The main objective of today’s lab is to use some basic mathematics to solve a few real world problems. In doing so, you are to begin getting accustomed to using the Visual Studio debugger.

- Be sure your output looks exactly like the specified output.
- Be sure to submit the completed project to CS150-01 Lab when you are done.
- Be sure to use the program skeleton and add comments to your code!
- Show the instructor or TA your solution to each problem before submitting.
- You do not need to submit the challenge question!

Lab 3.0
We are going to begin using the Visual Studio 2010 debugger to aid with debugging programs.

1. Go to CS150Public folder and drag a copy of the solution DebuggerEx to your desktop.
2. Build your solution and then execute the program using the command “Start Without Debugging.” You will see the following.

3. In looking at your output you wonder why num4 / num5 is 0 since both numbers are nonzero. What is going on? Let’s debug!
4. Close the output window and go back to the code. Set a breakpoint by clicking an executable statement in the light blue column as follows. Notice the red button next to the executable statement cout on line 16.
5. Let’s start the debugger and step through our program one executable statement at a time. Start the debugger by going to Debug → Start Debugging. The debugger will stop at the first executable statement that has a breakpoint. Your screen should look something like the following. Make sure the Locals tab is selected and not the Autos tab.

6. **Show your instructor/TA the above screen.**

7. Let’s talk about what we are looking at.

8. From here we can continue running the program until the next breakpoint by selecting Resume as shown below.

9. You can also just execute the next statement by selecting Step Over.

10. We will talk about Step Into and Step Out when we get to functions.

11. Execute each statement up to but not including the return statement.

12. ► **STOP – Show the instructor or TA**
Lab 3.1: Fahrenheit to Celsius

Add a project called 03_1_TemperatureConversion to your PUNetIDLabs solution. This project is to convert a Fahrenheit temperature to both Celsius and Kelvin. The conversion formulas are:

\[ C = \frac{5}{9} (F - 32) \]

\[ K = \frac{5}{9} (F - 32) + 273 \]

Sample Input/Output where the Fahrenheit temperature is the only input shown in bold below.

```
********************
Temperature Converter
********************
Enter a non-negative Fahrenheit temperature: 212
212 Fahrenheit is 100 Celsius
212 Fahrenheit is 373 Kelvin
```

1) Briefly describe the data that your program will need to use.

2) List the variable declarations necessary to store the data listed in 1.

3) Open up Visual Studio and write a complete program for the above problem.

4) Show the instructor/TA that you can step through your solution with the debugger.

► STOP – Show the instructor or TA
Lab 3.2: Time Converter

Add a project called `03_2_TimeConverter` to your PUNetIDLabs solution. This project is to convert a number of seconds into hours, minutes, and seconds in a format like HH:MM:SS.

Sample Input / Output where the total number of seconds is the only input shown in bold below.

```
***************
Time Converter
***************
Enter seconds since day began: 100
The time is 0:1:40
```

1) Briefly describe the data that your program will need to use.

____________________________________________________________________
____________________________________________________________________
____________________________________________________________________

2) List the variable declarations necessary to store the data listed in 1.

____________________________________________________________________
____________________________________________________________________
____________________________________________________________________

3) Open Visual Studio and write a complete program for the above problem.

► STOP – Show the instructor or TA

Optional Challenge:

Always print your time as HH:MM:SS so the above time would show 00:01:40

Once both projects are completed, place your solution PUNetIDLabs into the CS150-01 Drop folder on Turing. Your solution is to have all six (2 from lab 1, 2 from lab 2, 2 from lab 3) projects completely working and correct.