BLG 351E – Microcomputer Laboratory

Experiment 1

Introduction and Preliminary Work

This lab aims to introduce the MSP430 Education Board, MSP430G2553 microcontroller and MSP430 assembly language. You must understand **MSP430 Education Board Manual** and **MSP430 Architecture – Chapter 4** (especially registers, addressing modes and instruction set) before the experiment to be able to finish on time. In addition, if you will bring your own computer to the laboratory (recommended), you should install Texas Instruments Code Composer Studio IDE as explained in **CCS_Installation.pdf**.

Part 1 – Project Creation and Debugging

When Code Composer Studio starts up, select *Project -> New CCS Project* from the menu as shown in Figure 1.

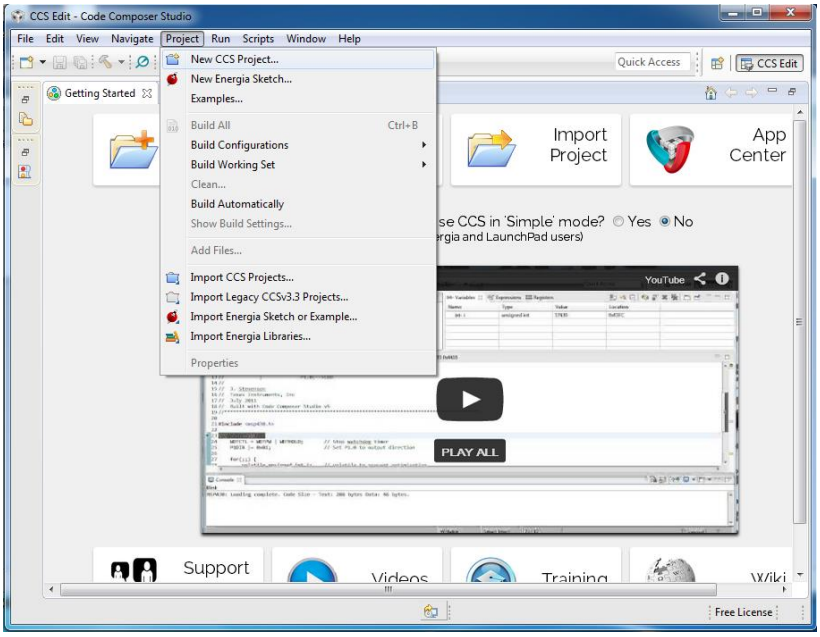


FIGURE 1: NEW PROJECT CREATION MENU

On the following window which is shown in Figure 2, *Target* has to be selected as MSP430G2553. Give a proper name to the project and select the newest *compiler version* in the compiler version drop down list. Then from the *project templates and examples*, select the *Empty Assembly-only Project*.

Code Composer Studio will create **main.asm** source file for your assembly program. The structure of the main.asm file is shown below. During the experiments, you will place your

assembly code to the section of the file which is commented as `;Main loop here` and the leave the rest of the file as is.

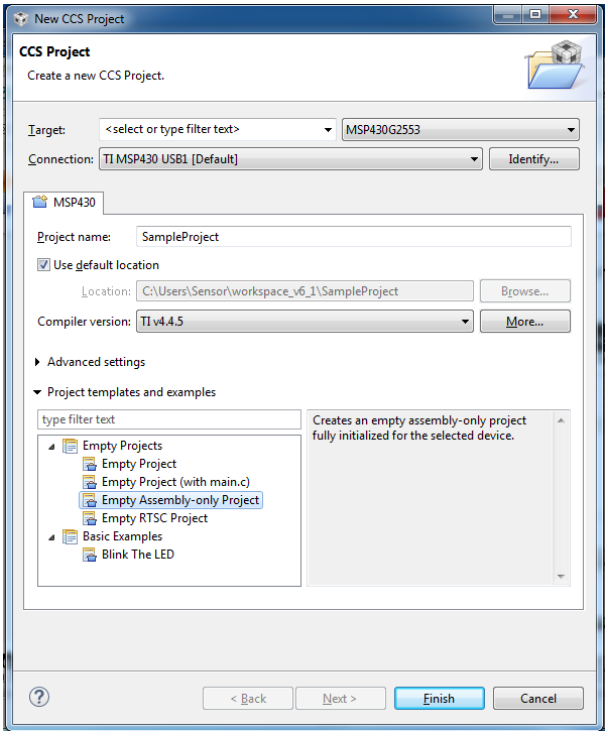


FIGURE 2: PROJECT PROPERTIES WINDOW

Write the following assembly code to the place left as main loop on your main.asm file.

```
SetupP1     bis.b   #001h,&P1DIR          ; P1.0  output
                                          ;
Mainloop    xor.b   #001h,&P1OUT          ; Toggle P1.0
Wait        mov.w   #050000,R15           ; Delay to R15
L1          dec.w   R15                   ; Decrement R15
            jnz     L1                    ; Delay over?
            jmp     Mainloop              ; Again
                                          ;
```

During the build process, compiler may see portions of your code unnecessary and remove them or try to optimize your code by taking other actions. In order to see the results of your code without any compiler modifications, you need to disable the compiler optimizing your code. You can do this by right clicking on your project and selecting the *Properties*. In the Properties Window, from the *Build* tab, select *MSP430 Compiler* and then *Optimization* section. In optimization section, select *optimization level* as **off** and click ok.

Building

Before loading your program to the board, you first need to build your program by right clicking on the project and selecting *Build Project* from the menu as shown in Figure 3.

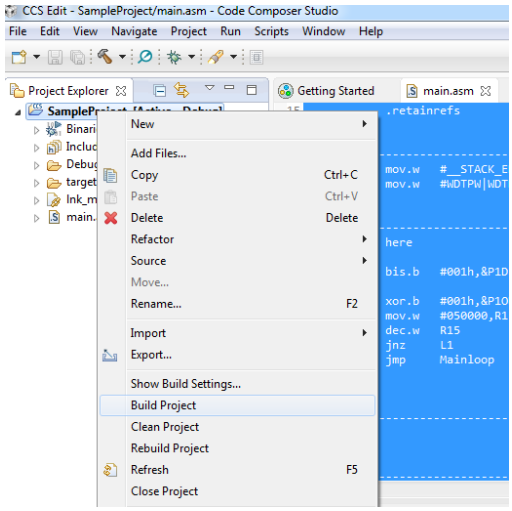


FIGURE 3: BUILDING THE PROJECT

Debugging and Loading

If build process does not complain about any errors, then your program is ready to be loaded to the board. If your board is not connected to the PC via USB connection, you should connect it now. In order to load your program and debug it, press F11 or select *Run -> Debug* from the menu. Code Composer Studio will load your program to the board and you will see the Debugging view right now as shown in the Figure 4.

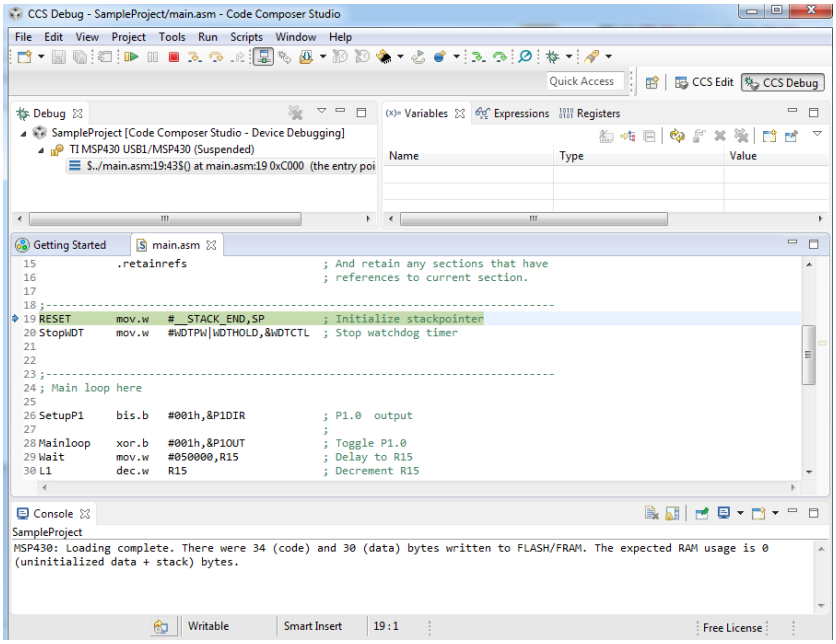


FIGURE 4: DEBUGGING VIEW

When the program is loaded to the board, then we have chance run the assembly code step by step by either pressing F5 on the keyboard or using the debugging menu (i.e., step into, step over) as shown in Figure 5.

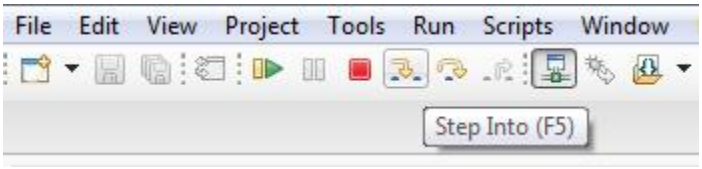


FIGURE 5: DEBUGGING MENU

You can use the step into and step over to execute the current assembly code line by line. The effect of these commands and your assembly code can be seen in the registers of the MSP430. You can view the contents of the all registers by Registers tab of the Debugging View which is shown in Figure 6.

(x)= Variables | Expressions | Registers

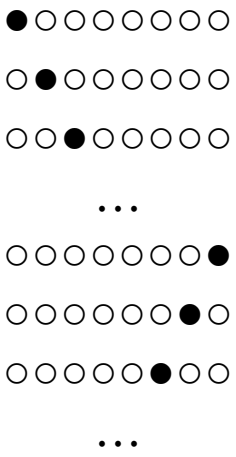
Name	Value	Description
Core Registers		Core Registers
PC	0xC00E	Core
SP	0x0400	Core
SR	0x0000	Core
R3	0x0000	Core
R4	0x9959	Core
R5	0xFFB6	Core
R6	0x1EF7	Core
R7	0xDB7F	Core
R8	0x36A7	Core
R9	0x75EF	Core
R10	0xFF93	Core
R11	0xE9EC	Core
R12	0x0000	Core
R13	0xFD90	Core
R14	0x0000	Core
R15	0x4EF6	Core
Special_Function		
ADC10		
System_Clock		
Comparator_A		
Flash		
Port_1_2		
Port_3_4		

FIGURE 6: REGISTERS TAB

When you click resume on debugging menu, your program starts running on the board. The debugging view can be terminated by simply clicking on Terminate on debugging menu or pressing Ctrl+F2.

Part 2 – Code Modification

Modify your code in Part 1 in such a way that LEDs in Port 1 are turned on and off sequentially as shown below.



Report

Your report should contain your program code (with explanations) for Part 1 and Part 2.