CSCE 1030: Homework 3

Due: 11:59 PM on Monday, October 16, 2017

PROGRAM DESCRIPTION:

The purpose of this programming project is to write a C++ program that uses programmer-defined functions to validate user input, calculate some results, and then print out a triangle shape to the screen based on input from the user.

REQUIREMENTS:

- As with all homework programs in this course, your program's output will initially display the department and course number, your name, your EUID, and your email address.

- You will first prompt the user to enter an even integer between 2 and 12, inclusively. You will validate the user's input by creating a programmer-defined function to ensure that the integer is an even integer in the range 2 to 12, inclusively. The integer entered by the user should be passed as a parameter to this function. If the number is not valid, you will display a meaningful error message before re-prompting the user to enter the integer again. The return type of this function should be a boolean data type and you are to use this boolean result in determining whether or not the user input is valid. You may assume that the user enters an integer, though it may be out of range.

- Once validated, you will calculate and return the product of the integers from 1 to the integer entered by the user using another programmer-defined function. Again, the integer entered by the user should be passed as a parameter to this function. The return type of this function should be an integer data type and you are to use this integer result and print it to the screen in a meaningful message.

- Finally, you will draw a right-justified right-angled triangle using a programmer-defined function that accepts an integer as a parameter. The integer entered by the user will specify the number of rows of integers that will form the triangle. In other words we may say that this integer entered by the user represents the height of the triangle. Each row in the triangle will be composed of a certain integer number (and space where needed)--the topmost row will contain one 1, the second row will contain two 2's, the third will contain three 3's and so on and so forth. You may only use `cout` statements that print a single integer, space, or a single new-line character (such as '`\n`' or `endl`). Maximize your use of repetition with nested for loops and minimize the number of `cout` statements. This function should be a void function that does not return a value. It should print a right justified right-

angled triangle of the appropriate size entered by the user. See the sample program runs for examples of what should be output.

- Your code should be well documented in terms of comments. For example, good comments in general consist of a header (with your name, course section, date, and brief description), comments for each variable, and commented blocks of code.

- Your program source code should be named “ homework3.cpp ”, without the quotes.

- Your program will be graded based largely on whether it works correctly on the CSE machines (e.g., cse01, cse02, …, cse06), so you should make sure that your program compiles and runs on a CSE machine.

- **This is an individual programming assignment that must be the sole work of the individual student.**

  You may assume that all input will be of the appropriate data type, although the range (e.g., a positive integer) may not be valid. Please pay attention to the SAMPLE OUTPUT for specific details about the flow and input/output of the program.
  You shall use techniques and concepts discussed in class – you are not to use global variables, goto statements, or other items specifically not recommended in this class.

DESIGN (ALGORITHM):
On a piece of paper (or word processor), write down the algorithm, or sequence of steps, that you will use to solve the problem. You may think of this as a “recipe” for someone else to follow. Continue to refine your “recipe” until it is clear and deterministically solves the problem. Be sure to include the steps for prompting for input, performing calculations (i.e. product calculations), and displaying output. You should attempt to solve the problem by hand first (using a calculator as needed) to work out what the answer should be for a few inputs. Show the hand calculations for the function that calculates the “product” and show a trace of the variables involved in that function.
Type these steps and calculations into a document (i.e., Word, text, or PDF) that will be submitted along with your source code. Note that if you do any work by hand, images (such as pictures) may be used, but they must be clear and easily readable. This document shall contain both the algorithm and any supporting hand-calculations you used in verifying your results.

SAMPLE OUTPUTS:

```
Please enter an EVEN number in range 2 - 12: 6
The product of integers from 1 to 6 is 720.
          1
        2 2
      3 3 3
    4 4 4 4
  5 5 5 5 5
 6 6 6 6 6 6
```

```
Please enter an EVEN number in range 2 - 12: 7
Invalid Entry - Please enter an EVEN number in range 2 - 12: 5
Invalid Entry - Please enter an EVEN number in range 2 - 12: 32
Invalid Entry - Please enter an EVEN number in range 2 - 12: 12
The product of integers from 1 to 12 is 479001600.
                     1
                   2 2
                 3 3 3
               4 4 4 4
             5 5 5 5 5
           6 6 6 6 6 6
         7 7 7 7 7 7 7
       8 8 8 8 8 8 8 8
     9 9 9 9 9 9 9 9 9
   10101010101010101010
  11111111111111111111
1212121212121212121212
```

TESTING:
Test your program to check that it operates as desired with a variety of inputs. Then, compare the answers your code gives with the ones you get from hand calculations.

SUBMISSION:
Your program will be graded based largely upon whether it works correctly on the CSE machines, so you should make sure your program compiles and runs on the CSE machines. Your program will also be graded based upon your program style. This means that you should use comments (as directed), meaningful variable names, and a consistent indentation style as recommended in the textbook and in class. We will be using an electronic homework submission on Blackboard to make sure that all students hand their programming projects on time. You will submit both (1) the program source code file and (2) the algorithm design document to the Homework 3 dropbox on Blackboard by the due date and time.

Note that this project must be done individually. Program submissions will be checked using a code plagiarism tool against other solutions, so please ensure

that all work submitted is your own. Note that the dates on your electronic submission will be used to verify that you met the due date and time above. All homework up to 24 hours late will receive a 50% grade penalty. Later submissions will receive zero credit, so hand in your best effort on the due date.
As a safety precaution, do not edit your program (using vi or pico) after you have submitted your program where you might accidentally re-save the program, causing the timestamp on your file to be later than the due date. If you want to look (or work on it) after submitting, make a copy of your submission and work off of that copy. Should there be any issues with your submission, this timestamp on your code on the CSE machines will be used to validate when the program was completed.

Example program header:

```
/*
 ============================================================================
 Name        : homework2.cpp
 Author      : Mark A. Thompson
 Version     :
 Copyright   : 2015
 Description : The program performs simple arithmetic operations based on in-
               put from the user.
 ============================================================================
 */
```

• Add a header to each function. Example function header:

```
/*
 ============================================================================
 Function    : deposit
 Parameters  : a double representing account balance and a double represent-
               ing the deposit amount
 Return      : a double representing account balance after the deposit
 Description : This function computes the account balance after a deposit.
 ============================================================================
 */
```