

# EEE204 - Introduction to Embedded Systems

## Experiment 2

### Objectives

- Become familiar with the MSP430 instruction set data transfer instructions, arithmetic instructions, logic instructions, and the program control instructions.
- Learn to use bit set and bit clear instructions to set and clear individual bits within an operand.

### Materials

- Code Composer Studio IDE
- MSP430F5529 USB LaunchPad development kit

### Experimental Work

#### E1

- 1) Create a new Empty Assembly-only CCS project titled: **ASM\_ADD**.
- 2) Type the following code into the `main.asm` file where the comments say "Main loop here".

```
main:
    mov.w    #371, R4
    mov.w    #465, R5
    add.w    R4, R5

    mov.w    #0FFFEH, R6
    add.w    #1h, R6

    mov.w    #0FFFFh, R7
    add.w    #1h, R7

    mov.b    #255, R8
    mov.b    #1, R9
    add.b    R8, R9

    mov.b    #-1, R10
    add.b    #1, R10

    mov.b    #127, R11
    add.b    #127, R11

    jmp main
```

3) Debug your program. If you have errors correct them and continue debugging until your program is successfully downloaded to the Launchpad board.

4) Open the Register Viewer and expand the Core Registers item to see the CPU registers. Expand the status register.

5) Step your program to observe the operation of each addition

**E2:**

- Do the operation "AAAA + 7777" and fill the table below according to the result.

C	Z	N	V

b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0

- Write an assembly language program to do following operation :  
D135AAAA + 11117777 = E247 2221

```

      1 1 1 1
      ↑ ↑ ↑ ↑
D  1 3 5 A A A A
+  1 1 1 1 7 7 7 7
-----
E  2 4 7 2 2 2 1
    
```

**E3:** Each case in this experiment is independent of others. Type in the following codes into the main.asm file and observe the content of the registers.

**a)**

- mov.b #11110000b,R5  
and.b #00111111b,R5
- mov.b #11000001b,R5  
or.b #00011111b,R5
- mov.b #01010101b,R5  
xor.b #11110000b,R5

	R5.7	R5.6	R5.5	R5.4	R5.3	R5.2	R5.1	R5.0
1								
2								
3								

**b)**

- mov.b #00000000b,R5
- bis.b #10000001b,R5
- bis.b #01000010b,R5
- bis.b #00100100b,R5
- bis.b #00011000b,R5
- bic.b #00011000b,R5
- bic.b #00100100b,R5
- bic.b #01000010b,R5
- bic.b #10000001b,R5

	R5.7	R5.6	R5.5	R5.4	R5.3	R5.2	R5.1	R5.0
1								
2								
3								
4								
5								
6								
7								
8								
9								