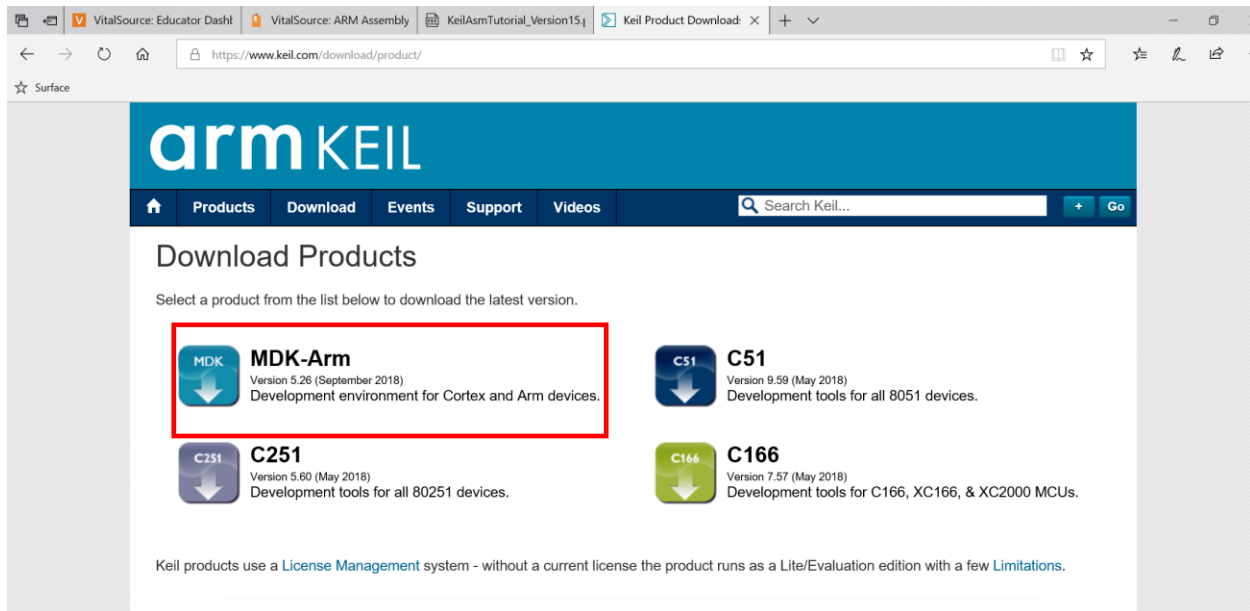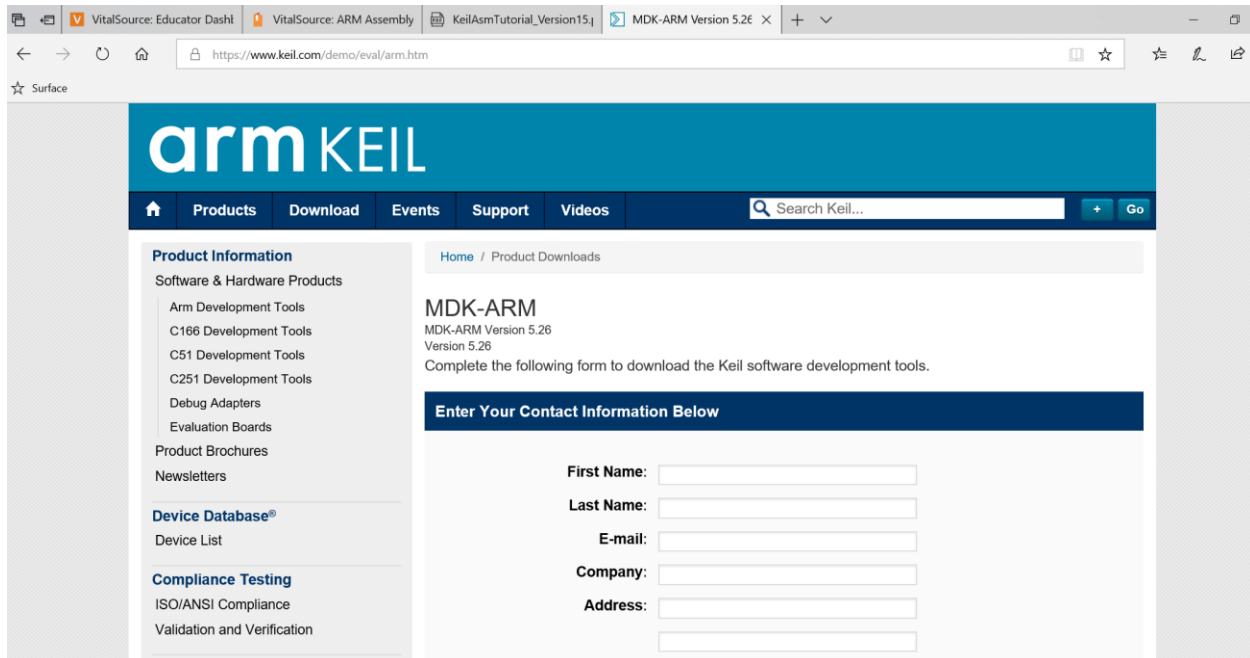# Lab 1: Introduction to Assembly Programming

Downloading and installing the Keil IDE

1. Click on the following link: https://www.keil.com/download/product/

2. Choose MDK-ARM.

3. Fill out the form, type in the device we are using and then click on the submit button, at the bottom of the page.

4. Click on the MDK526.EXE (the most recent version) link

5. Choose Save.

6. Execute the downloaded file. Installing the software is straight forward; choose the Next button in each step, until the setup finishes.

Creating an Assembly project in Keil

1. Open the **Keil IDE** by clicking on its icon on the desktop.

2. Choose *New uVision Project* from the *Project* menu.
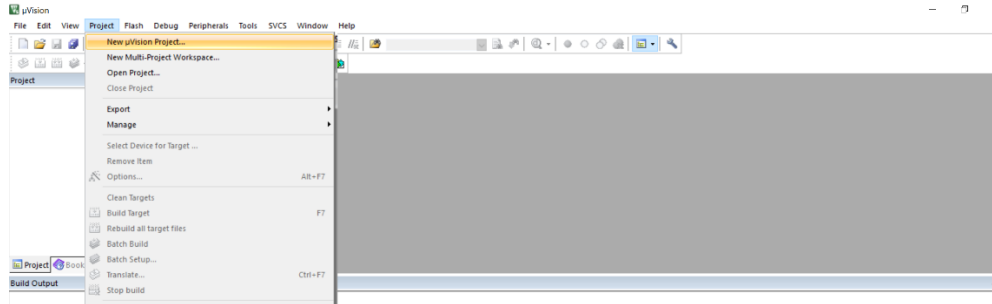
3. Create a new folder, and Name the new project, e.g. *OurFirstProject*. Type the name *ourFirstProject* for the project and click **Save**. Project name can be different from folder name. Do not make a directory, file or project name with a space in it. A space will prevent simulation from working properly.
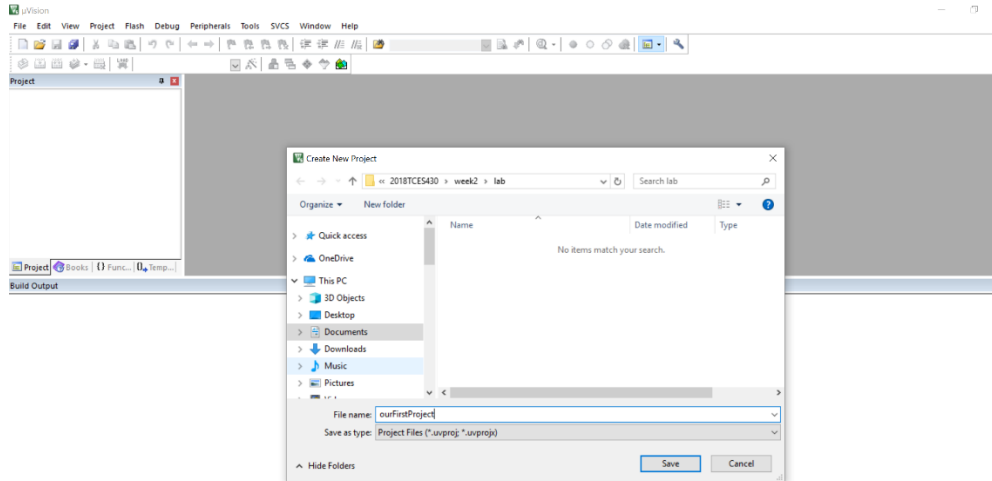
4. For the pop-up window "*Select device for Target*", choose *ARM --> ARM Cortex M4 --> ARMCM4_FP*
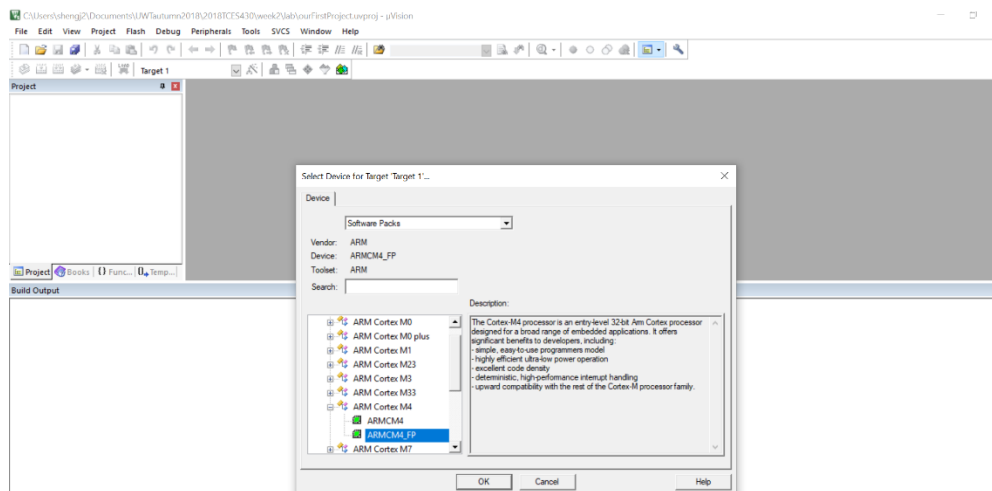
5. For the window "*Manage Run-time Environment*", check the software component *CMSIS CORE* and *Device Startup*
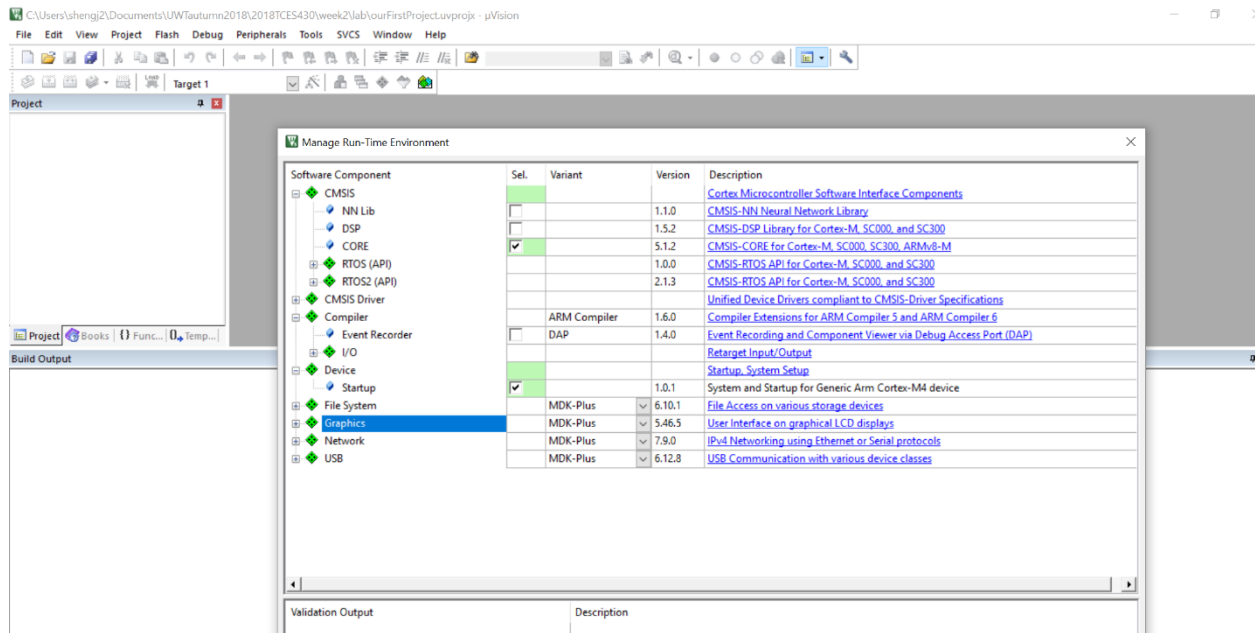
6. Now the project window looks like below:

7. Click on the "+" symbol for Target 1, expand the tree. Right click on *source group 1* and choose *Add New Item to Group 'Source Group 1'*
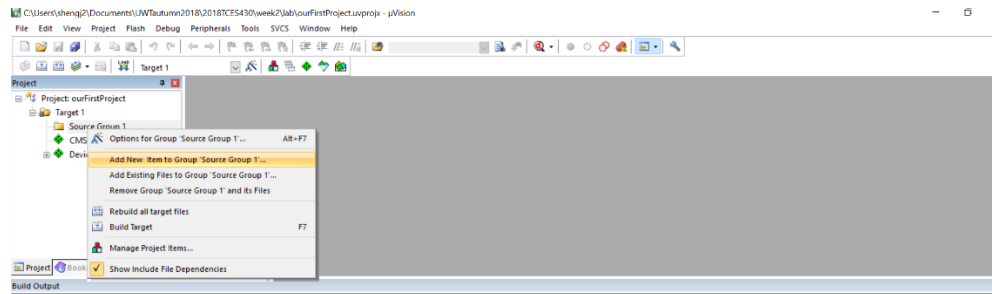
8. Add and name a new *.s* file, e.g., *program.s* file to the project. Press Add.

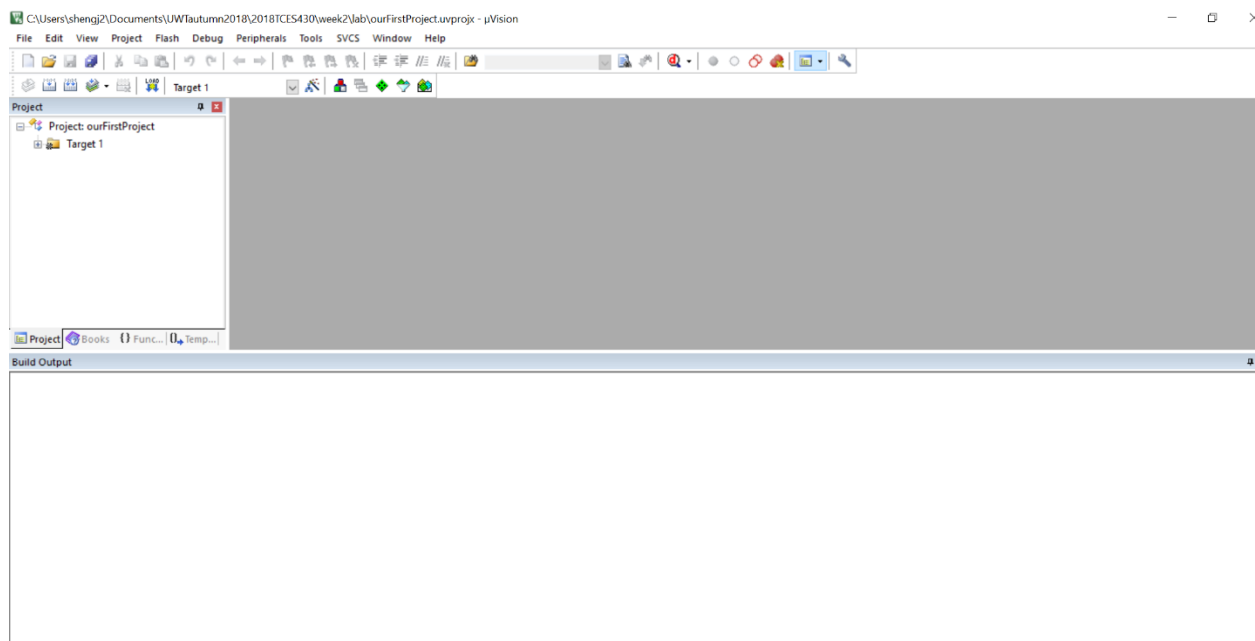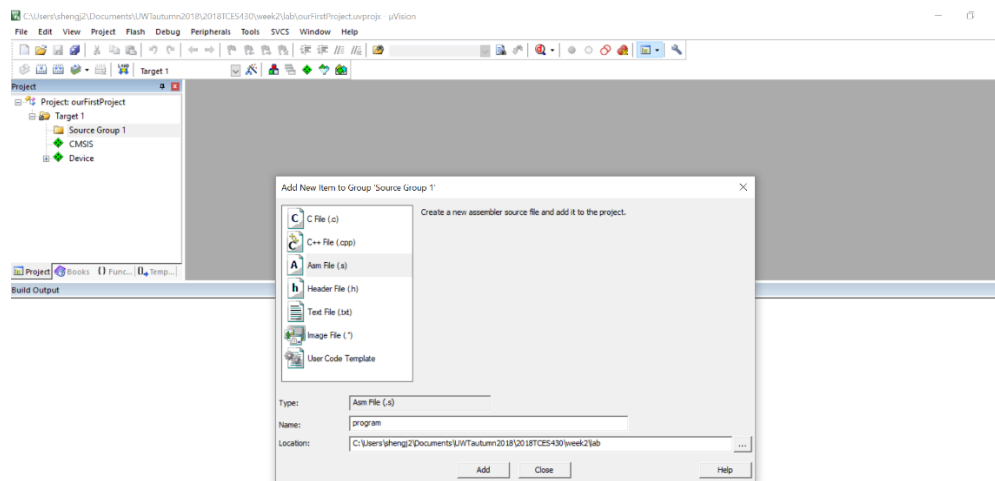9. Now type in your *program.s*, save the file and build the project by press the button **build**. If the program is built successfully, you should see the "0 errors, 0 warnings" message in the Build Output Window. Build Output window displays the errors, warning and build messages during build process.
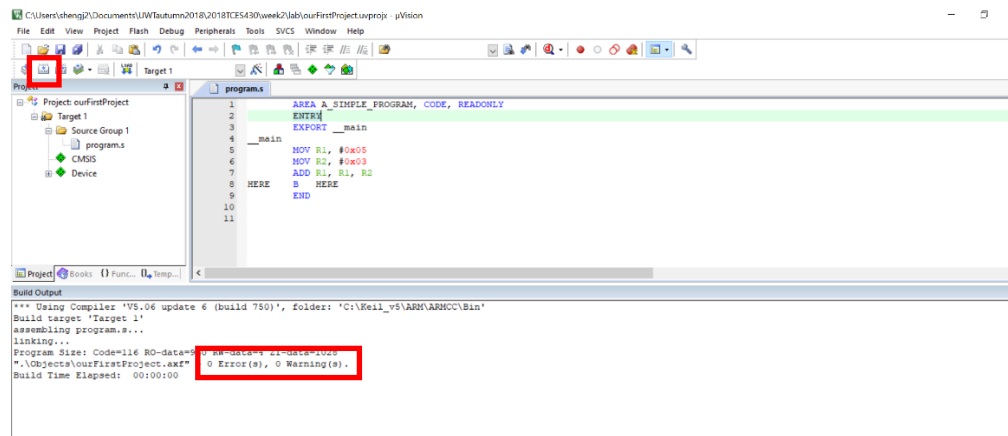
10. Before starting debugging, press the button "*Options for Target*". On the menu bar, click *Debug* and choose to use *Simulator* (or *Stellaris ICDI*), then click on *OK*.

11. To start debugging, click on *Start/Stop Debug Session* icon or choose *Start/Stop Debug Session* from the *Debug* menu. (or simply press Ctrl+F5)
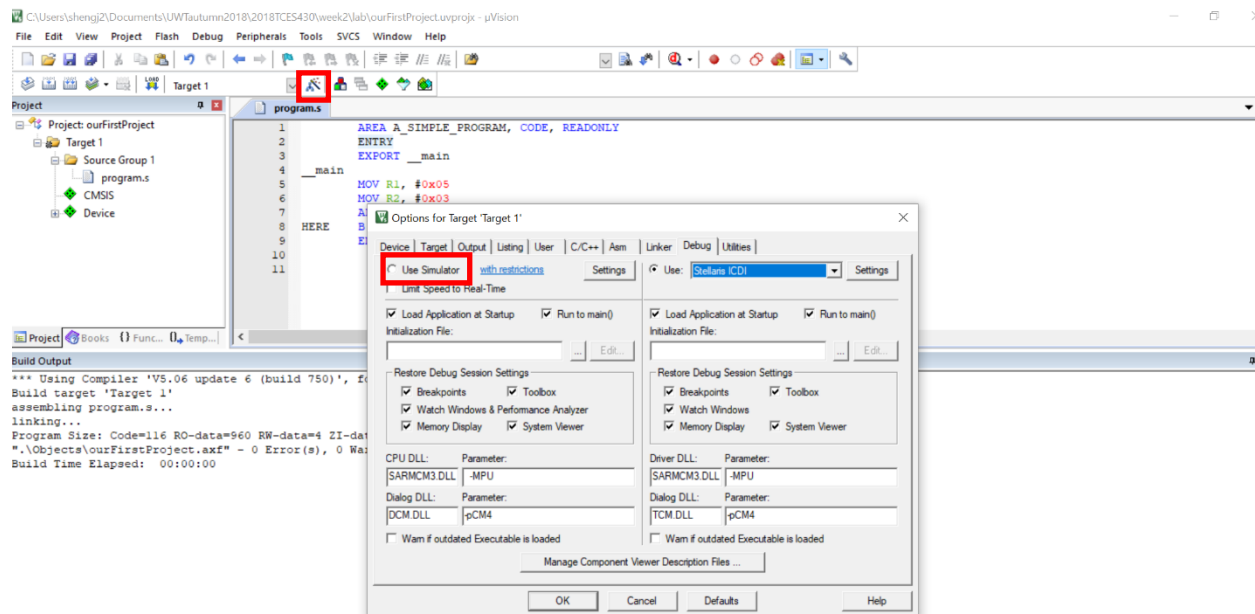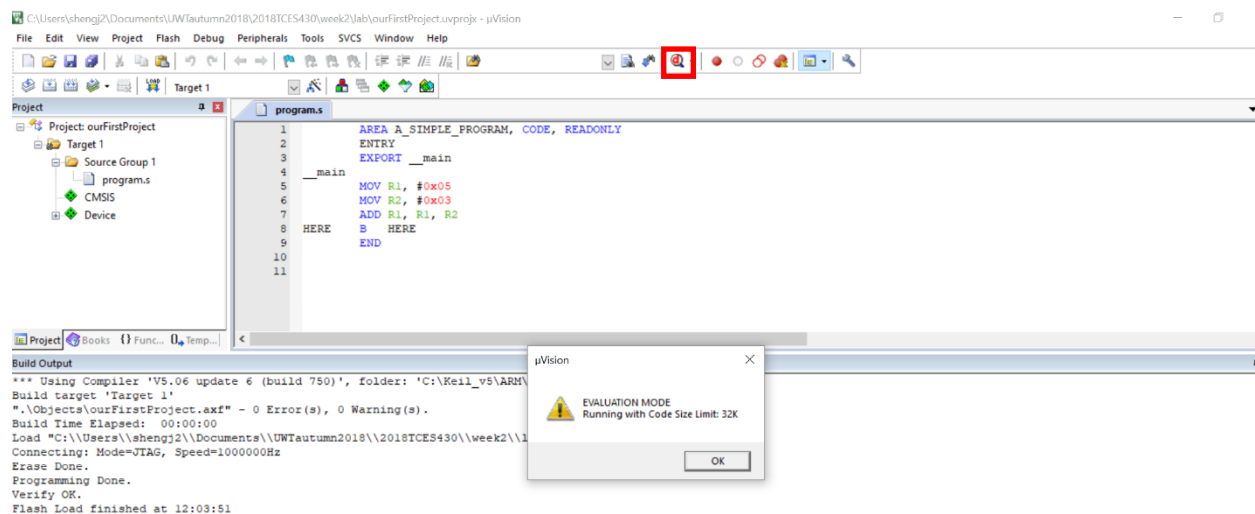

12. If it starts tracing successfully, a cursor appears in front of the next instruction to be executed.
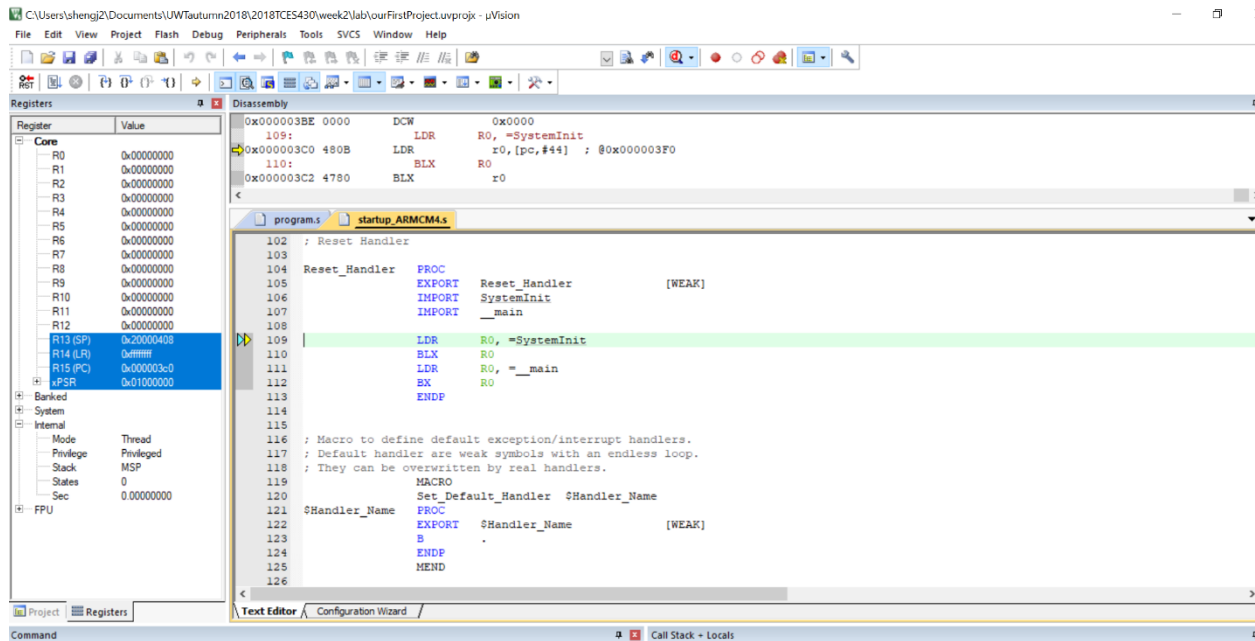
13. To trace the program, use the **Step Over** button or click on Step Over from the Debug menu. It executes the instructions of the program one after another. To trace the program, you can use the **Step** button, as well. The difference between the **Step Over** and **Step** is in executing functions. While Step goes into the function and executes its instructions one by one, **Step Over** executes the function completely and goes to the instruction next to the function. To see the difference between them, trace the program once with Step Over and then with Step. When you are in the function and you want the function to be executed completely you can use **Step Out**. In the case, the instructions of the function will be executed, it returns from the function, and goes to the instruction which is next to the function call.
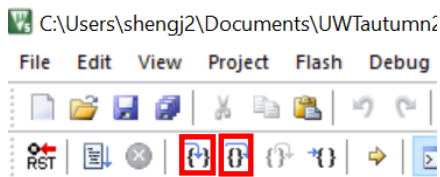
14. To exit from the debugging mode press **Start/Stop Debug** Session button
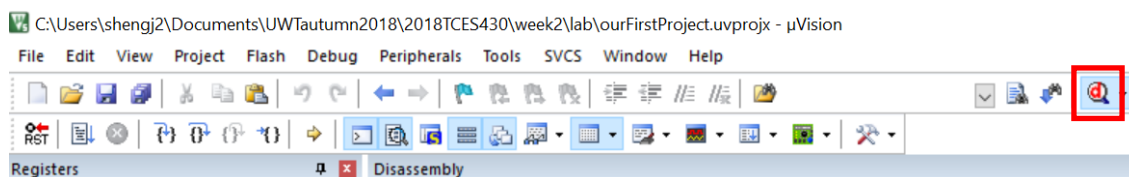
15. Do the Assembly Programming exercise: Hohl & Hinds Textbook 3.9.6 on p. 57, 3.9.8 on p. 58, and 5.8.5 on p. 100.