CS 150 Lab 3
Arithmetic and the Debugger

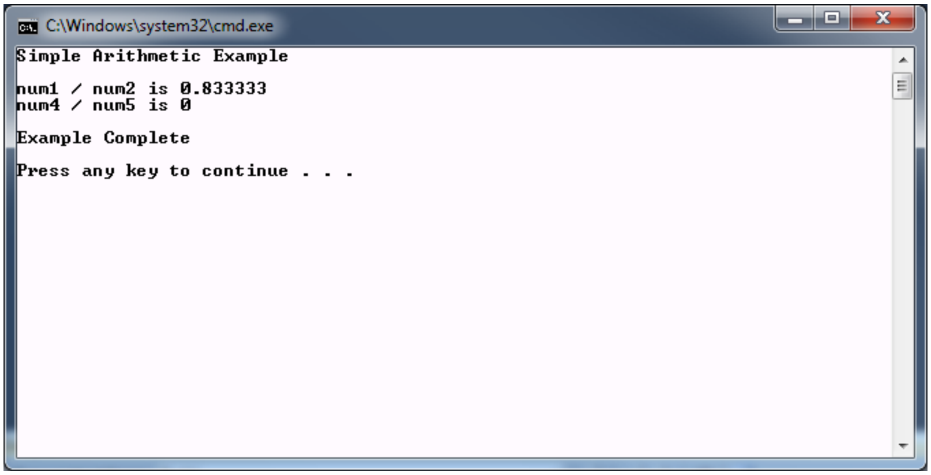
The main objective of today's lab is to use some basic mathematics to solve a few real world problems. In doing so, you are to begin getting accustomed to using the Visual Studio debugger.

- Be sure your output looks exactly like the specified output.
- Be sure to submit the completed project to **CS150-02 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

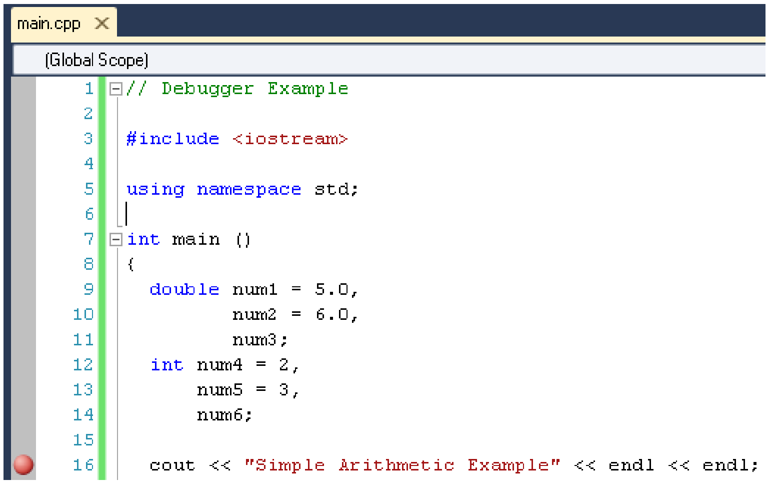
We are going to begin using the Visual Studio 2010 debugger to aid with debugging programs.

1. Go to **CS150-02 Public** folder and drag a copy of the solution **DebugEx** to your desktop.
2. Build your solution and then execute the program using the command "Start Without Debugging." You will see the following.



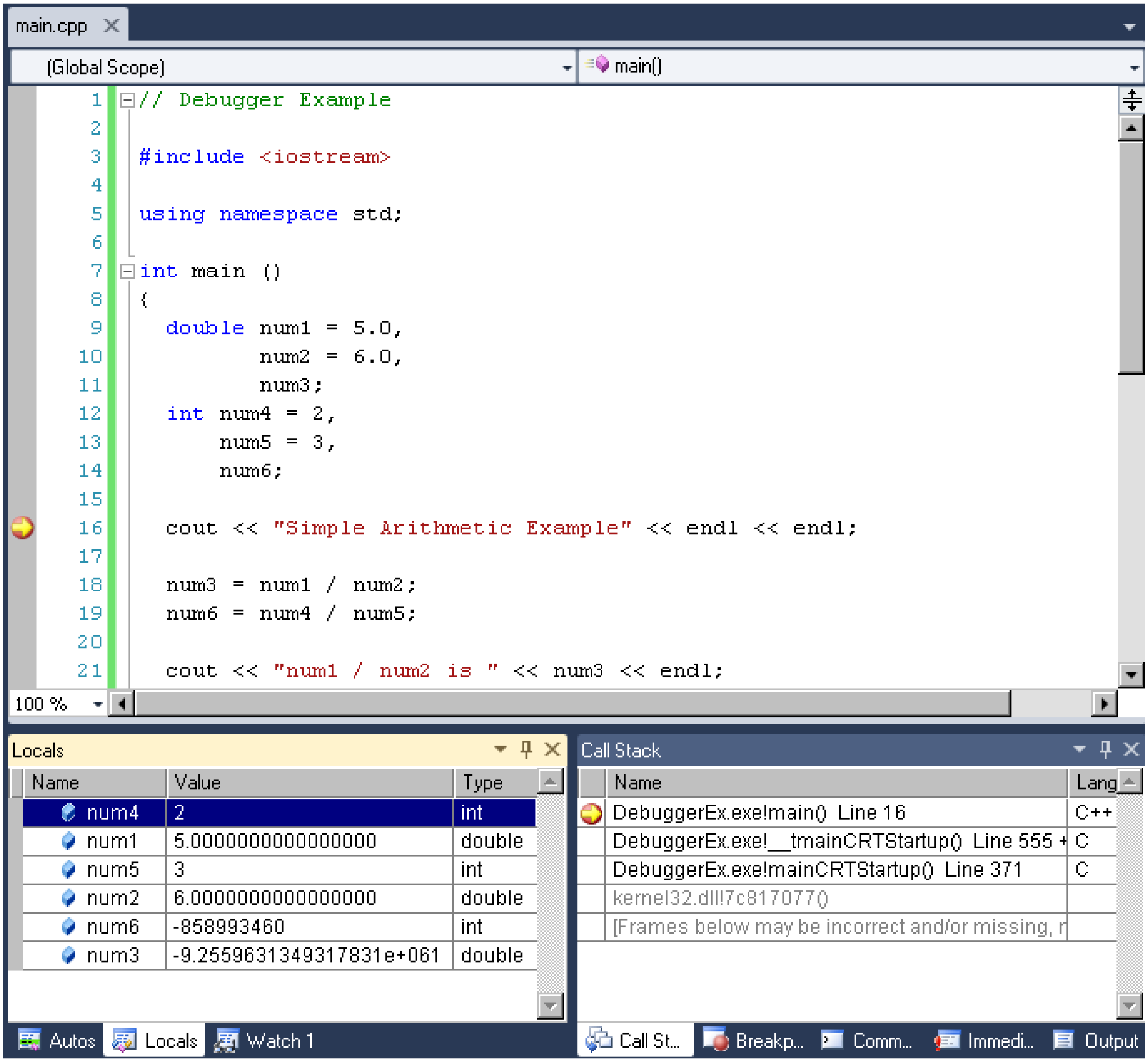
```
Simple Arithmetic Example

num1 / num2 is 0.833333
num4 / num5 is 0

Example Complete

Press any key to continue . . .
```

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.



```
 1  // Debugger Example
 2
 3  #include <iostream>
 4
 5  using namespace std;
 6
 7  int main ()
 8  {
 9    double num1 = 5.0,
10           num2 = 6.0,
11           num3;
12    int num4 = 2,
13        num5 = 3,
14        num6;
15
16    cout << "Simple Arithmetic Example" << endl << endl;
```

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.



```
// Debugger Example

#include <iostream>

using namespace std;

int main ()
{
   double num1 = 5.0,
          num2 = 6.0,
          num3;
   int num4 = 2,
       num5 = 3,
       num6;

   cout << "Simple Arithmetic Example" << endl << endl;

   num3 = num1 / num2;
   num6 = num4 / num5;

   cout << "num1 / num2 is " << num3 << endl;
```

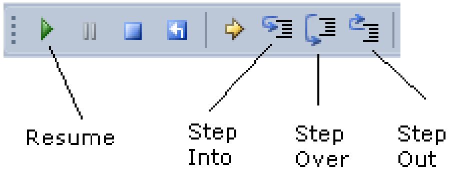
Locals

Name	Value	Type
num4	2	int
num1	5.0000000000000000	double
num5	3	int
num2	6.0000000000000000	double
num6	-858993460	int
num3	-9.2559631349317831e+061	double

Call Stack

Name	Lang
DebuggerEx.exe!main() Line 16	C++
DebuggerEx.exe!__tmainCRTStartup() Line 555 +	C
DebuggerEx.exe!mainCRTStartup() Line 371	C
kernel32.dll!7c817077()	
[Frames below may be incorrect and/or missing, r	

6. **<u>Show your instructor/TA the above screen.</u>**
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. **► <u>STOP – Show the instructor or TA</u>**

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 **CS150-02 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.