Langara College

Department of Computing Science & Information Systems

CPSC1160 – Algorithms and Data Structures I

Lab_03: Recursive Functions

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1. Instructions

a. Writing your program with nice style is part of your evaluation. Indentation, documentation, modularization and selecting good names for your variables and constants are important.
b. Read whole assignment first and make sure that you understand different parts of assignment and due dates. If you have any doubt or you are not clear about assignment you should ask in lab sessions or office hours. There is no grantee to get answer for your questions in this regard via email out of those times.
c. Create a folder named **Lab3**.
d. Inside folder **Lab3,** create a file for each problem.
e. Use eclipse or any other IDE to create and run your programs.
f. If eclipse does not compile your programs, you can follow the steps given below to compile your program:
   i. Open a MinGW command prompt and change directories to your program folder.
   ii. On the command line, enter the compiling command like the following example to compile your program:

```
g++ -Wall -std=c++11 MyProgram.cpp  -o MyProgram
```

   This command will produce the executable file in the name of MyProgram.exe.
   iii. On the command line enter the name of the executable file (without the .exe extension) to run your program

2. Problem 1: [40 marks] Recursion vs. Iteration (filenames: **RecVsIter.cpp** and **answers.pdf).**

This is an experimental programming to compare iterative and recursive versions of the same function.

Part 1: [6 marks] Iterative and Recursive Fibonacci functions (Functions: **iterFibo(n)** and **recFibo(n)**)

As we discussed in the lectures, Fibonacci series is like `0, 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, ...`. The first and second elements of series are 0 and 1 and each elements is summation of latest two elements. For example 10-th element is calculated by adding 8-th and 9-th element which is 34.

Write two functions that generate n-th element of Fibonacci series in iterative and recursive modes. For each function you pass an int number as parameter of function and it returns n-the element of Fibonacci series.

Part 2: [6 marks] Iterative and Recursive Factorial functions (Functions: **iterFact(n)** and **recFact(n)**)

Write two functions that implements factorial in iterative and recursive mode. For each function you pass an int number as parameter of function and it returns factorial of number. i.e: iterFact(n) and recFact(n) calculate and return n!.

Part 3: [16 marks] Experiment1 (new version of **RecVsIter.cpp**)

Use the following main function as your main and run your program with `5, 10, 20, 25, 30 and 40` as value for n.

```
int main() {
    char answer = 'Y';
    int n;
      do {
          cout << endl << endl;
          cout <<">===============( New RUN )===============<" <<endl;
          cout << "\nPlease enter an integer number: ";
          cin >> n;
          cout << endl;
          cout << "Iterative Factorial(" << n <<") is " << iterFact(n) << endl;
          cout << "Recursive Factorial(" << n <<") is " << recFact(n) << endl;
          cout << "Iterative Fibonacci(" << n <<") is " << iterFibo(n) << endl;
          cout << "Recursive Fibonacci(" << n <<") is " << recFibo(n) << endl << endl;
          cout << "Do you want to continue? (Y/N)";
          cin >> answer;
      } while (toupper(answer) == 'Y');
       cout << "The Program has ended gracefully!" ;
       return 0;
}
```

1. What do you observe?
2. Do you see any kind of error? If yes, explain it.
3. Justify your observations.

Modify your code in order to resolve the error(s). **Do not change main() function. Do not use built-in classes in C++.**

Part 4: [12 marks] Experiment2 (new version of **RecVsIter.cpp**)

Now run your program with `25, 30, 35, 40, 45, 50 and 55` as value for n.

1. What do you observe?
2. Do you see any kind of error? If yes, explain it.
3. Justify your observations.

Modify your code in order to resolve the error(s). **Do not change main() function. Do not use built-in classes in C++.**

4. If you are about to choose between recursive and iterative version of Factorial and Fibonacci functions, which one do you choose and why?

Note: Answer the questions from part 3 and part 4 in **answers.pdf** file.

3. Problem 2: [10 marks] Online quiz (Filename: **Quiz.pdf**)

Answer Multiple Choice Quiz for chapters 17 at www.cs.armstrong.edu/liang/cpp3e/quiz.html. Then save your results as an image and paste them into a text file. Finally convert text file to pdf version named Quiz.pdf.

4. Due date

- By the end of the lab time, demonstrate **first** and **second** parts of **Problem 1** to the instructor.
- By 11:59pm on Sunday, January 22, 2017, submit a zip file of Lab3 includes 3 files named RecVsInter.cpp, answers.pdf and Quiz.pdf to D2L.