# EECE 344 Digital Systems Design

## Lab 0: Setting up the Development Environment

Due: in the lab meeting in the second week

## 1 Pre-Lab

1. The purpose of this prelab is to prepare you with a Keil MDK that uses a version 5 compiler and supports the Stellaris ICDI on the laptop you use throughout the semester. Make sure you have a laptop, or you can loan a laptop from the University, running Windows 10 or 11. You need this laptop for all labs. You are expected to bring your laptop to every of the lab meetings. If you plan to loan a laptop from the University, please get one by the first week of this semester. In this course, we use TI's Launchpad that has TM4C123GH6PM microcontrollers. If you **do not have a Keil** on your laptop, then please directly proceed to Step 2 of this pre-lab and skip the remaining of this step (Step 1). If you **already have a Keil** on your laptop from your previous installation, then please make sure that it satisfies the following two requirements: (1) it has compiler version 5. Either Arm **Compiler 5.06 update 7 (build 960)** or Arm **Compiler 5.06 update 6 (build 750)** works for this course. Compiler 5.06 has better support than Compiler 6 for the C code on the microcontroller used in this course, especially bit level operations and timing. Keil MDK version 5.37 and newer stops including Compiler 5. Figure 1 shows that you can check if your Keil uses Compiler 5 in the Target dialog after you have opened a project (Lab_0_Project, available from Canvas).

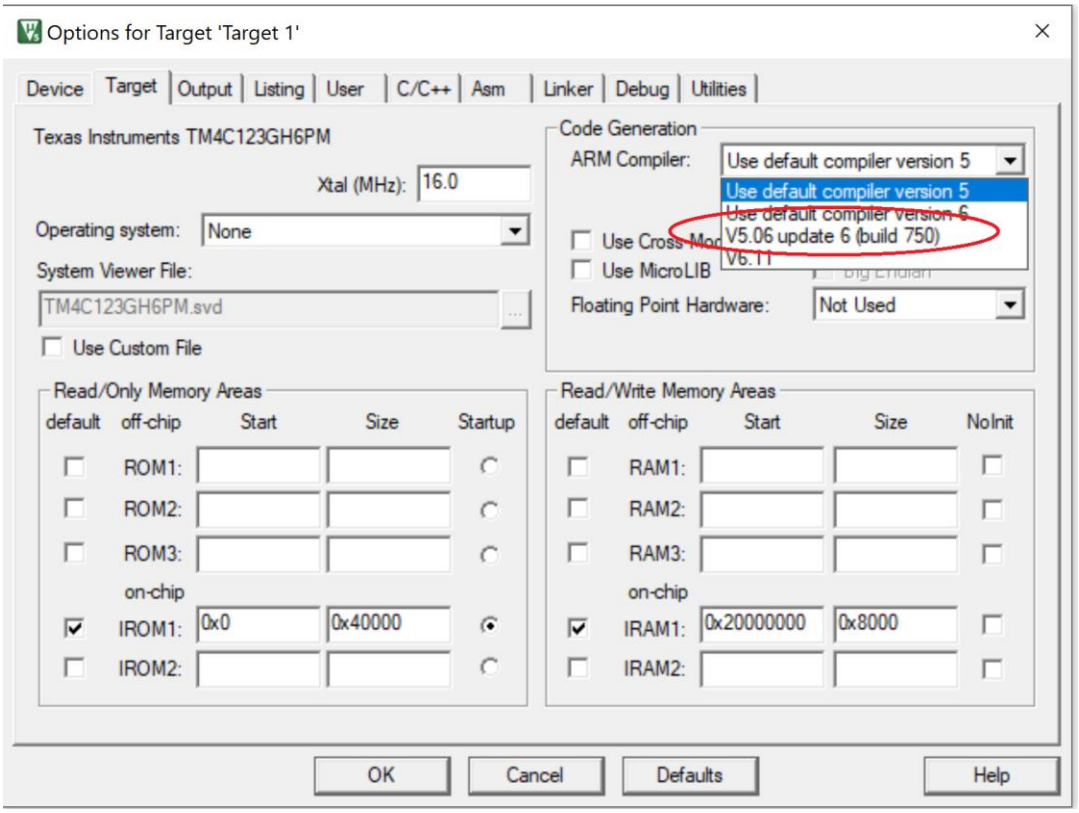



**Figure 1: Keil Compilers**

If your Keil satisfies this compiler requirement, then plug in your Tiva Launchpad and see if your environment satisfies the requirement: (2) it supports the Stellaris ICDI adapter. In your Keil project, open the Target dialog and choose “Debug”. See if Stellaris ICDI is listed. Figure 2 shows a screenshot of a correct configuration.

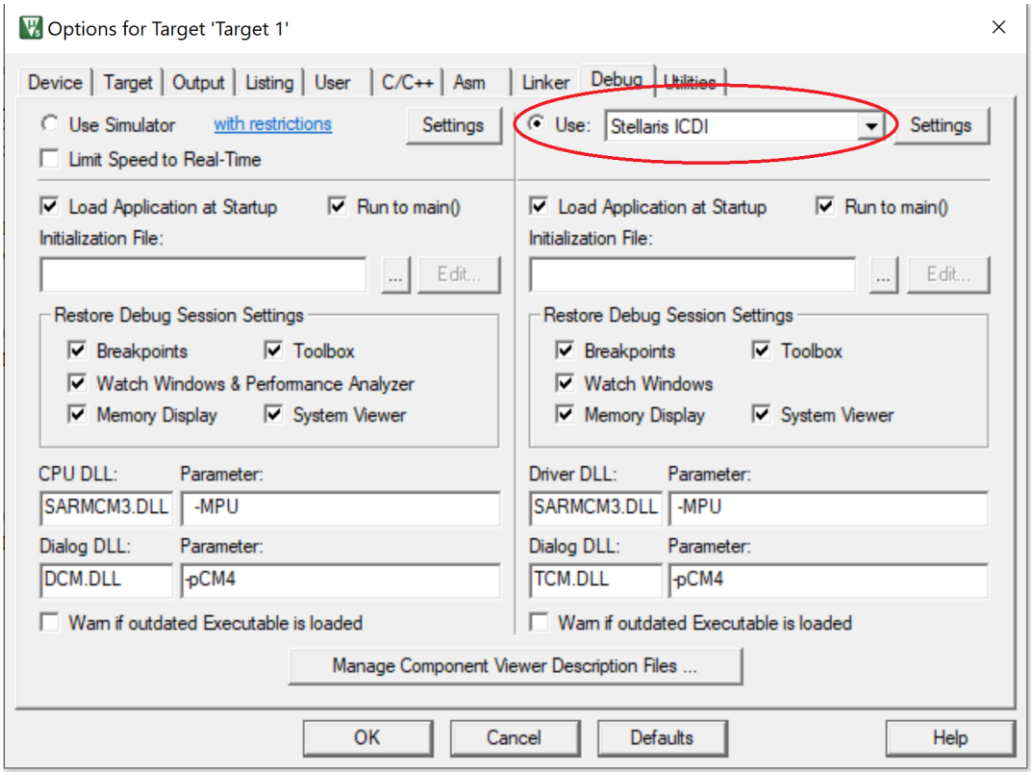



**Figure 2: Stellaris ICDI Supported in Keil**

If Stellaris is supported in your Keil, then you can go to Step 6 of this pre-lab. After completing Step 5 of this prelab **without any single error**, go ahead to complete Section 3 of this handout. That means that you have a working Keil environment with good device drivers for this course. You are ready to demonstrate your Keil environment to your instructor. If your existing Keil MDK cannot satisfy (1) and (2), then it means that your existing Keil is not suitable for the labs of this course. Then you are expected to follow the pre-lab from Step 2 to set up a working Keil MDK. Note: you might try to do some research to include Compiler 5 in your newer Keil MDK. However, as the CMSIS version progresses, resolving dependency issues associated with compiler errors after incorporating Compiler 5 becomes increasingly intricate.

2. Install and run Keil MDK version 5.34 on the laptop that you use. You can download its installation file from here. If you already have a different version of Keil installed, it is fine to install a second Keil. Only make sure that you install the second one in a different directory. Make sure you are clear about the path to your Keil 5.34, because you will need that path information in Step 4.
3. In this step, you are to install the necessary drivers for your Launchpad. Plug in your Launchpad to your laptop’s USB port. Download the driver from the website: https://www.ti.com/tool/STELLARIS_ICDI_DRIVERS. Follow "Stellaris Driver Installation Guide (Rev. C)" on the same web page to install the device drivers. If you have previously installed device drivers for your Launchpad, they may still be good.

4. The Launchpad requires the Stellaris ICDI adapter to be supported by the IDE. However, according to this article, In MDK v5.29 as well as newer versions of MDK the support for the Stellaris ICDI debug adapter has been removed, which will cause such a debugger DLL error. Install software legacy support "MDK_Stellaris_ICDI_AddOn.exe" from the website: https://developer.arm.com/documentation/ka002280/latest. You should make sure that this addon is installed into the Keil folder on your computer by specifying the correct "Destination Folder" in the installation wizard. Figure 3 shows what is seen in the instructor's laptop. Note: the path information in your own installation may look different from what is shown in Figure 3.

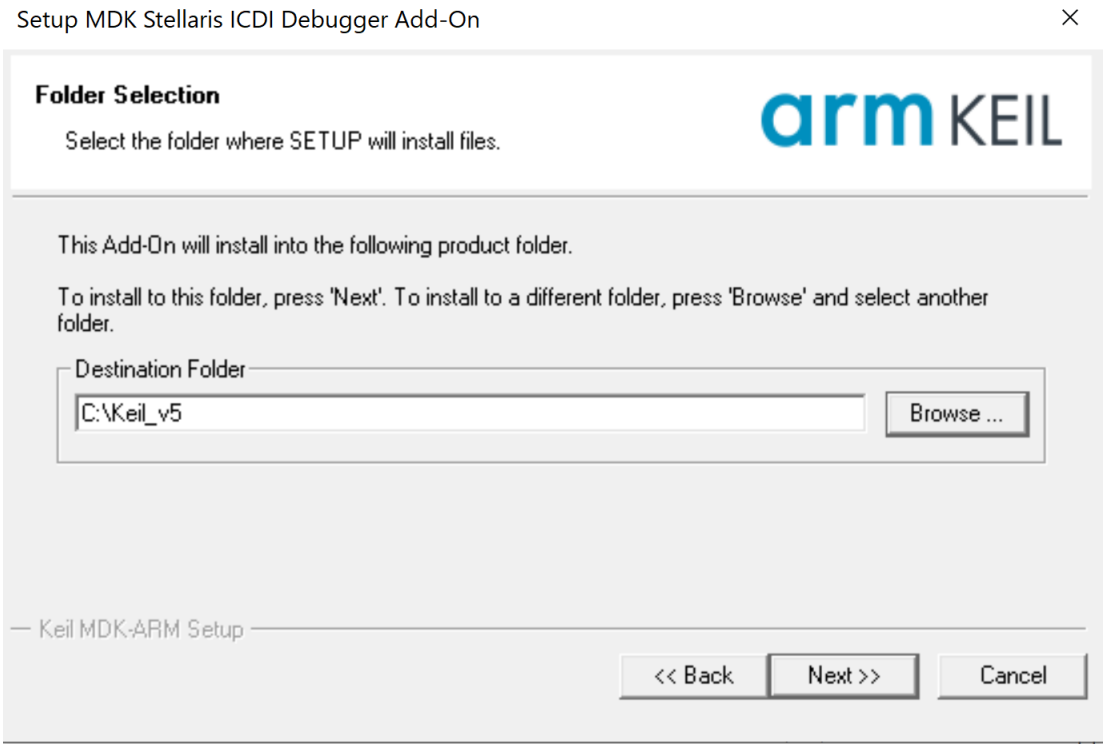



**Figure 3: Install the legacy support for Stellaris ICDI**

To verify that your Launchpad is successfully supported by your operating system, open "Device Manager" on your Windows operating system. You will see that your Stellaris Virtual Serial Port is recognized without any question mark, similar to Figure 4 below (the COM number might be different). Any device regarding this Stellaris ICDI should not have any question mark.

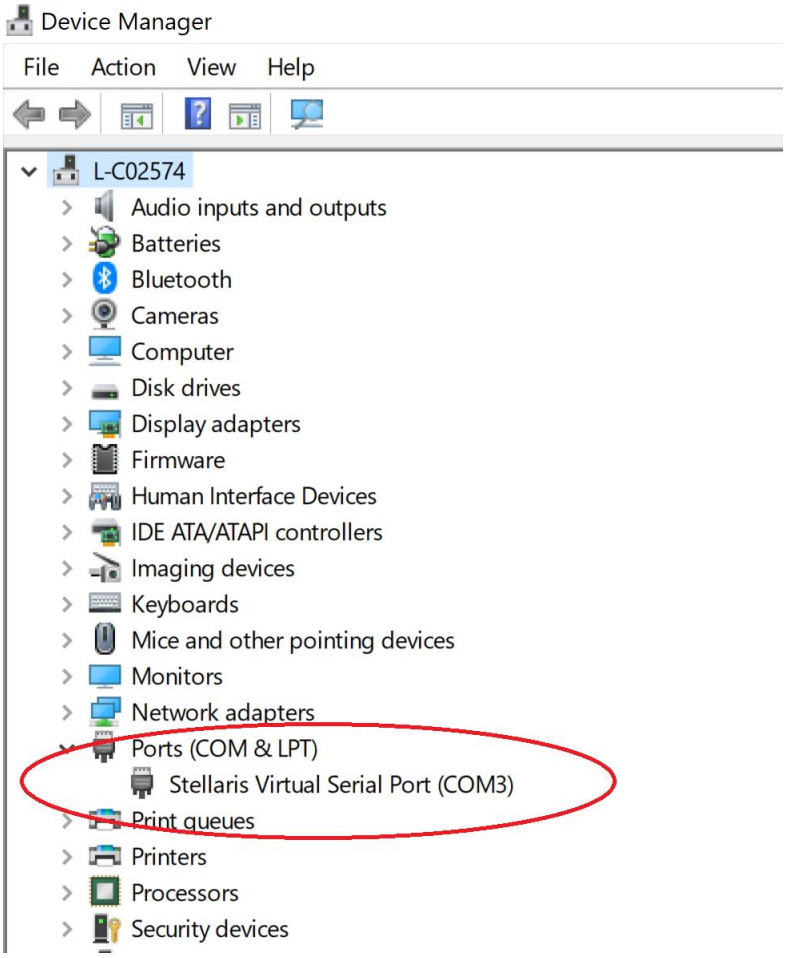



**Figure 4: The laptop successfully recognizes Stellaris ICDI**

5. Download and unzip Lab_0_Project.zip from the course website on Canvas into your laptop. Navigate to the folder containing the project. Double click the file "LED.uvprojx" to open the project in your Keil MDK. Your Keil might indicate that certain necessary pack is missing and start to install it. Simply accept what needs to be installed. Typically, it is "Keil::TM4C_DFP". It may take a few minutes for the **Pack Installer** to install this pack. Then the project and its C code should be able to show in Keil. Compile and run the project Lab_0_Project. There should not be any errors. Download the binary into your Launchpad. Reset the Launchpad. You should see the red LED turns on and off periodically. If everything is successful, you have done this prelab well.

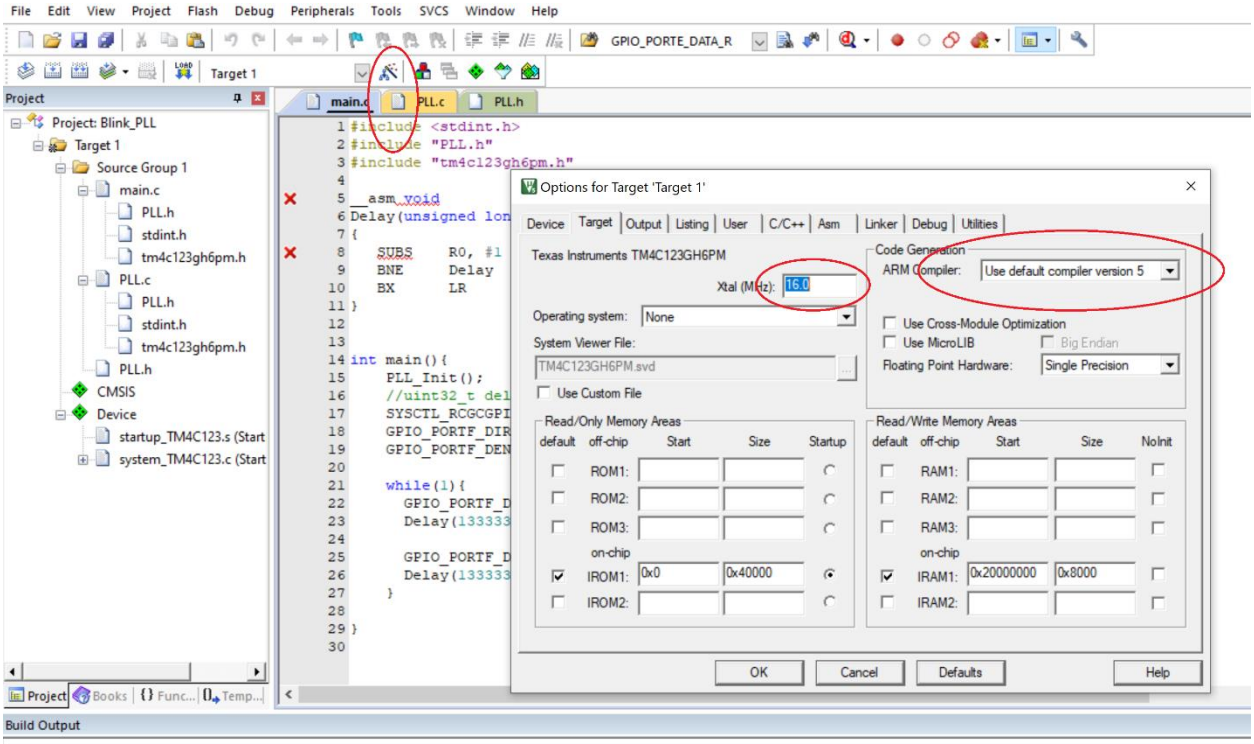
# 2 Objective

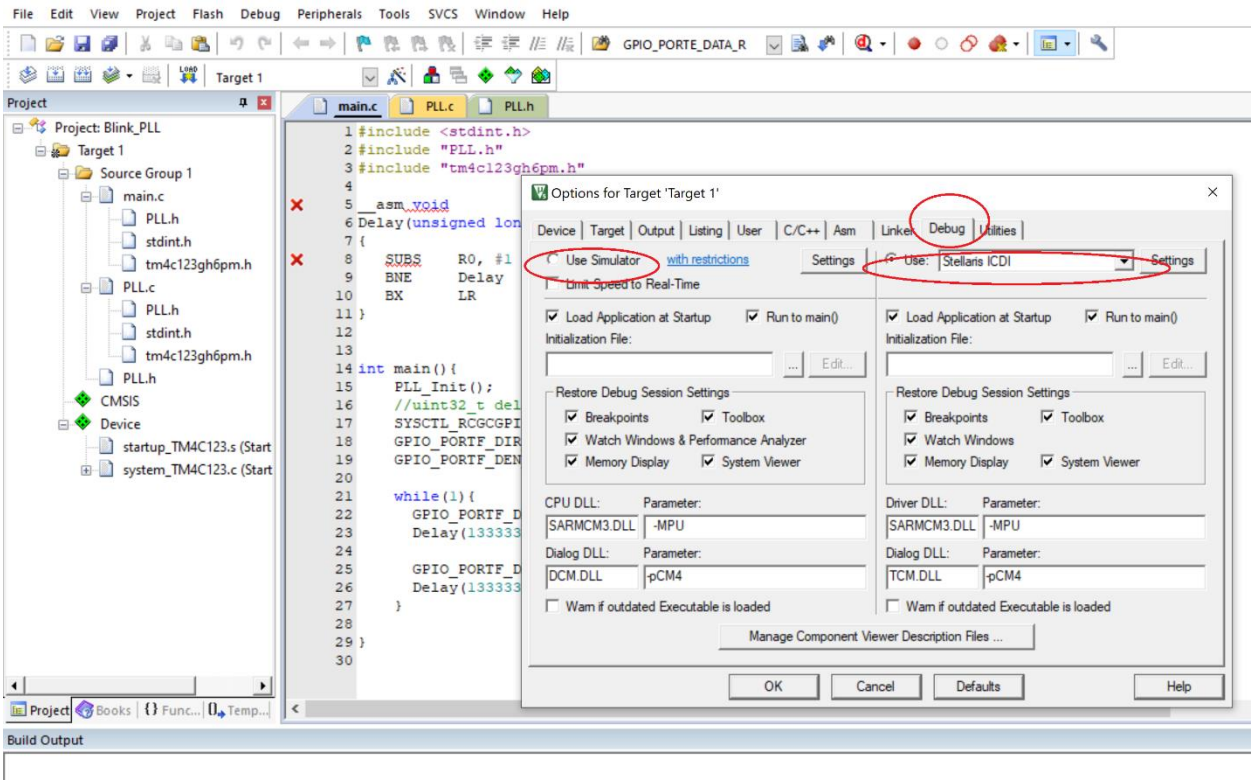
The major objective of this lab is to set up a working environment used throughout the semester. Besides, get familiar with the Integrated Development Environment (IDE) used in this class, ARM Keil uVision, through compiling, debugging, simulating and downloading a given project.

# 3 Configuration and Debugging

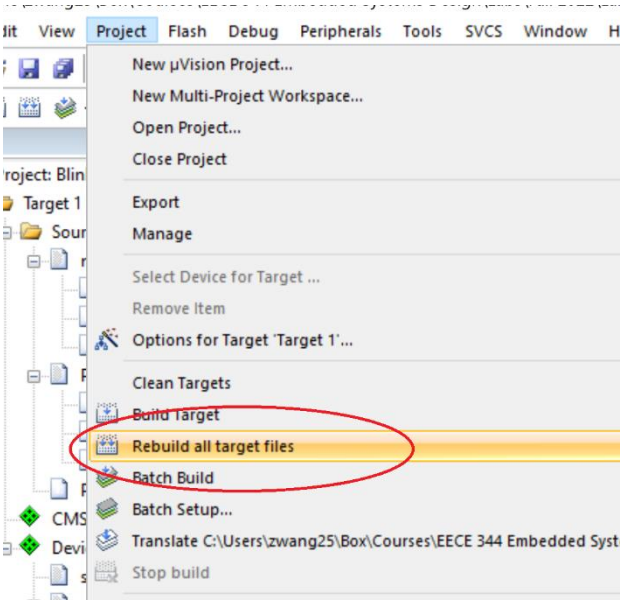
This part briefly points out several important features useful in Keil.

## 3.1 Choose the correct compiler and the mode of debugging.

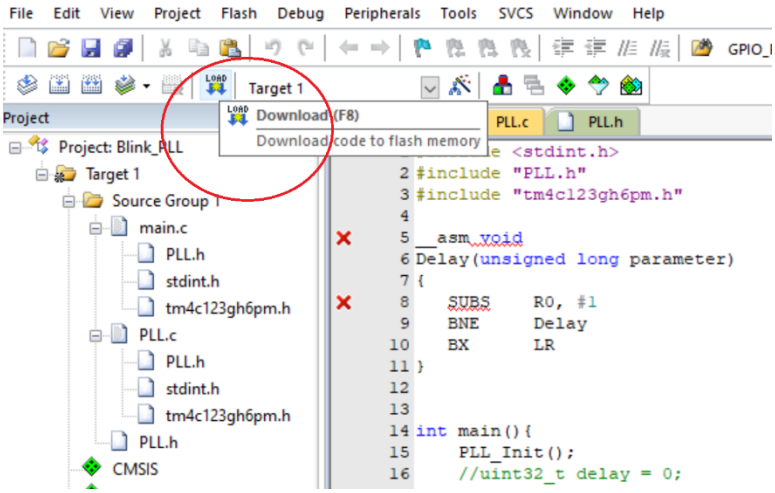


## 3.2 Compile the code in Keil.

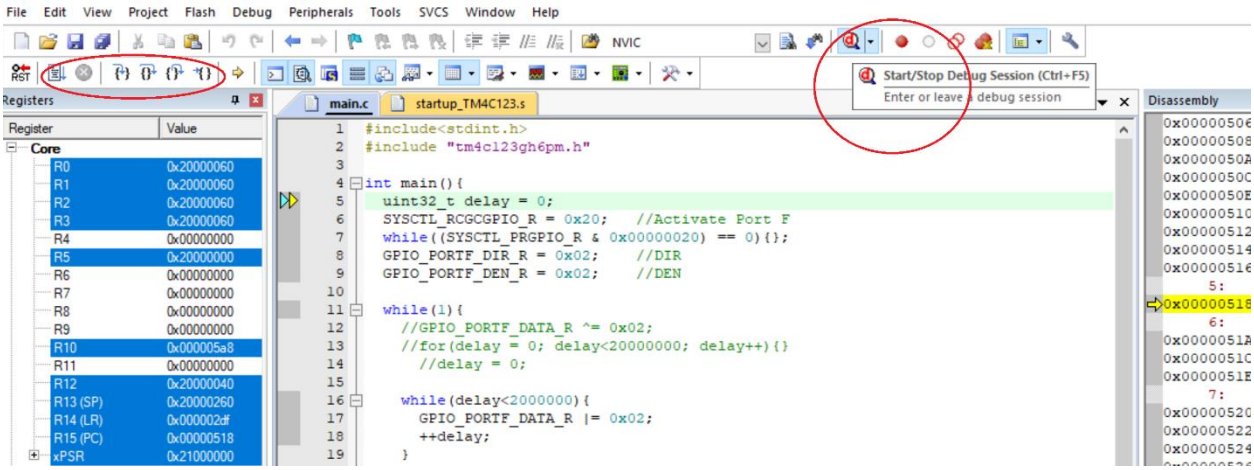



## 3.3 Connect your Launchpad to a USB on your computer. Download the code onto your Launchpad. Your Launchpad should be able to turn on and off the red LED.




## 3.4 Then we can enter the debugger to carry out some basic debugging.

The debugger has a rich set of features. Get yourself familiar with stepping through the code, setting break points, and utilizing the logic simulators. We will use these features many times in the lab.




## 4 Demonstration

Your instructor will ask you to demonstrate your program. You should show that you have a working Launchpad and a functioning Keil, including its debugger.

## 5 Deliverables

This lab has no deliverables, only demonstrations.