

# CS 150 Lab 4

## If Statements and Relational Operators

The main objective of today's lab is to solve a problem that uses conditional logic and formatted output. You are to continue using the Visual Studio debugger to help identify any logical errors that your program contains.

1. Be sure your output looks exactly like the specified output.
2. Submit your solutions folder with the completed project to **CS150-01 Drop** folder when you are done.
3. Use the program skeleton and add comments to your code.
4. Write small pieces of code and test as you go.

Show the instructor or TA the output of your menu before moving on. And then finally, show the instructor or TA your final solution.

### Lab 4.1

Add a project called **04\_1\_SpeedOfSound** to your **PUNetIDLabs** solution that solves the following problem.

The speed of sound traveling through a gas medium depends on the density of the medium. The less dense the medium, the faster the speed of the sound travels. The following table shows the speed of sound at 0 degrees Celsius.

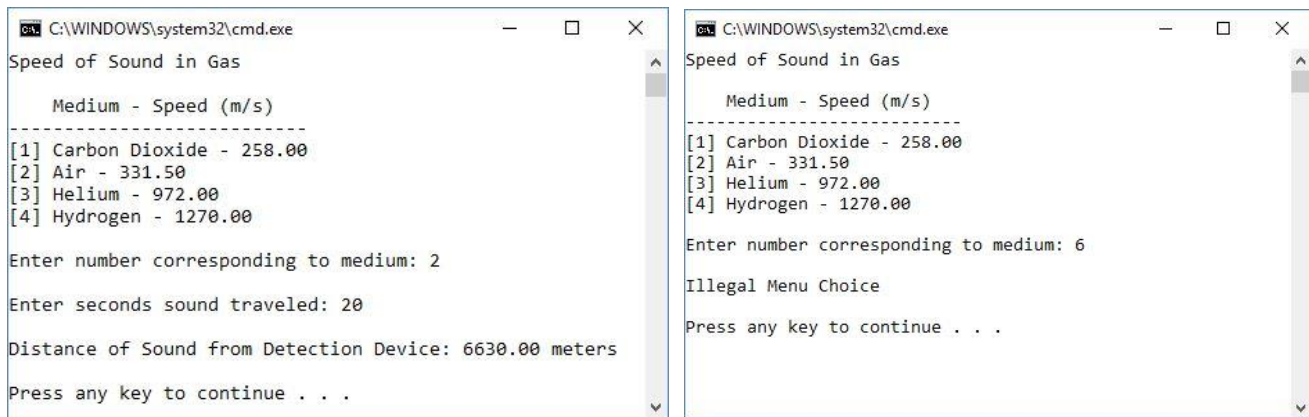
Consider the following table showing the speed of sound through a gas medium:

Medium	Speed (Meters/Second)
Carbon Dioxide	258.0
Air	331.5
Helium	972.0
Hydrogen	1,270.0

Write a program that displays a menu allowing the user the ability to select one of the four gases. The program is to ask the user to enter the time it took (in seconds) for the sound to travel from the source to the detection location. The program is to report how far away (in meters) the source of the sound is from the detection location.

- 1) Check to make sure the user has selected a valid menu choice. If an invalid choice is entered, output the message "Illegal Menu Choice" and terminate the program.
- 2) Optional Challenge: Do not accept any input times less than 0 or more than 60 seconds.

Here is how your program is to work:

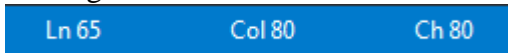


```
C:\WINDOWS\system32\cmd.exe
Speed of Sound in Gas
Medium - Speed (m/s)
-----
[1] Carbon Dioxide - 258.00
[2] Air - 331.50
[3] Helium - 972.00
[4] Hydrogen - 1270.00
Enter number corresponding to medium: 2
Enter seconds sound traveled: 20
Distance of Sound from Detection Device: 6630.00 meters
Press any key to continue . . .

C:\WINDOWS\system32\cmd.exe
Speed of Sound in Gas
Medium - Speed (m/s)
-----
[1] Carbon Dioxide - 258.00
[2] Air - 331.50
[3] Helium - 972.00
[4] Hydrogen - 1270.00
Enter number corresponding to medium: 6
Illegal Menu Choice
Press any key to continue . . .
```

**Note:**

1. In order to output the values to 2 decimal places, you need to do the following:
  - At the top of the program add: **#include <iomanip>**
  - Inside the main, add: **cout << fixed << setprecision (2);**
2. Your program is to compile without any errors or warnings.
3. Do not use any magic constants in your program.
4. In order for your program to print correctly, you need to have 80 or less characters per line. There is an extension that can help you with this.
  - Go to Tools->Extensions and Updates
  - Click Online on the left
  - In the search box on the top right, type in (guidelines)
  - Select **Editor Guidelines** and click **Download**, then **Install**. You will need to restart Visual Studio when prompted. *This might be the second result listed.*
  - Now, you can right click anywhere in the .cpp file, go to Guidelines->Add Guideline, and a dotted vertical red line will appear. This will help guide you so that you don't type past this point.
  - To find column 80, go to a blank line and space until you hit Col 80. You can see this by looking at the blue status bar at the bottom of the screen.



**► STOP – Show the instructor or TA**

Once your project is complete, print out your code in color and turn it in. There must be no line wraps.

## Lab 4.2 (Optional)

Add a project called **04\_2\_Hypotenuse** to your **PUNetIDLabs** solution that solves the following problem.

A right triangle, shown at right, is a triangle where one of the three angles is 90 degrees. An interesting trait of a right triangle is the fact that the squares of the two sides add up to the square of the hypotenuse, the side opposite the right angle. The hypotenuse is always the longest of the three sides. For this project, you need to use these facts to determine if a triangle is a right triangle. You will be given the length of each side and must determine which side is potentially the hypotenuse. In the figure  $a^2 + b^2 = c^2$ .

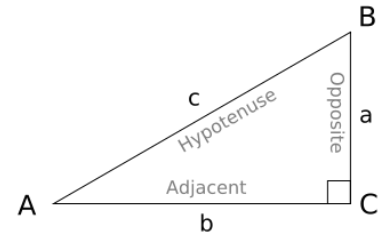


Figure 1  
<http://mrhiggins.net/algebra2/wp-content/uploads/2008/05/righttri2.png>

### Sample Output

```
C:\Windows\system32\cmd.exe
*****
*   Right Triangle   *
*****

Please give me the length of all three sides: 1 1 2
This is not a right triangle!
Press any key to continue . . .
```

```
C:\Windows\system32\cmd.exe
*****
*   Right Triangle   *
*****

Please give me the length of all three sides: 3 5 4
This is a right triangle!
The hypotenuse is length: 5
Press any key to continue . . .
```

Test your program on the following input:

- 10 8 6
- 7 13 10
- 2 4 4

► **STOP – Show the instructor or TA**

Place your solution PUNetIDLabs into the **CS150-01 Drop** folder on Grace. Your solution is to have all previous projects completely working and correct.

## Challenge (Optional)

Add a project called **04\_3\_LeapYear** to your **PUNetIDLabs** solution that solves the following problem.

The goal of the challenge is to write a program to determine if a year is a leap year or not.

A year is a leap year if it is divisible by 4. The only exception to this is if it is a century year. Then it is a leap year only if it is divisible by 400.

In case you're wondering, these are the rules for the Gregorian calendar, which began to be adopted in 1582 when they realized that having a leap year every 4 years resulted in the days of the year being very off after a several centuries. (The actual length of a year is 365.24219 days, not an even 365.25 days).

The program should accept a single year as input and output either "Leap year" or "Not a Leap year."

Questions:

- What years do you need to use to test your program to make sure that you've covered all possibilities?
- Can you determine a single relational expression that represents the above rules and use this in your program?