

This lab exercise is a chance to gain familiarity (or refresh your memory) regarding the Microsoft *Visual Studio* Toolset, and to create a simple C++ Program.

## Due Date

You must *submit* the source code for the solution to this lab exercise to *Moodle* by

**Monday, June 10, 2025**

in order to receive full credit for this work. You must also *demonstrate* the solution to the instructor during class, at the earliest opportunity.

## Design the MilesPerGallon Program

Before we begin any programming task, it is a good idea to think about what we will need our program do:

- What will be the inputs to our program?
- What will be the outputs from our program?
- How would we solve this problem if we were doing it *without* a computer (that is, using **only** pencil and paper)?

What does it mean to calculate “miles per gallon” (MPG) when driving a car?

A more detailed description of MPG is: “miles travelled” for some amount of “gallons of fuel used”.

Miles travelled is easy enough to calculate: write down the odometer value at the beginning of your measurement, and the odometer value at the end. The distance travelled is the difference between the two.

Measuring “gallons of fuel used” is a bit tricky, because we do not have a precise value for how much fuel is remaining in the tank at any particular moment. A simple way to address this issue is:

- When purchasing fuel, always fill the tank to the top.
- Write down the odometer value each time you fill the tank.
- Also write down how many gallons you purchased each time you fill the tank.

**Miles travelled** between fill-ups is

$$MilesTravelled = OdometerAtLatestFillup - OdometerAtPreviousFillup$$

**Miles-per-gallon** between fill-ups is

$$MilesPerGallon = \frac{MilesTravelled}{GallonsPurchasedAtLatestFillup}$$

## WARNING


The most important detail to remember about any computer work you do is to **DOUBLE CHECK** that your work is saved on a backup device, such as a flash drive.

In case you do not have a flash drive with you: another technique for saving your work is to compose an EMail message to yourself, and attach the source file as an attachment to that EMail. Do this *before* you shut down or reboot the PC.

## Software Development Tools

If you have not already installed a working development toolset for C++ on your computer, please refer to the **Appendix** on the last page of this lab document. Most of this document assumes you are running *Visual Studio Community* on a Windows 10 computer.

## Know where your files are!

Be sure you are familiar with using the **File Explorer** tool on a Windows computer. On **Windows 10**, you can easily start the **File Explorer** tool by clicking the small icon (on the task bar) that looks like a file folder (  ).

Experiment with the menus until you feel that you can “find your way around”. (If you are using a **MacIntosh** or a **Linux** computer, then you should become familiar with whatever file management tools that system provides.)

Regardless of whether or not you are using a flash drive, it is important to know the **actual location** of your *Visual Studio* project. Very often students just save their project on the “desktop”, or blindly trust *Visual Studio* to choose a default location. Then, when they need to access the actual Windows files for their project, they have difficulty finding the correct folder.

It is also important to give a unique name to each *Visual Studio* project you create. For example, you might name the project for this lab exercise “**MilesPerGallon**”. However, if you have difficulty and need to start over for whatever reason, it would be smart to name the *second* attempt “**MilesPerGallon2**”. This will help avoid confusion.

## Software Tools that You Will Need to Complete this Lab Exercise:

- **File Explorer:** to create directories, as well as to copy and rename the source code file.
- A **browser:** to login to the *Moodle* Learning Management System and download the sample code, and also to submit your final solution.
- **Visual Studio:** to edit, compile and execute your program.

## Prepare a Folder on Your Hard Drive

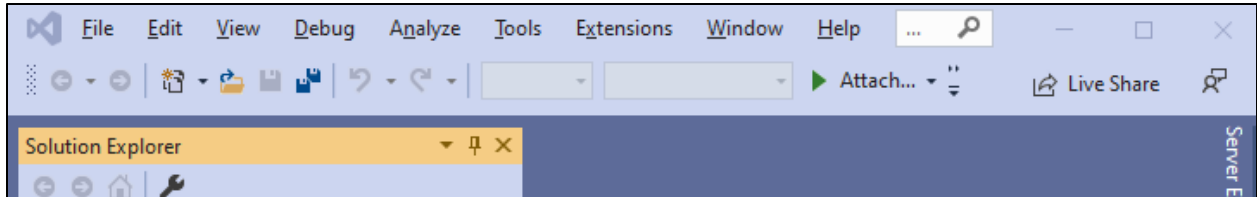
1. In the **File Explorer** window, navigate to the root directory of the C-drive (**C:\**) and create a folder named “**CSC237**”.
2. Inside the “**CSC237**” folder, create a folder named “**Lab**”, and open that folder.
3. Inside the “**C:\CSC237\Lab**” folder, create another folder named “**Lab02a\_MilesPerGallon**”. (In this course, we follow the convention of numbering Lab exercises to correspond to the relevant chapter in the textbook.)

## Basic Mechanics of Using Microsoft *Visual Studio*

4. Start the *Visual Studio* environment **either** by double-clicking the shortcut on the desktop (if present) **OR** by following menus (more or less) like the following:

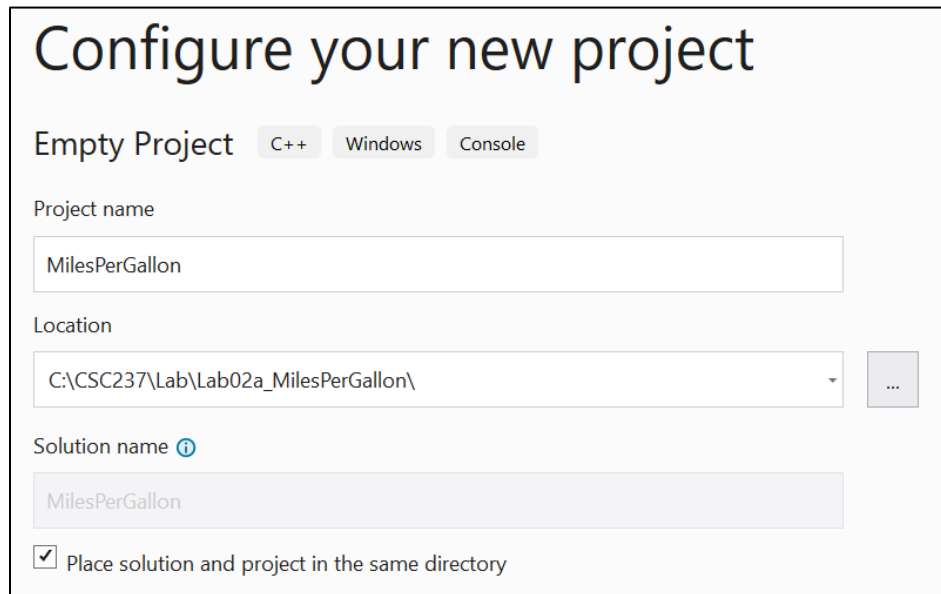
Click on the **Start** button (lower-left corner) and scroll down to the “V” section, where you will see the icon for *Visual Studio*. Click on that *Visual Studio* icon.

5. When *Visual Studio* opens, click the “**Continue Without Code**→” link near the bottom of the screen. You should see a window open that looks something like the following:



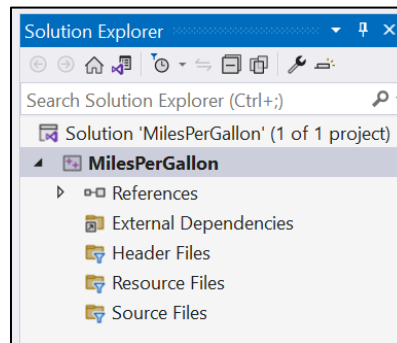
6. Click the “**File → New → Project**” menu. You will see the “**Create a new project**” screen open: Select “**Empty Project**”, and click “**Next**”.
7. Next you will see the “**Configure your new project**” screen open:
  - In the Project name field, enter “**MilesPerGallon**”.
  - Click the “...” button (to the right of the Location field).
  - Navigate to the “**C:\CSC237\Lab\Lab02a\_MilesPerGallon**” folder, and click “**Select Folder**”.

Your screen should now contain the following:



- Verify that the Project name field contains “**MilesPerGallon**”, that the Location field contains “**C:\CSC237\Lab\Lab02a\_MilesPerGallon**” and that the “Place solution and project in the same directory” box **IS** checked.
- Click “**Create**”. (Wait while *Visual Studio* initializes the project.)

The *Visual Studio* window should show a “**Solution Explorer**” window that looks something like:

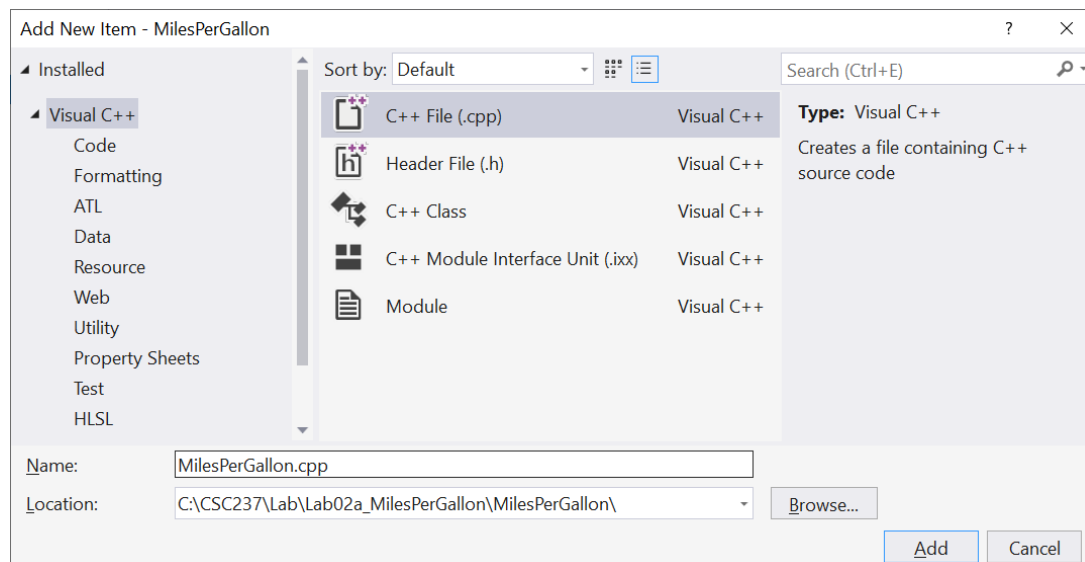


(If you do not see the “Solution Explorer” window, click the **View** → **Solution Explorer** menu.)

8. Click **View** → **Solution Explorer**:

In the “**Solution Explorer**” window, there is a folder named “Source Files”.

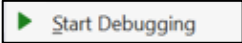
**Right-click** “Source Files” and select **Add** → **New Item...**



Select the file type (**C++ File**) and fill-in the file name (**MilesPerGallon.cpp**).  
Click “**Add**”.

Type your first attempt at the source code for the **MilesPerGallon.cpp** file into the editor.

Not sure where to begin, when writing the code?  
Use the **SAMPLE CODE** example for Chapter 1 as a guide.  
(This is available on *Moodle*.)

When you are ready to test the code, click the “**Debug** → **Start Debugging**” menu (  ).

Observe the execution window, as the program starts and waits for the user to input a data value:

```
Enter Odometer at PREVIOUS fill-up:
```

## Sample Output

In the sample output shown below, text that the user types is shown in **BOLD** font. When the program actually runs, all text is shown in the same font.)

### Sample Input / Output

```
Enter Odometer at PREVIOUS fill-up: 35000
Enter Odometer at LATEST fill-up: 35300
Distance travelled = 300.0 miles.
Enter gallons purchased at LATEST fill-up: 10
Your fuel economy is: 30.0 MPG.

C:\CSC237\Lab\Lab02a_MilesPerGallon\MilesPerGallon\x64\Debug\MilesPerGallon.exe
(process 14588) exited with code 0.
```

### Sample Input / Output

```
Enter Odometer at PREVIOUS fill-up: 42305
Enter Odometer at LATEST fill-up: 42677
Distance travelled = 372.0 miles.
Enter gallons purchased at LATEST fill-up: 11.4
Your fuel economy is: 32.6 MPG.

C:\CSC237\Lab\Lab02a_MilesPerGallon\MilesPerGallon\x64\Debug\MilesPerGallon.exe
(process 12040) exited with code 0.
```

## Submit and Demonstrate the Working Program

- Submit the source code file (**\*.cpp**) for the working program to *Moodle* assignment for this Lab Exercise.
- Demonstrate the working program to the instructor during class.
- Be sure to save a copy of the source file (**\*.cpp**) in a safe place for future reference.

(NOTE: the “**.cpp**” filename suffix may not be visible on your computer, but the “Type” column will clearly indicate something like “**C++ File**” or “**C++ Source**”.)

## Appendix: Software Development Tools

### Windows 10 users: Installing Visual Studio for C++ on a Windows 10 Computer

If you have not already installed Visual Studio on your computer, go to the following web page:

<https://docs.microsoft.com/en-us/visualstudio/install/install-visual-studio?view=vs-2022>

Follow the instructions for installing **Visual Studio Community** on your computer.

When the instructions direct you to **Choose Workloads**, choose “Desktop Development with C++”.

### MacIntosh users: Developing C++ Programs on a MacIntosh Computer

There is a version of *Visual Studio* for MacIntosh computers:

<https://learn.microsoft.com/en-us/visualstudio/mac/installation?view=vsmac-2022>

Many students who use a MacIntosh computer choose **XCode**:

<https://developer.apple.com/xcode/cpp/>

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