calculate the nth term in the Fibonacci sequence. But your second function will do this using a recursive implementation. Your recursive implementation should be called `nthFibonacciRecursive()`. You should not use any loops in this version of the function, you will calculate the nth Fibonacci number by recursively calling the `nthFibonacciRecursive()` function itself in the appropriate manner in order to calculate the correct term of the sequence.

3. In your `main()` function, prompt the user to enter a value for n. You should then call each of your two different implementations, and display the result of their calculation of the nth term of the Fibonacci sequence, which if you implement the two different versions correctly, should always give the same result. Be careful of using large values of n, as the recursive implementation especially may take quite a while to calculate in cases of large n.

Your program output should look something close to the following when I run your program:

NOTE: Now that our programs have more functions than just the `main()` function, the use of the function headers becomes meaningful and required. Make sure that all of your functions (`main`, `nthFibonacciIterative`,

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`nthFibonacciRecursive`) have function headers preceding them that document the purpose of the functions, and the input parameters and return value of the function.

Assignment Submission

An eCollege dropbox has been created for this assignment. You should upload your version of the assignment to the eCollege dropbox named `Assg 05 Fibonacci Sequence` created for this submission. Work submitted by the due date will be considered for evaluation.

Requirements and Grading Rubrics

Program Execution, Output and Functional Requirements

1. Your program must compile, run and produce some sort of output to be graded. 0 if not satisfied.

2. 25+ pts. Your program must have the 2 required named functions, that accept the required input parameters and return the required values (if any).

3. 25+ pts. Your iterative implementation must use loops/iteration to implement its calculation. The function must of course correctly compute the nth term of the series.

4. 40+ pts. Your recursive implementation must perform its calculation using recursion. You must have the correct base cases defined. Your function must of course correctly compute the nth term of the series. trials, and count up the successful trials from all of the trials performed, and return the correct probability ratio. Your ratio must be correct.

5. 10+ pts. You must prompt the user for n in main, and correctly display the returned results form your function as shown.

Program Style

Your programs must conform to the style and formatting guidelines given for this course. The following is a list of the guidelines that are required for the assignment to be submitted this week.

1. The file header for the file with your name and program information and the function header for your main function must be present, and filled out correctly.

2. A function header must be present for all functions you define. You must document the purpose, input parameters and return values of all functions.

3. You must indent your code correctly and have no embedded tabs in your source code. (Don't forget about the Visual Studio Format Selection command).

4. You must not have any statements that are hacks in order to keep your terminal from closing when your program exits.

5. You must have a single space before and after each binary operator.

6. You must have a single blank line after the end of your declaration of variables at the top of a function, before the first code statement.

7. You must have a single blank space after , and ; operators used as a separator in lists of variables, parameters or other control structures.

8. You must have opening { and closing } for control statement blocks on their own line, indented correctly for the level of the control statement block.

   Failure to conform to any of these formatting and programming practice guidelines for this assignment will result in at least 1/3 of the points (33) for the assignment being removed for each guideline that is not followed (up to 3 before getting a 0 for the assignment). Failure to follow other class/textbook programming guidelines may result in a loss of points, especially for those programming practices given in our Deitel textbook that have been in our required reading so far.