ECE332 – MPLAB X Tutorial v05 – Sept. 8, 2020

Microchip MPLAB X should already be installed in the CETA PC lab.

Start MPLABX. The letters MNUM refer to the installed version of MPLABX. As if this writing we are using MPLAB X version 5.40.

Start >> Microchip >> MPLAB X IDE vMNUM

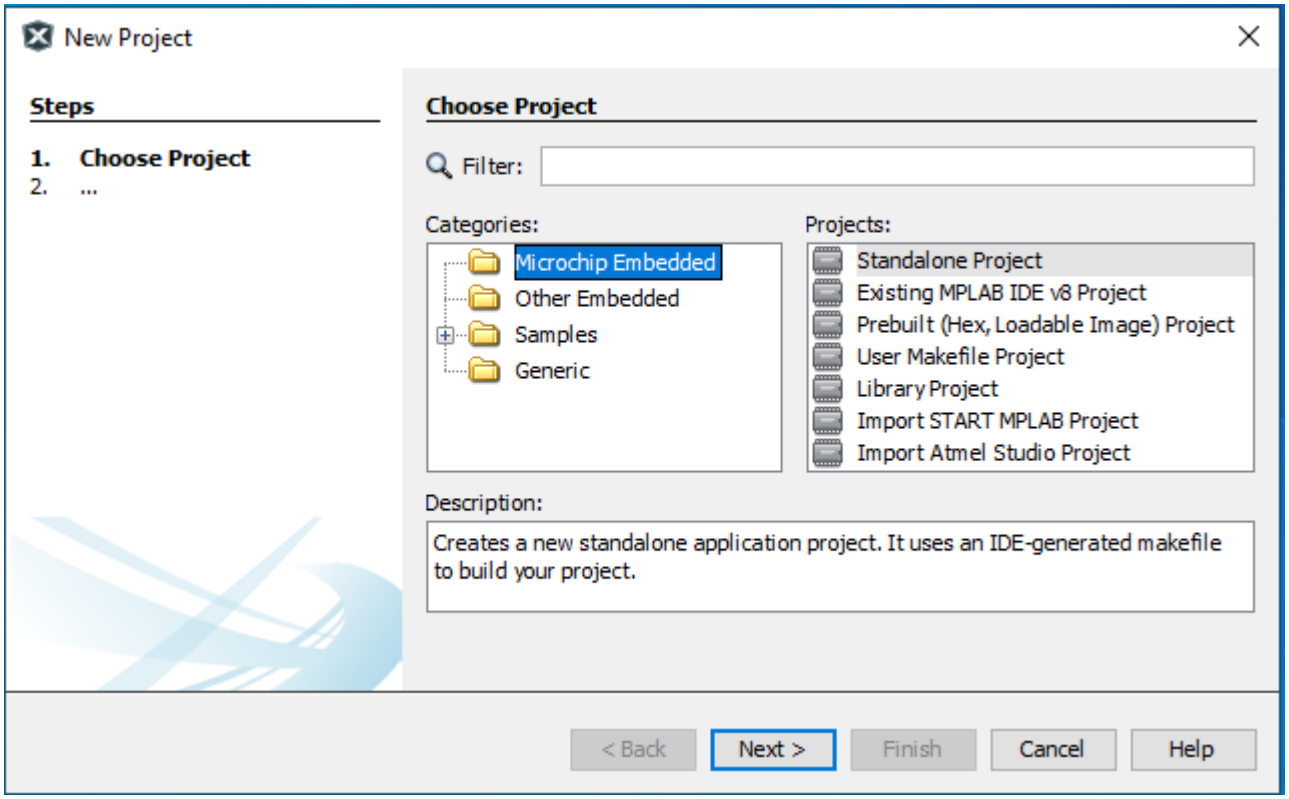
After a few moments the MPLAB X IDE window opens.

New Project

To start a new assembly language project:

File >> New Project

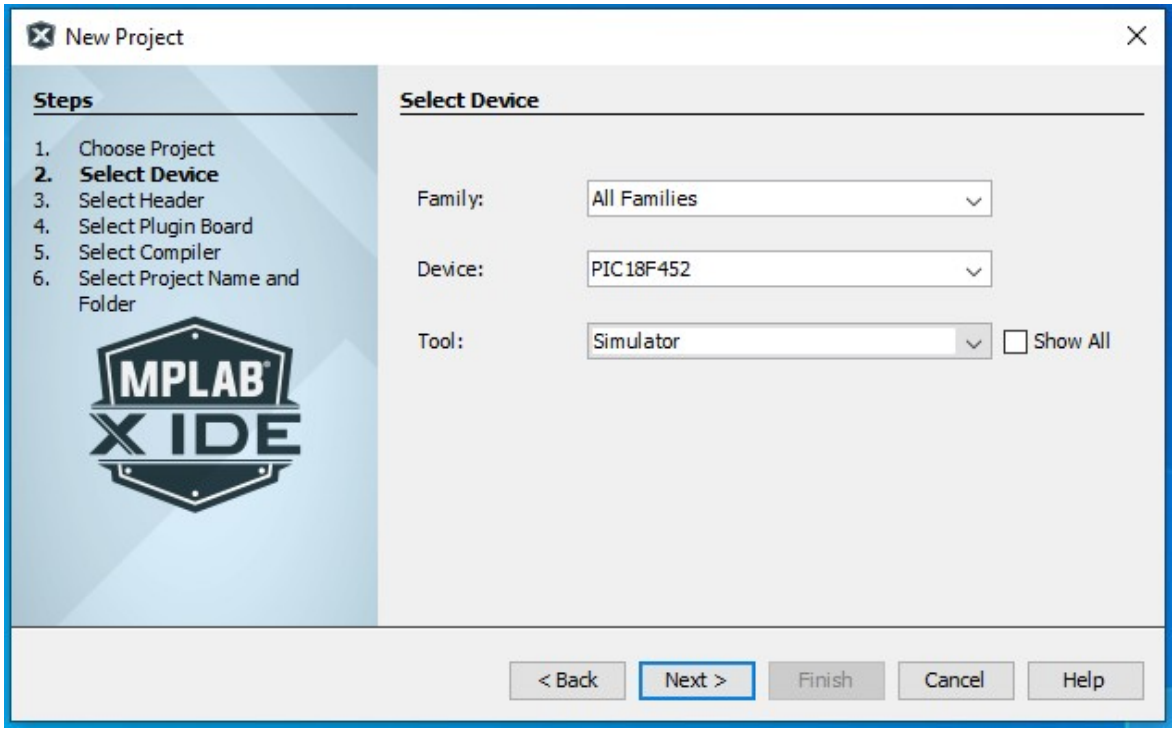
In the New Project window, click “Microchip Embedded” and “Standalone Project” then click Next.



The New Project window opens at step 2. Select Device

- To the right of the *Family:* field click the down arrow and scroll to select “advanced 8-bit MCUs (PIC18)”.
- In the *Device:* field enter PIC18F452 then click the Enter key to accept your entry
- To the right of the *Tool:* field click the down arrow and select “simulator”.

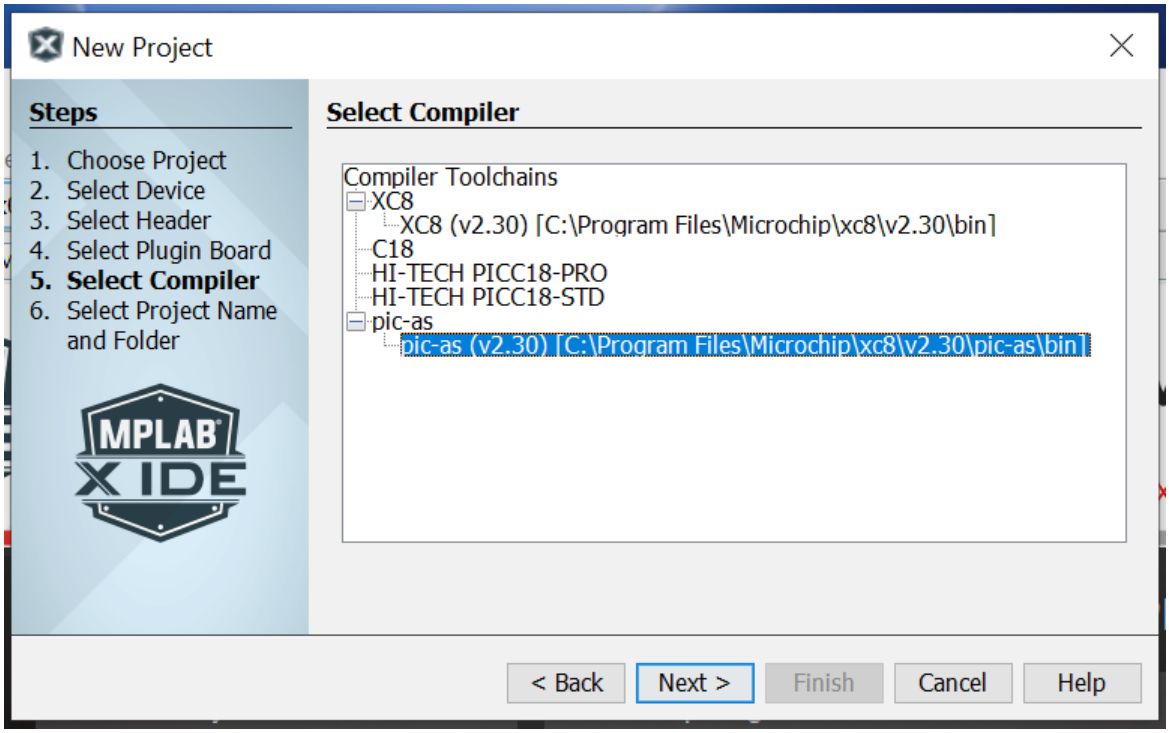
Click Next



As previously stated, here we assume that you will be making a new assembly language project.

In the New Project window, *step 5*, in the Select Compiler pane, to the left of “pic-as” click the + symbol to expand that choice. Next, click the choice *pic-as (CNUM)* where CNUM is the version of compiler installed. As of this writing the latest is version 2.30.

Click Next



In the New Project window, *step 6*, to the right of the field Project Location: click the Browse… button to open a file browser window. Navigate to a location for your project. To make a new folder you can click the Make New Subfolder icon which is to the upper right, just below the X icon.

- Consider using a memory stick. Here, a location on a memory stick is used:

  D:\MPLABX\Start

- or your home directory. Your path would look like where UserName is your user name

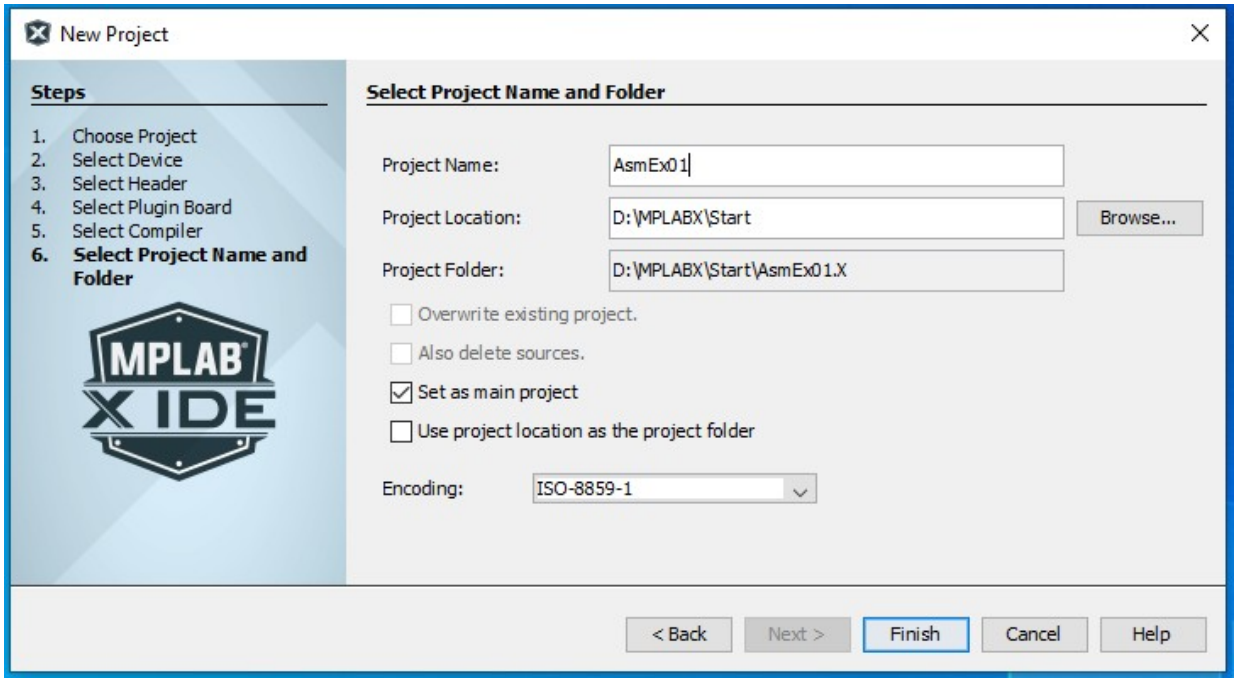
  C:\Users\UserName\MPLABX\Start

- Don't select any system file location that starts with C:\Program Files (x86) or C:\Program Files

Verify that:

- Set as main project is checked
- Use project location as the project folder is not checked

In the Project Name: field enter the name AsmEx01. Note that the Project Folder: field will be formed by appending the project name field value after the project location field value.



Click Finish. In a few moments the project is made. Next, make a necessary adjustment. Select:

File >> Project Properties (AsmEx01)

In the new window, in the Categories: pane click on pic-as Global Options to change the view. The in the Additional options: pane copy in the following text, which we will discuss in class. Click OK.

```
-Wl,-Map=test.map -Wa,-a -Wl,-presetVec=0h
```

The next step is to copy in the includes file either from Blackboard or the file cabinet

ECE332_assembly_includes_00.inc

into the project folder which here is at the following location:

D:\MPLABX\Start\AsmEx01.X\

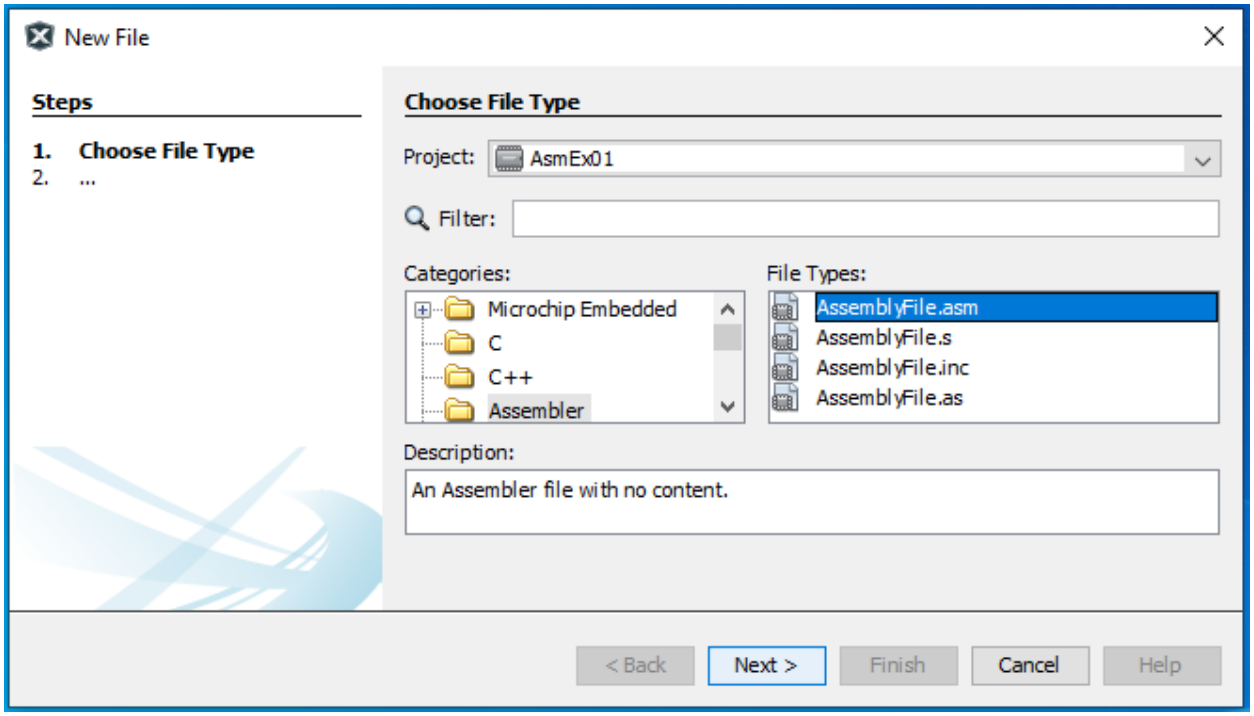
Back in the MPLABX window, add the file to the project. To the upper left, click the Projects tab then point at “Source Files”, right click and select *Add Existing Item…* In the pop-up window verify that to the lower right “Relative” is selected, click to select the includes file and then click Select.

To save you the trouble of starting with a blank source file, you can copy main.asm to the same location and add it to the project Source Files and you dd for the include file.

Otherwise, to make a new main file, select:

File >> New File…

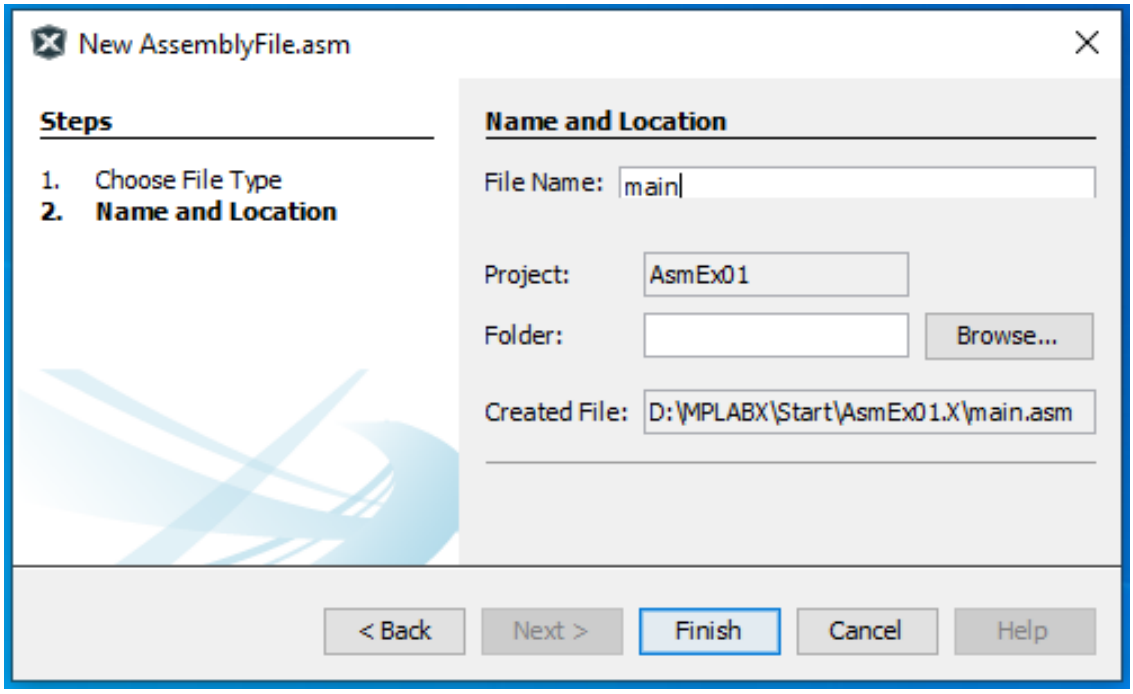
In the New File window, in the Categories: pane click Assembler, then in the File Types: pane click, AssemblyFile.asm then click Next



In the New AssemblyFile.asm window

- Change the File Name: field value to main
- Verify that the Project: field has the project name
- Leave the Folder: field blank for this example
- Notice that the Created File: name is formed by appending the Project Folder field value with the File Name and file type extension.

Click the Finish button.



The new file main.asm will contain the following. After copying or copy-pasting in the following. Next, change TheDate and YourName to the actual date and your name. Be sure to save all your work till this point:

File >> Save All

```
; main.asm - TheDate - YourName
; An example assembly language program
; Insert in properties box
;    pic-as Global Options -> Additional options:
;    -Wl,-Map=test.map -Wa,-a -Wl,-presetVec=0h
#include "ECE332_assembly_includes_00.inc"
#include <xc.inc>

            PSECT   udata_acs
            GLOBAL  Valx
Valx:       DS      1           ; place for value

            PSECT resetVec,class=CODE,reloc=2
resetVec:   goto    main        ; goto entry

            PSECT   code
main:       movlw   0x5A        ; get a value
            addlw   0x3C        ; add another
            movwf   Valx,c      ; write value

done:       bra     done
            END     resetVec    ; start address
```

Next, build the program

Production >> Build Main Project

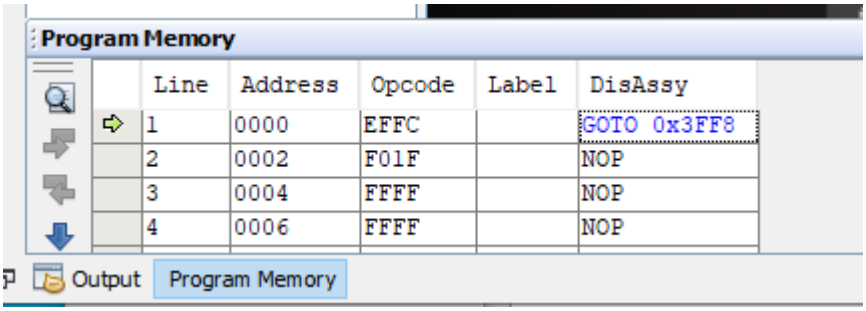
After a few moments in the Output panes below a message should appear that the build was successful.

Viewing Program Memory

Once the program is built, take a look at program memory.

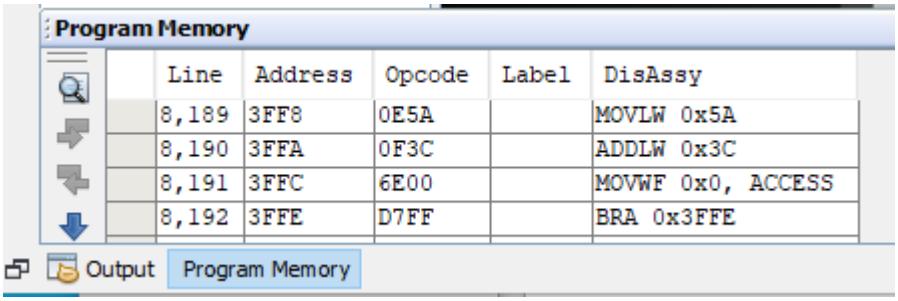
Window >> Target Memory Views >> Program Memory

Examine the contents of address 0x00000, there should be a GOTO instruction. If however a NOP or "no operation" instruction is present, then either (1) you didn't actually build your project successfully or (2) you didn't insert the necessary pic-as Global Options. Check each to verify.



Click the blue down arrow shown to the lower left and in the pop-up "Go To" window and under "GoTo What:" click Address. Next enter the address the GOTO instruction refers to which is 0x3FF8 and then click the *Go To* button, then the *Close* button.

In the Program Memory pane scroll so that address 0x3FF8 is at the top. You should see something similar to the following. Note that you at the boundary of each column heading you can use your mouse to adjust the column width.



Debugging by Simulation

To prepare for debugging, in main.asm click left then right and select Toggle Line Breakpoint. The line in file should now be highlighted in red.

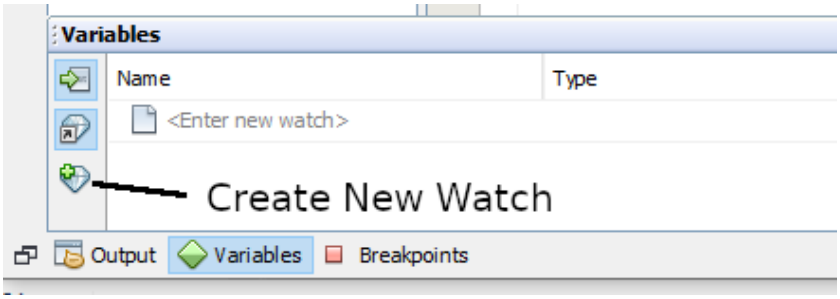
```
main:       movlw   0x5A      ; get a value
```

Start the debugger and in a few moments the debugger will be started

Debug >> Debug Main Project

Open the variables window. Look along the lower edge of the IDE window, some tabs for windows will appear down there.

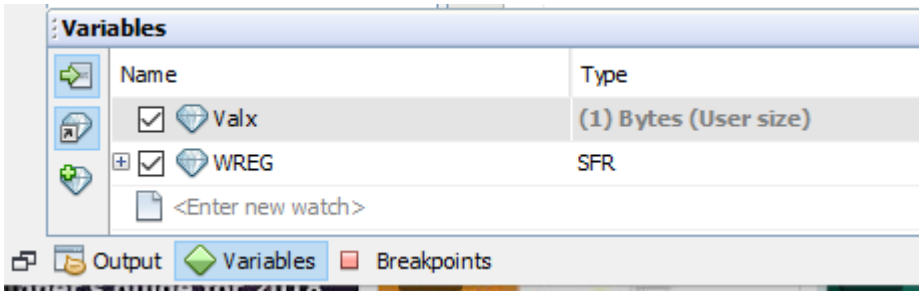
Window >> Debugging >> Variables



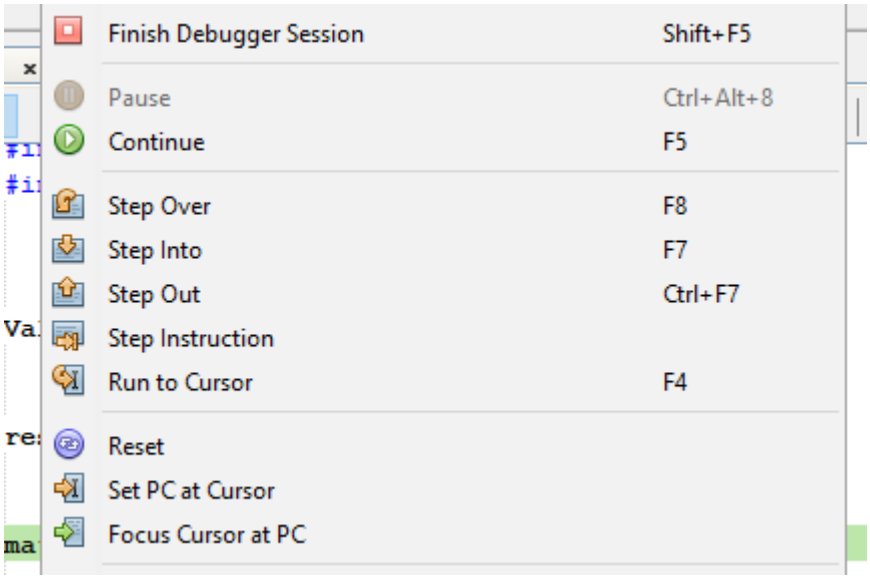
To display a variable or register click the Create New Watch button. In the pop-up New Watch window click the Global Symbols button, click on Valx, then OK. In the Variables window, to the right of Valx right click on “(1) Bytes (Select Size?)” and select:

User Defined Size >> 8 bits

Reopen the Global Symbols button, this time click the SFR’s radio button. Scroll to find WREG, click on it, then click OK.



To control execution of the program under the debugger you can use the Debug pull-down menu, which shows the various debug related icons as well as the corresponding hot-keys. A few of the icons are shown below. After moving the menus about you can make the debug sub-menu appear.



At this point Step Over and Step Into have the same effect.

- Click Step-Over and notice the value loaded into the W register (WREG).
- Click Step-Over, explain the value in the W register.
- Click Step-Over, explain the value at the Valx address

Today's Turn-In

Use a word processor to assemble a document:

- At the top have the title, "ECE332 studio" followed by the date and your name.
- In a few sentences describe today's activity
- Insert a screen shot showing in program memory, starting at the address for main, where the GOTO statement goes to.
- Copy the source code in, using 11 point CourierNew font, single spaced without any paragraph spacing.

Produce a PDF to upload to Blackboard.

Installing MPLAB X and xc8 Compiler Tool Chain

In our computer labs MPLAB X and the xc8 compiler tool chain is already installed. Students planning on installing MPLABX should download the software from the file cabinet FTP server. To open the file cabinet you can use a web browser. We have had good experience with Firefox or Google Chrome. Open the following URL:

ftp://filecab@buzbox1.hartford.edu/

User Name: filecab
Password...: FileCabPwx1!

The FTP server should open. Click to open the folder for Microchip. Inside that click to open the folder for MPLAB5x40_01. As of this version of the tutorial, the following files are being used for Windows version 10.

- MPLABX-v5.40windows-installer.exe
- MPLAB XC8 Compiler v2.30
- picsimlab_0.8.2_win64_setup.exe
- com-picsim-picsimlab_mplabx5.40.nbm

Save the files listed above into a folder, perhaps in a folder with the name:

C:\Downloads\Microchip

Install MPLAB X
Open the downloads folder, click on the installer for MPLAB X IDE, right click and select Open. Click Yes to allow the installer to make changes to your computer, then click Next to setup the Wizard. Click to accept the license and click Next. For the license type verify that Free is selected and click Next.

For the Installation Options Installation Directory: accept the default location. For Proxy Setting:, select "No Proxy" and click Next.

In the Select Applications window, to save space you can unselect other other device families and only have the 8 bit MCUs selected. Click Next, then click Next to start the install.

The Completing the Wizard page makes it easier to download other tools. If you are not planning on using a 32 bit processor, there is no need for the Harmony tool. The MPLAB Code Configurator (MCC) is a convenience tool for newer PIC microcontrollers. According to Microchip documentation, you can install that later. All you have to do is select MCC from the software's extensive plugin library, which installs that software for you. MCC.

Install XC8 Compiler and Tools
Open the download folder, click on the installer for xc8, right click and select Open. Click Yes to allow the installer to make changes to your computer, then click Next to setup the Wizard. Click to accept the license agreement and click Next.

In the License Type window, if you don’t have a paid-for license, click ‘Free’ and then then Next. Accept the default installation directory, click Next. It may help to have xc8 added to the PATH, so click to add that, then click Next. In the Ready to Install Compiler window, click Next.

In the Installation Complete window the Host ID will already be entered into the corresponding field. Click Next to accept the code. In the next window click Finish.