# CS 150 Lab 08

# Loops! Ifs! Increments! Oh my!

**Date:** Wednesday, October 21, 2009

The purpose of today's lab is to for you to get some hands-on experience with the different things you can do with loops.

- Be sure to answer the given questions before you start.
- Be sure your output looks **exactly** like the specified output.
- Save each project in a folder called 08LabPUNetID. When you have completed the required projects, drop your folder in CS150-02 Lab.
- Show the instructor to TA your solution to each problem before submitting it.

## Lab 8.1

For this lab, you will need to create a new Visual Studio project that will contain your source code. Name this project "08_1SumsXXXXXXXX", replacing the XXXXXXXX with your PUNetID.

Write a program that will produce **two** values. Ask the user to input a positive integer less than 100. If the user does not input a positive integer that is less than 100 print the message "**That is not a positive integer less than 100!**" and terminate the program. Next, ask the user if they want to use odd or even integers to produce a sum. The user should be able to enter either E or e for even numbers and O or o for odd numbers. If the user gives something other than E, e, O, or o for this input, ask the user again for good input.

Once the user has answered your questions, you need to calculate:

- The sum of the even (or odd) integers from 1 to the user's number
- The average of the even (or odd) integers from 1 to the user's number (to one decimal place)

**Sample Input and Output:**

```
 *****************
/ Sums &          \
\        Averages /
 *****************

Please enter a positive integer less than 100: 10
Do you want to use the Even or Odd integers? E

Sum of even integers: 30
Average of even integers: 6.0
```

```
 *****************
/ Sums &          \
\        Averages /
 *****************

Please enter a positive integer less than 100: 10
Do you want to use the Even or Odd integers? O

Sum of odd integers: 25
Average of odd integers: 5.0
```

1. List each variable declaration necessary to store the data and information in your program. The variable name and type must be enough information to describe the information the variable holds.

2. Briefly describe the calculations you will need to perform in your program. Be sure to explain which variables from 1. will be used in each calculation.

3. For each loop used in your program, discuss what will happen in the loop and what data and conditions will be used by the program to stop the loop.

# *Challenge Program!*

For this lab, you will need to create a new Visual Studio project that will contain your source code. Name this project "08_2PiXXXXXXXX", replacing the XXXXXXXX with your PUNetID. Since this problem is a *challenge* you do not need to submit it.

You can approximate Pi by using Leibniz's formula:

$$1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \frac{1}{9} - \cdots = \frac{\pi}{4}.$$

(from http://en.wikipedia.org/wiki/Leibniz_formula_for_pi)

Your program needs to approximate Pi using the formula above until the denominator is 593. Print the table shown below for each denominator used (from 1 to 593). All of the floating point numbers are to be displayed with 16 digits past the decimal point.

**Sample input and output follow:**

```
  ************************************
 / Leibniz's Pi Approximator-o-izer /
************************************

Denominator                Pi/4                    Pi
-------------------------------------------------------
          1 1.0000000000000000 4.0000000000000000
          3 0.6666666666666667 2.6666666666666670

          ----- 5 to 589 OUTPUT HERE -----

        591 0.7845535712127520 3.1382142848510082
        593 0.7862399118535615 3.1449596474142458
```

1. List each variable declaration necessary to store the data and information in your program. The variable name and type must be enough information to describe the information the variable holds.

2. Briefly describe the calculations you will need to perform in your program. Be sure to explain which variables from 1. will be used in each calculation.

3. For each loop used in your program, discuss what will happen in the loop and what data and conditions will be used by the program to stop the loop.

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