

# CSE 3442/5442: Embedded Systems

## Lab 1: Introduction to the QwikFlash Board

### Objective:

The purpose of this lab assignment is to familiarize with:

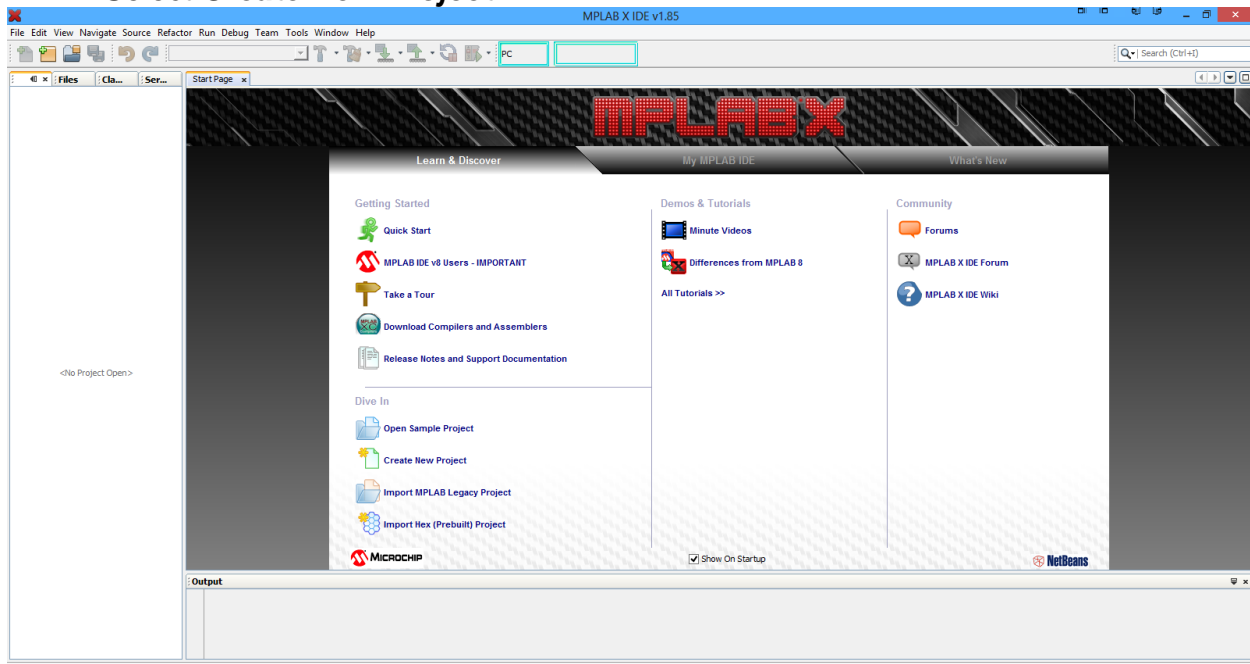
1. QwikFlash board (which is a PIC18F452 microcontroller chip based board with various I/O devices.)
2. MPLAB X IDE used to create PIC microchip code programs and build '.hex' that will run in PIC chip.
3. XC8 is a C compiler for PIC chips.
4. The PICKit3 is the programmer used to upload your program to the PIC.

### Part 1: MPLAB X IDE and XC8 Compiler

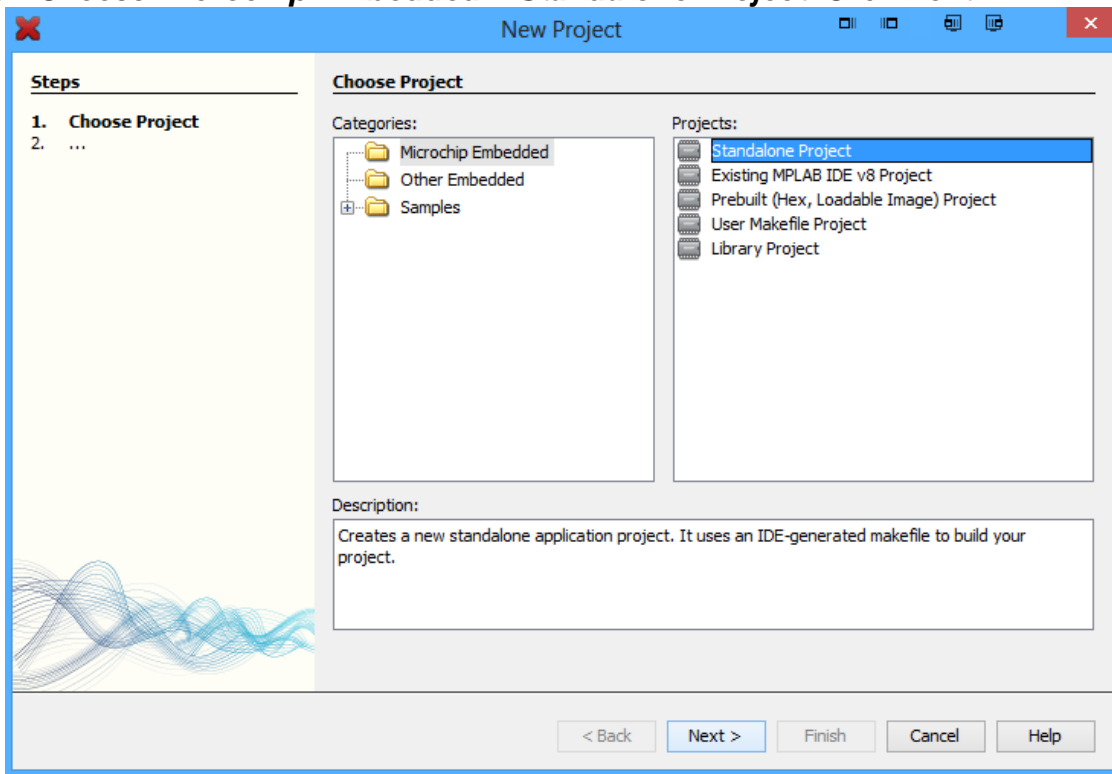
This part will introduce MPLAB X IDE

1. Copy 'Lab1\_example\_1.c' program from the 'CSE3442 files' folder located in the embedded M: server to your Z: drive. Open MPLABX IDE.

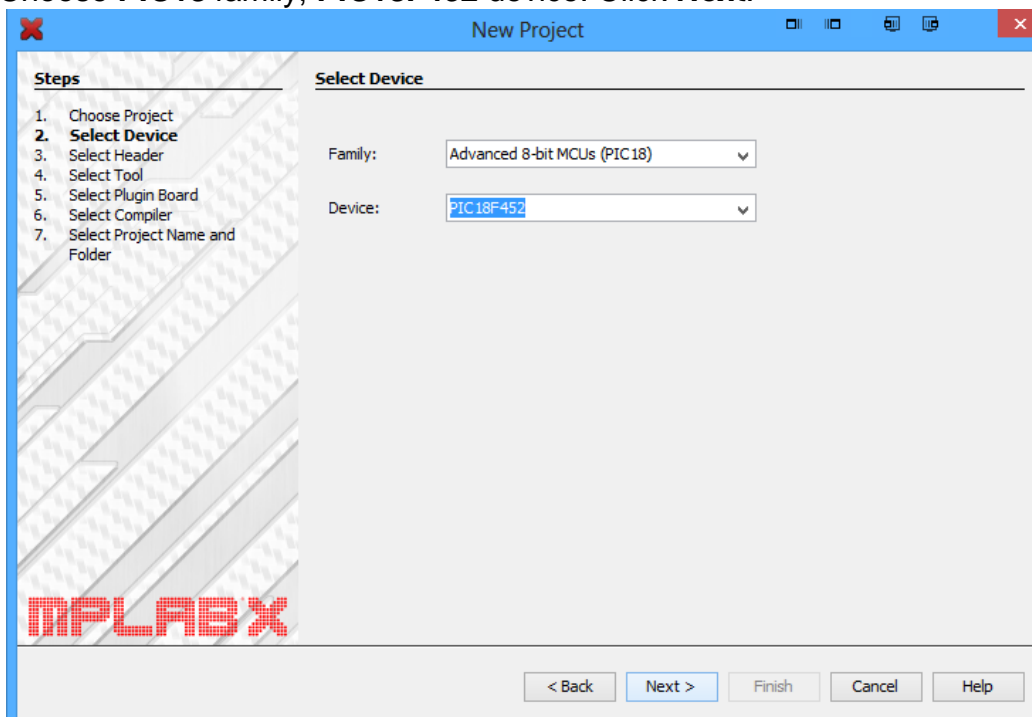
### 2. Select *Create New Project*



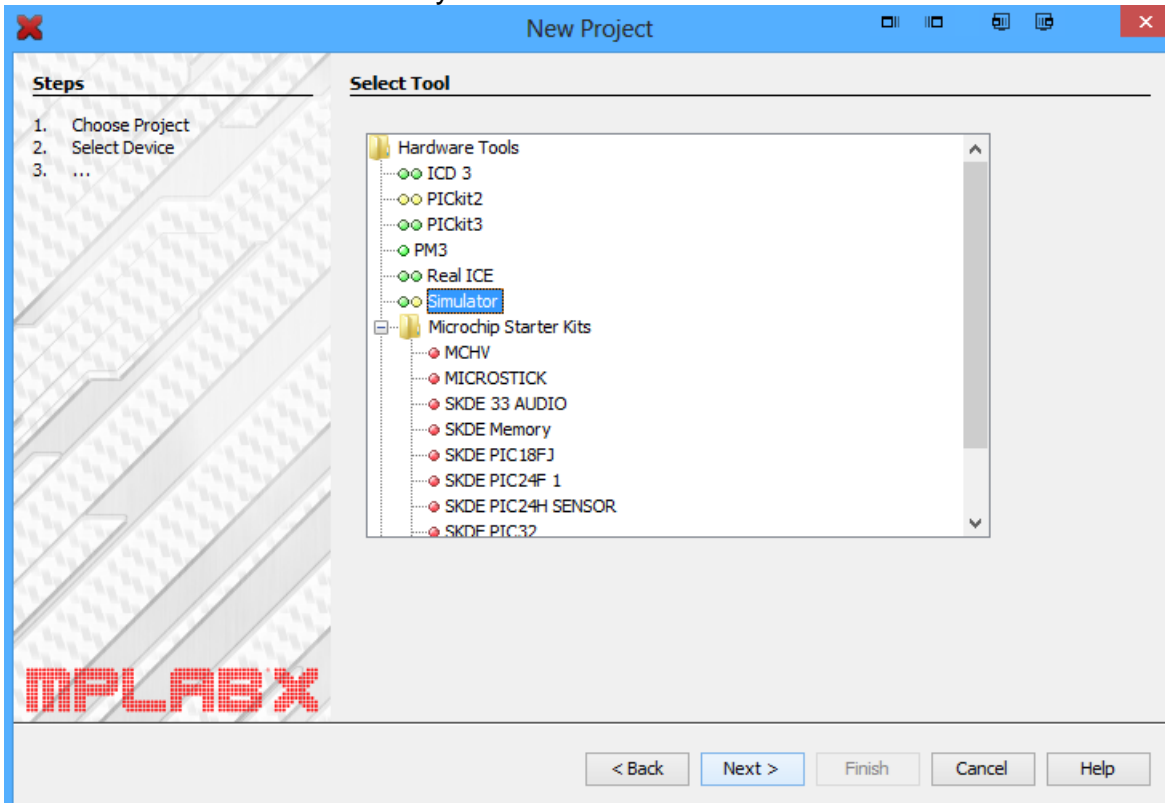
3. Choose **Microchip Embedded** > **Standalone Project**. Click **Next**.



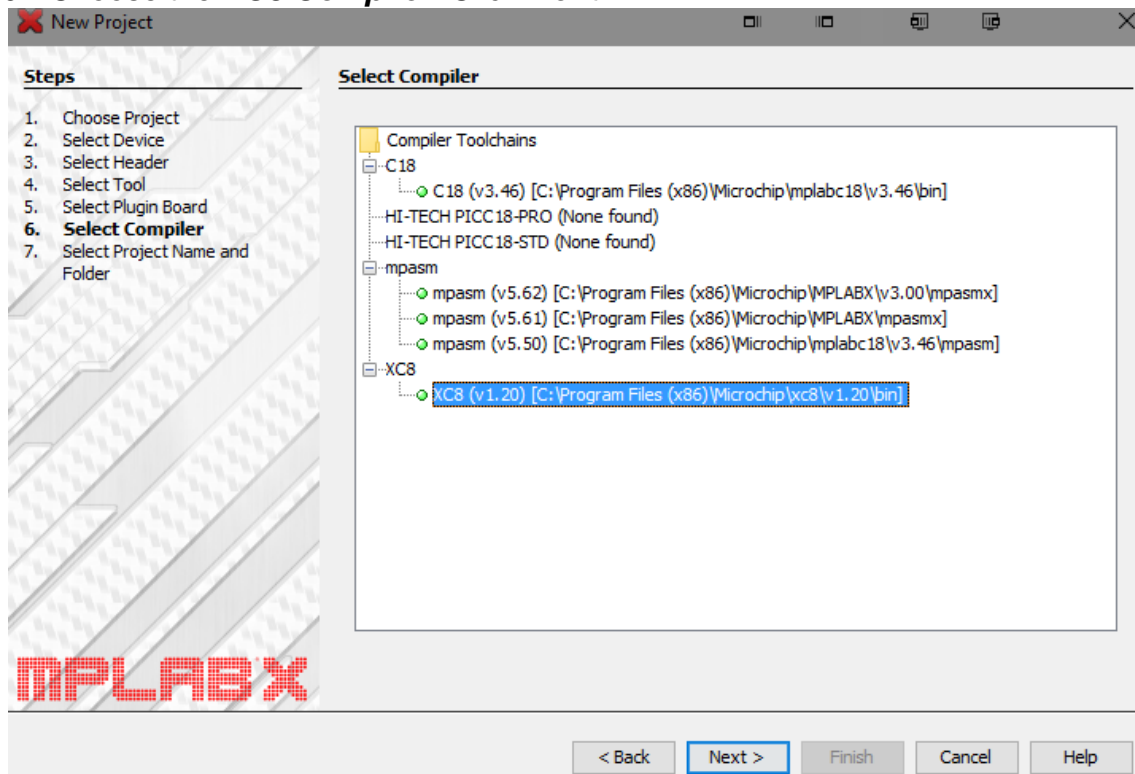
4. Choose **PIC18** family, **PIC18F452** device. Click **Next**.



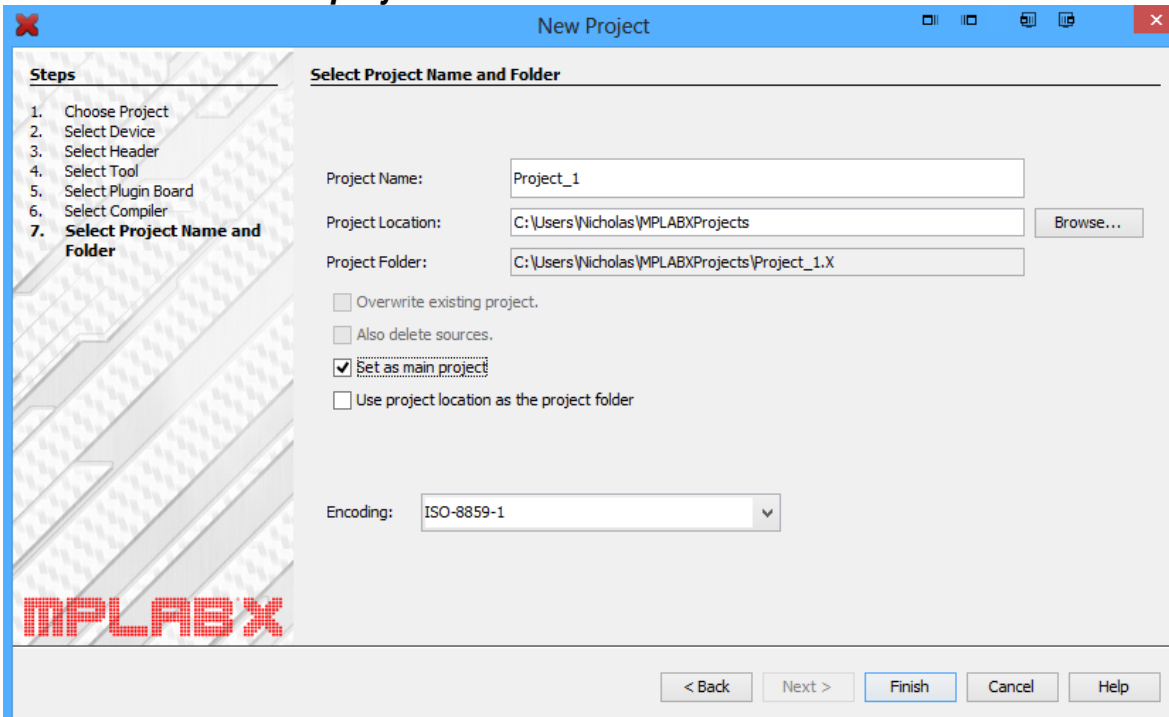
5. Choose the **Simulator** as your hardware tool. Click **Next**.



6. Choose the **XC8 Compiler**. Click **Next**.

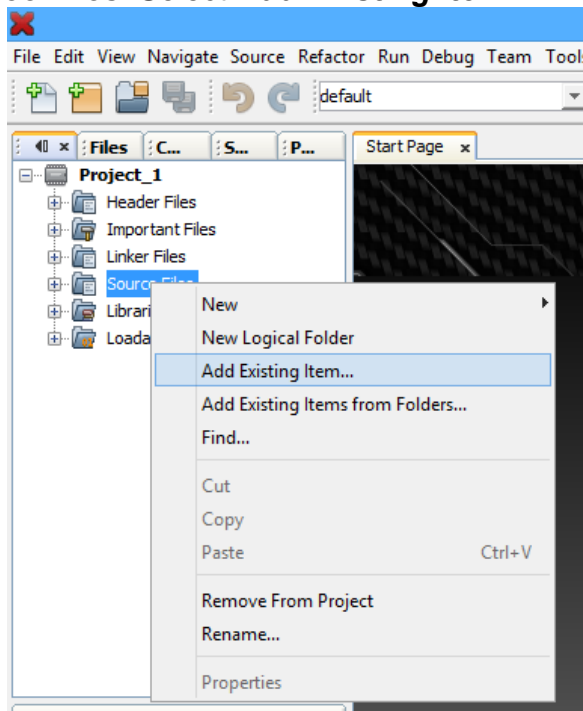


7. Use **Project\_1** as your project name.  
Project location should be Z:\YourNetID (most likely is Z drive)  
Project folder should be Z:\YourNetID\Project\_1.x  
Click **Set as main project**.

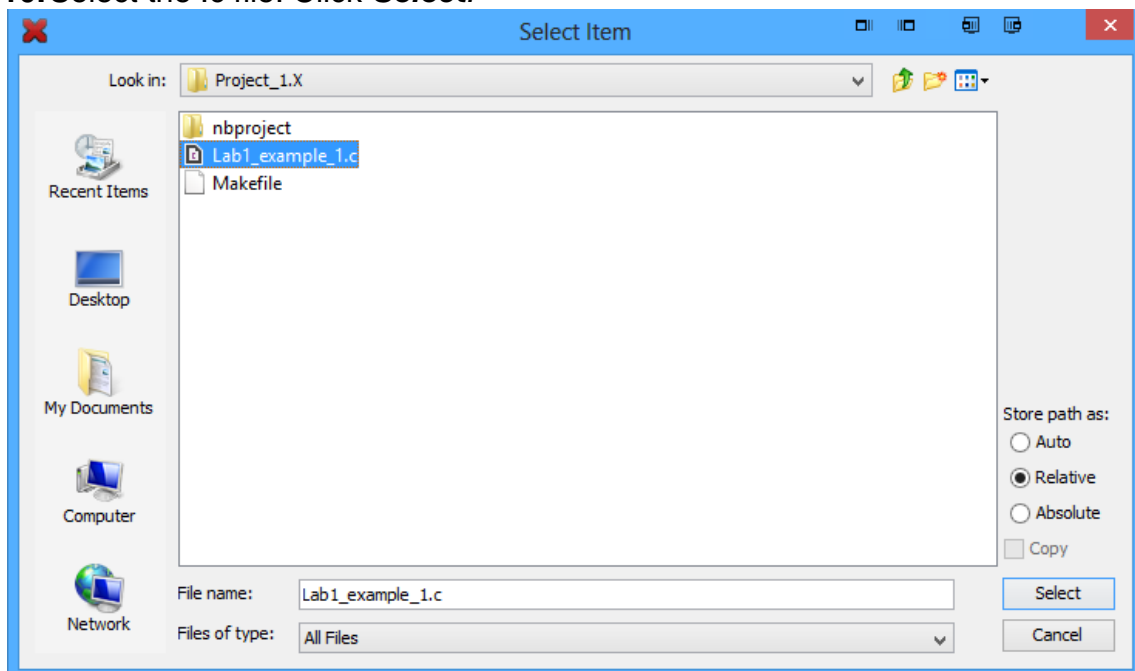


8. Copy the 'Lab1\_example\_1.c' file to your Project\_1.x folder.

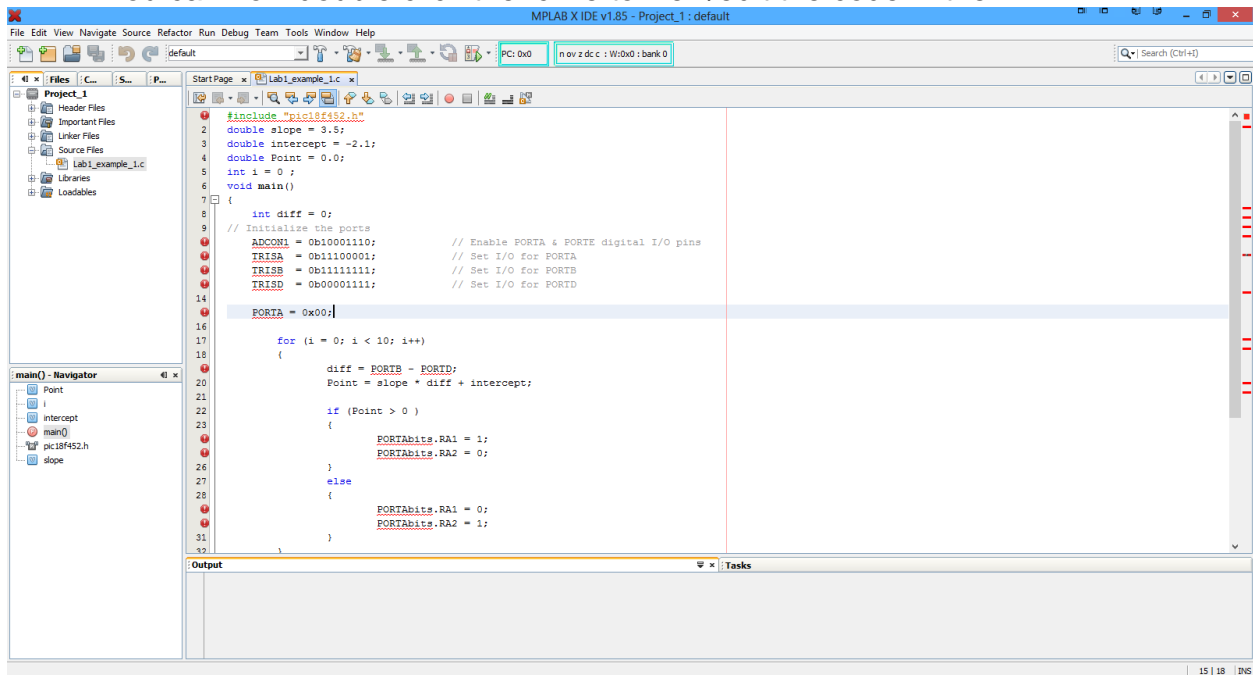
9. Right-click **Source Files**. Select **Add Existing Item...**



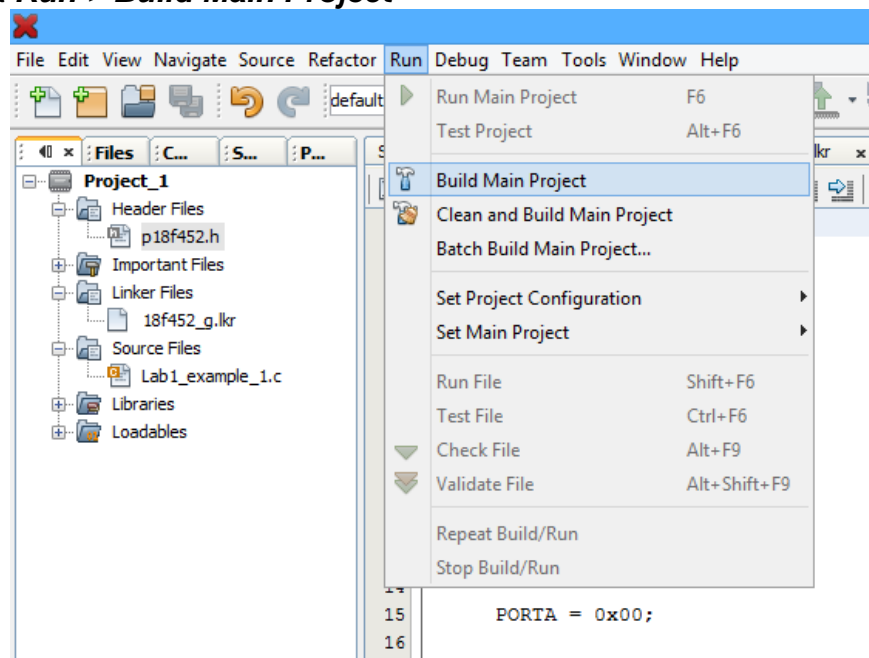
10. Select the .c file. Click **Select**.



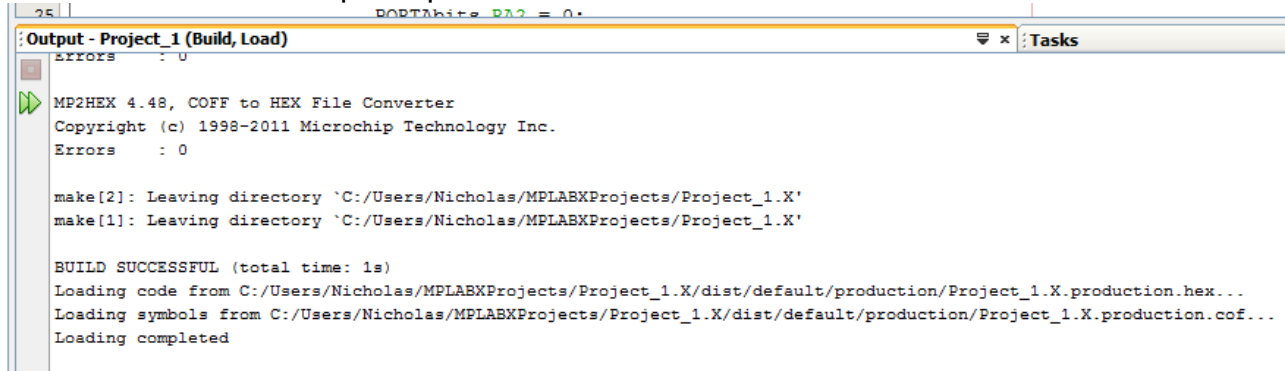
## 11. You can now double click the .c file to view/edit the code in the MPLABX IDE.



## 12. Select **Run > Build Main Project**



13. In the output console you should see **BUILD SUCCESSFUL and Loading completed**. The .hex file (which is the only file you upload to a PIC) has now been created, but we will not physically upload it to the PIC for this example. We will instead use the Simulator to mimic the PIC's capabilities completely within the desktop computer.



```
PORTBbits_RA2 = 0;

Output - Project_1 (Build, Load)
Errors : 0

MP2HEX 4.48, COFF to HEX File Converter
Copyright (c) 1998-2011 Microchip Technology Inc.
Errors : 0

make[2]: Leaving directory `C:/Users/Nicholas/MPLABXProjects/Project_1.X'
make[1]: Leaving directory `C:/Users/Nicholas/MPLABXProjects/Project_1.X'

BUILD SUCCESSFUL (total time: 1s)
Loading code from C:/Users/Nicholas/MPLABXProjects/Project_1.X/dist/default/production/Project_1.X.production.hex...
Loading symbols from C:/Users/Nicholas/MPLABXProjects/Project_1.X/dist/default/production/Project_1.X.production.cof...
Loading completed
```

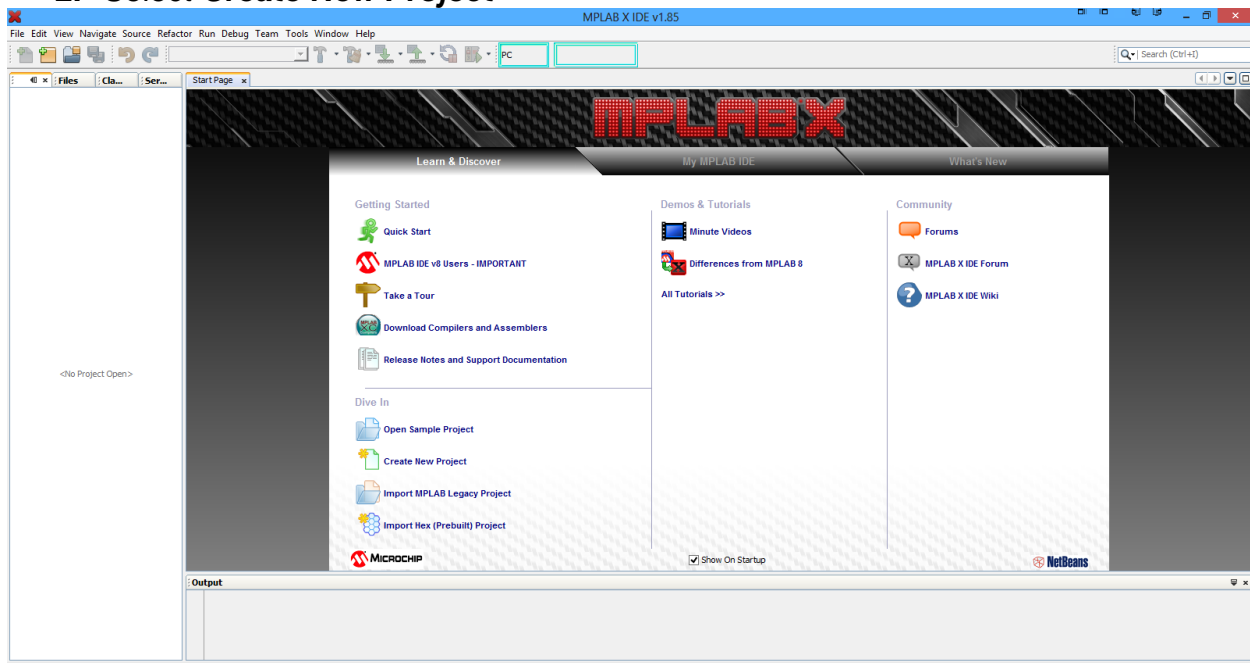
14. Open up the following windows.
- a. Watch (*Window > Debugging > Watches*)
  - b. Special function Registers (*Window > PIC Memory Views > SFRs*)
  - c. Logic Analyzer (*Window > Simulator > Analyzer*)
  - d. Stimulus (*Window > Simulator > Stimulus*)
15. You may now set various breakpoints within the C code, run the debugger simulation (*Debug > Debug Main Project*), and **Step Into (F7)** a line-by-line execution of the program.
16. Play around with the windows/watches opened up in **Step 15** and see ports, registers, variables, etc. change values as you are stepping through the code. You may also use the Stimulus to imitate physical changes to the PIC's input pins on **PORTB** and **PORTD**.

If you have any questions/issues call the TA, if not you can move on to part 2.

## Part 2: 'Hello, World!' program

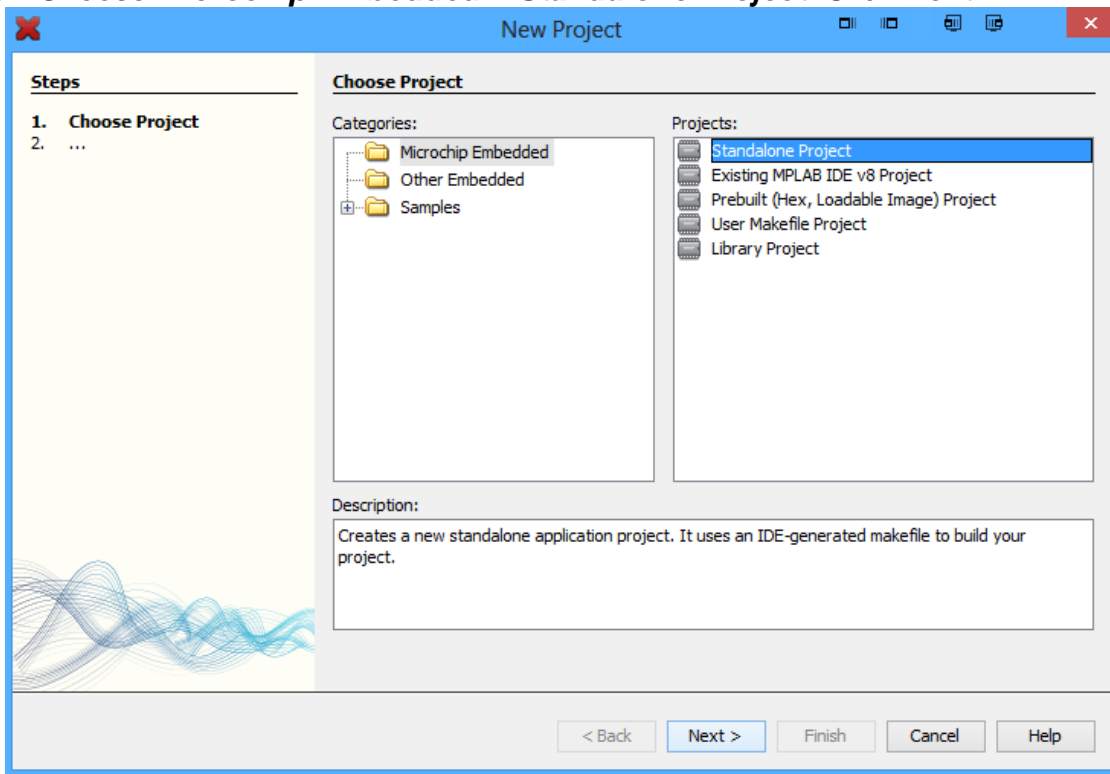
The purpose of this part is to get familiar with running PIC programs using the QwikFlash board. The code will display a message on the LCD along with an incrementing number.

1. Copy 'Lab1\_example\_2.c' program from the 'CSE3442 files' folder located in the embedded M: server to your Z: drive. Open MPLABX IDE.
2. Select **Create New Project**

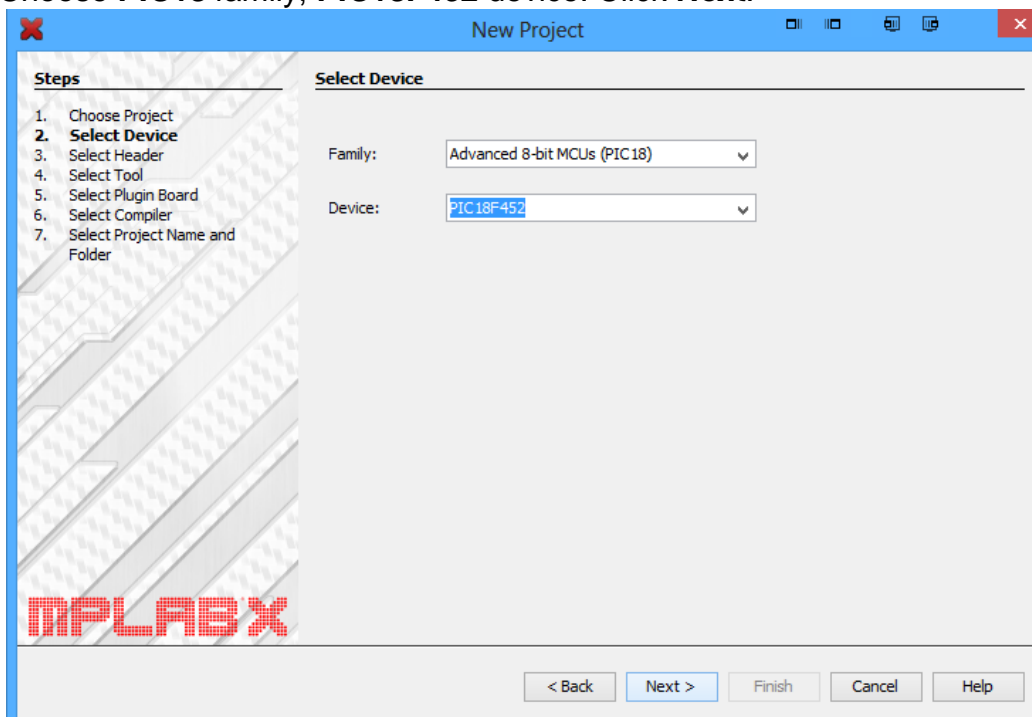




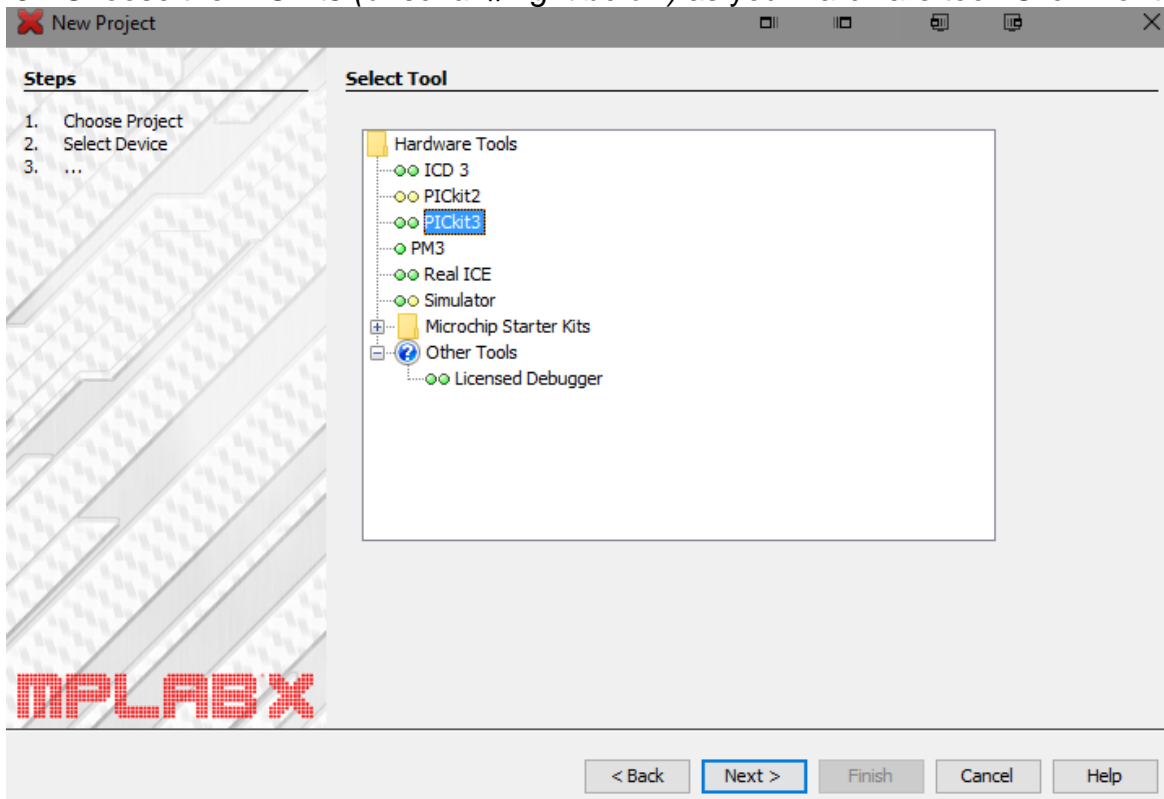
3. Choose **Microchip Embedded** > **Standalone Project**. Click **Next**.



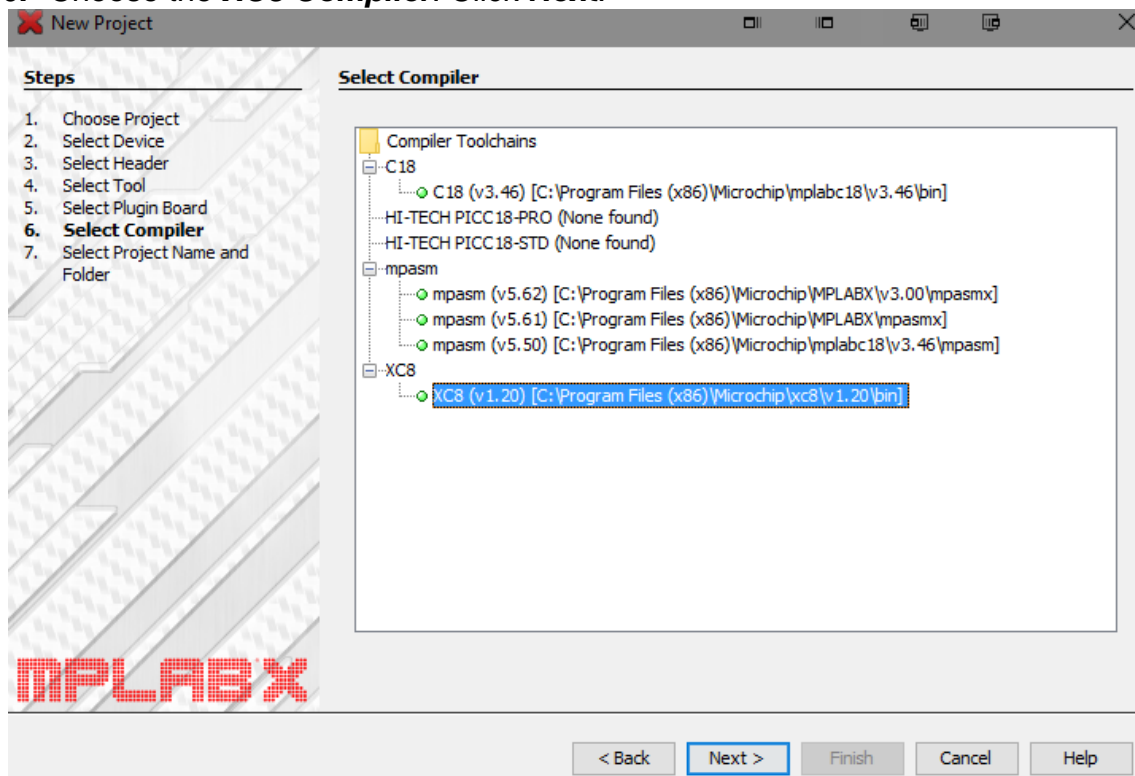
4. Choose **PIC18** family, **PIC18F452** device. Click **Next**.



5. Choose the **PICkit3** (or serial # right below) as your hardware tool. Click **Next**.



6. Choose the **XC8 Compiler**. Click **Next**.



7. Use **Project\_2** as your project name.  
Project location should be Z:\YourNetID (most likely is Z drive)  
Project folder should be Z:\YourNetID\Project\_2.x  
Click **Set as main project**.

**Steps**

1. Choose Project
2. Select Device
3. Select Header
4. Select Tool
5. Select Plugin Board
6. Select Compiler
7. **Select Project Name and Folder**

**Select Project Name and Folder**

Project Name:

Project Location:

Project Folder:

Overwrite existing project.

Also delete sources.

Set as main project

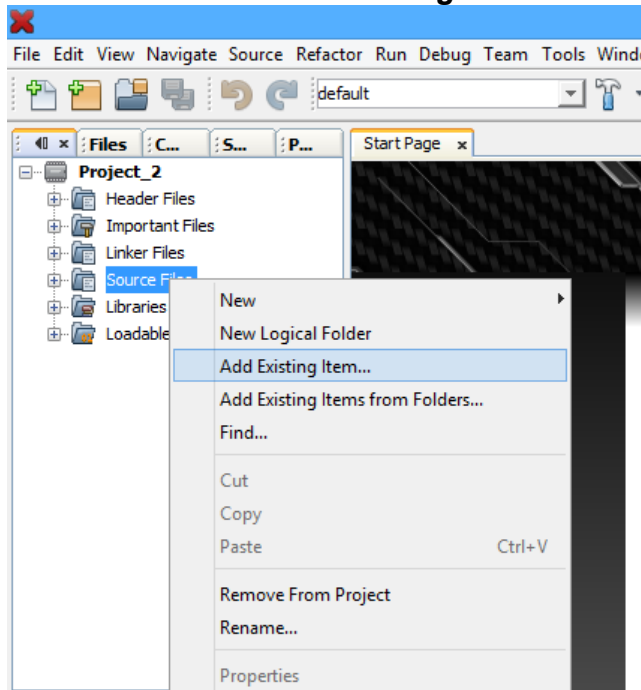
Use project location as the project folder

Encoding:  ▼

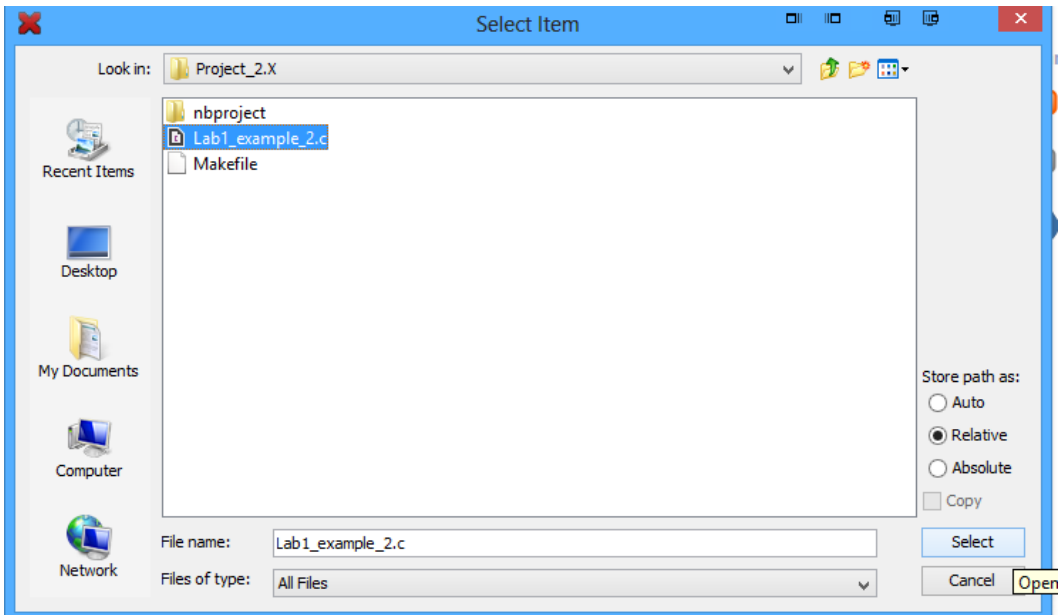
< Back   Next >   **Finish**   Cancel   Help

8. Copy the 'Lab1\_example\_2.c' file to your Project\_2.x folder.

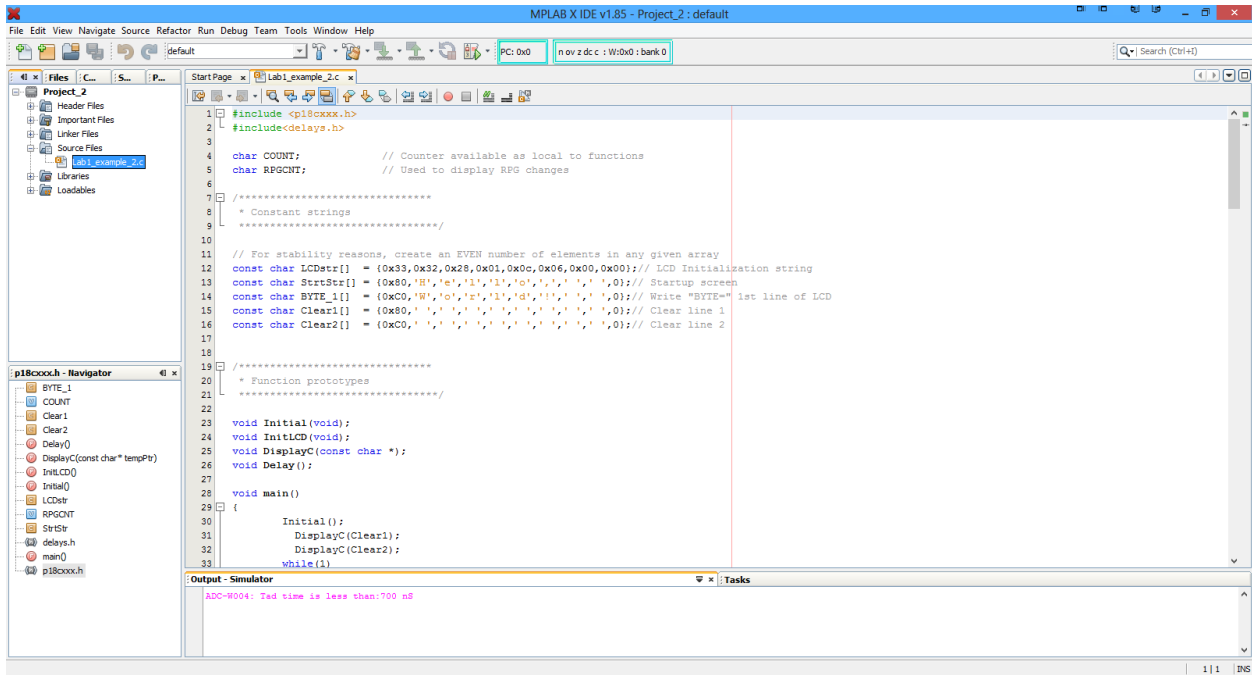
9. Right-click **Source Files**. Select **Add Existing Item...**



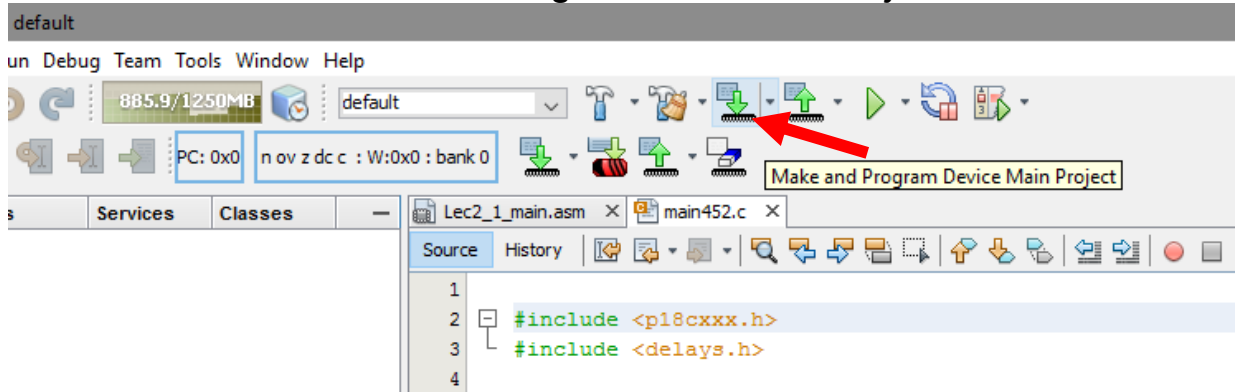
10. Select the .c file. Click **Select**.



## 11. You can now double click the .c file to view/edit the code in the MPLABX IDE.



## 12. Select the button **Make and Program Device Main Project**.



## 13. In the output console you should see a success message indicating that your program was uploaded to the PIC.

There should now be a message and an incrementing number displayed on the QwikFlash Board's LCD Module.

**IMPORTANT:** Execute the "QwikFlash\_Reset.bat" file in the shared M: drive. This code will overwrite the PIC so no student code is left behind. Do this at the end of every lab throughout the semester.

**Assignment:**

Write a lab report (using a word processor, submit as pdf) discussing the following:

1. What is the purpose of the function ***void Initialize\_PIC()***? How does this function relate specifically to the QwikFlash board?
2. Explain the process of printing characters to the LCD module in the function ***void Print\_To\_LCD(const char \* tempPtr)***.

You can use reference materials for help on the two questions on the class webpage <http://omega.uta.edu/~nbb0130/CSE3442.html> (Chapter-7 of Embedded Design..., QwikFlash Board Schematic, etc.)

Submit your report via BlackBoard before the beginning of the next lab (one week).