**ECE3301 Spring 2024 Session 3 Midterm 1**

Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Problem 1 (10 points) Score: \_\_\_\_\_\_\_\_\_\_\_\_

Answer by True or False:

1. Maximum program space in PIC18F is 2MB \_\_\_\_\_\_\_\_\_\_
2. Harward architecture has a separate program and data memory \_\_\_\_\_\_\_\_\_\_
3. Access Bank has memory/registers in strictly Bank 0 \_\_\_\_\_\_\_\_\_\_
4. PIC18F has 75 core instructions \_\_\_\_\_\_\_\_\_\_
5. EEPROM cannot be written into \_\_\_\_\_\_\_\_\_\_

Problem 2 (10 points) Score: \_\_\_\_\_\_\_\_\_\_\_\_

Indicate whether the following locations can be accessed **BEST** by the Access Bank (mark AB), by BSR (mark BSR) or None (mark None):

1. Memory location 0x70 \_\_\_\_\_\_\_\_\_\_
2. PORTC \_\_\_\_\_\_\_\_\_\_
3. Status Register \_\_\_\_\_\_\_\_\_\_
4. Memory location 0x325 \_\_\_\_\_\_\_\_\_\_
5. IR (Instruction Register) \_\_\_\_\_\_\_\_\_\_

Problem 3 (16 points) Score: \_\_\_\_\_\_\_\_\_\_\_\_

PIC18 has 6 addressing modes. Identify the addressing modes for the following instructions:

a) SWAPF PLUSW0 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

b) SETF 0x0A \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

d) MOVLW 0x20 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

e) RLCF 0x20, F \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

g) TSTFSZ SUM,1 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

h) MOVFF POSTINC1, POSTDEC2 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

i) LFSR 1,0x0100 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

i) MOVLB 0x03 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Problem 4 (20 points) Xcredit (5 points) Score: \_\_\_\_\_\_\_\_\_\_\_\_

Find the Zero (Z), carry (C), and sign (N) flags in the PIC18F after the following logic and arithmetic operations have been executed – Notes: the instructions are independently executed (no carry over from instruction to the next)

If No change, mark NC. Make sure to make ‘0’ or ‘1’ for the flags that are affected

Assuming: [WREG] = 0x5A,

FSR0 = 0x056,

[0x20] = 0xA5,

[0x21] = 0x89,

[0x40] = 0x4F,

[0x56] = 0xFF

Z flag C flag N flag OV flag Extra Credit

1. RRNCF 0x56,F \_\_\_\_ \_\_\_\_ \_\_\_\_ \_\_\_\_ W =\_\_\_\_\_, [0x56] = \_\_\_\_\_
2. SWAPF 0x40,W \_\_\_\_ \_\_\_\_ \_\_\_\_ \_\_\_\_ W = \_\_\_\_\_, [0x40] = \_\_\_\_\_
3. XORWF 0x20,W \_\_\_\_ \_\_\_\_ \_\_\_\_ \_\_\_\_ W = \_\_\_\_\_, [0x20] = \_\_\_\_\_
4. CLRF INDF0 \_\_\_\_ \_\_\_\_ \_\_\_\_ \_\_\_\_ FSR0 = \_\_\_\_, [0x56] = \_\_\_\_\_
5. ADDWF 0x21,F \_\_\_\_ \_\_\_\_ \_\_\_\_ \_\_\_\_ W = \_\_\_\_\_, [0x21] = \_\_\_\_

Problem 5 (10 points) Score: \_\_\_\_\_\_\_\_\_\_\_\_

Assuming that the variables A, B, C and RESULT are located respectively at the locations 0x20, 0x21, 0x22 and 0x30.

Write a sequence of PIC18F assembly instructions to implement the following C statement:

RESULT = 2A - B +2C;

Make sure to use EQU statements to assign the values of the variables. Use those assignments in the code (use variables’ names in the code).

**CODE:**

Problem 6 (17 points) Score: \_\_\_\_\_\_\_\_\_\_\_\_

Assuming that the following locations have the data contents:

[0x10] = 0x20

[0x20] = 0xF0

[0x30] = 0xFF

[0x40] = 0x55

[0x50] = 0xF0

[0x60] = 0xA6

Carry = 1

ORG 0x100

MOVLW 0x10,W ;

ADDWF 0x20, W ;

ADDWFC 0x30, F ;

MOVF 0x40,W ;

XORWF 0x50,F ;

SWAPF 0x50 ;

ADDWF 0x50,W ;

BZ LABEL1 ;

SETF 0x70 ;

BRA DONE ;

LABEL1

BNC LABEL2 ;

MOVLW 0x55 ;

MOVWF 0x70 ;

BRA DONE ;

LABEL2

CLRF 0x70 ;

DONE

SLEEP ;

END ;

Assuming that all the instructions are executed in series, show the results of the affected variables/registers after the entire program is executed. **Need to show the calculations after each instruction is executed:**

**[0x30] = \_\_\_\_\_\_\_\_\_\_\_**

**[0x50] = \_\_\_\_\_\_\_\_\_\_\_**

**[0x70] = \_\_\_\_\_\_\_\_\_\_\_**

Problem 7 (17 points) Score: \_\_\_\_\_\_\_\_\_\_\_\_

Assuming that we have an array called Number1 with 10 values. The starting location of this array is at 0x30.

We also have another array called Number2 with also 10 values with the starting location at 0x40.

A variable called Counter is located at location 0x50.

Two variables called POS and NEG are located respectively at locations 0x61 and 0x62.

A last variable called RESULT is at location 0x70

Write an assembly program to do the following:

1. Using a loop, move the 10 consecutive values from array Number1 to array Number2
2. While moving the data in part a), check each number in the array Number1. If the number if positive, add 1 to the variable POS. If the number is negative, add 1 to the variable NEG.
3. When the loop is completed, load the variable POS into register W and use either the instruction CPFSGT or CPFSLT to compare W against the variable NEG. If POS > NEG, set the variable RESULT with the value 0xFF else set RESULT to 0x00

Requirements/Hints:

1. Set all the variable names with the address locations using EQU
2. Use FSR registers
3. Use loop counter technique
4. Initialize the variable Counter and clear the variables POS and NEG

**CODE:**

;

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