Homework 11 - Recursive functions

Start Assignment

Due Monday by 11:59pm **Points** 30 **Submitting** a file upload

Module 11 – Recursion

Homework Exercises

Summary

1. Predict-The-Output Question #7 from chapter 14 of our textbook (9th edition: pages 945 - 946, 10th ed: 959 - 960)
2. Programming Challenges 1, 6, and 8 from chapter 14 (9th edition: pages 946 - 947, 10th ed: 960 - 961)

> *Please remember to add comments throughout your code, and place each programming project in its own program file or files.*

Predict-The-Output Question (5 points)

7. What is the output of the following three programs?

A)
```
#include <iostream>
using namespace std ;

int function (int) ;

int main() {
   int x = 10 ;
   cout << function (x) << endl ;
   return 0 ;
}

int function (int num) {
   if (num <= 0)
      return 0 ;
   else
      return function(num - 1) + num ;
}
```

B)
```
#include <iostream>
using namespace std ;

void function(int) ;

int main() {
   int x = 10 ;
   function(x) ;
   return 0 ;
}

void function (int num) {
   if (num > 0) {
      for (int x = 0 ; x < num ; x++)
         cout << '*' ;
      cout << endl ;
      function (num - 1) ;
   }
}
```

C)
```
#include <iostream>
#include <string>
#include <cstdlib>
using namespace std ;

void function (string str, int pos) ;

int main(int argc, char** argv) {
   string names = "Adam and Eve" ;
   function (names, 0) ;
   return 0 ;
}

void function (string str, int pos) {
   if (pos < str.length())  {
      function(str, pos + 1) ;
      cout << str[pos] ;
   }
}
```

Project 1 – Iterative Factorial (5 points)

Programming Challenge #1: Write an iterative version (using a loop instead of recursion) of the factorial function shown in this chapter. Demonstrate the use of the function in a program that prints the factorial of a number entered by the user. Use these numbers: 0, 1, 2, 5, 10, and 20. *Make sure that your answer doesn't go negative or is too small to make sense,* but do *not* use a **float** or a **double** to hold the results.

Project 2 – Recursive Member Test (10 points)

Programming Challenge #6: Write a recursive Boolean function named **isMember**. The function should accept three parameters: an array of integers, an integer indicating the number of elements in the array, and an integer value to be searched for. The function should return **true** if the value is found in the array or **false** if the value is not found.

Demonstrate the use of the function in a program that asks the user to enter values into an array of numbers, then prompts for value(s) to be searched for in that array. Search for two numbers in the array and two numbers that aren't in the array.

Project 3 – Palindrome Test (10 points)

Programming Challenge #8: (Haven't we seen this before?) A palindrome is a string such as "madam", "radar", "dad", and "I ", which reads the same forward and backward. The empty string is regarded as a palindrome. Palindromes consider only letters and numbers. Spaces and punctuation should be ignored.

For example, the following strings are also a palindromes: "Sit on a potato pan, Otis!", "Red roots to order.", and "Bob 7117 Bob".

Write a *recursive* function with the heading:

```
bool isPalindrome(string str, int lower, int upper)
```

that returns **true** if and only if the part of the string **str** in positions **lower** through **upper** (inclusive at both ends) is a palindrome. Test your function by writing a main function that repeatedly asks the user to enter strings. These strings are then tested for palindromicity (is that even a word?). The program terminates when the user presses the ENTER key without typing any characters before it.

Demonstrate your program using the following test cases:

reed
Kayak
Deed
12345
A Toyota's a Toyota.
Stressed desserts.
74 ABC ba47
Never odd or even.
A man, a plan, a canal, Panama

Make sure that all functions appear after **main** in the program file.

Submit all program files, screen snips of the output of your programs, and a document with the answers to the "Predict-The-Output" question.

Links

Additional Files and Programs	Next Assignment
none	Homework 12

Lab for this Module	Prior Assignment
Lab 11 - Recursion	Homework 9