

## Quiz1Solution ECE2560 Sp202

Collaboration with other students is not allowed

Submit your answers in Word or pdf format to Carmen. Do not email directly to your TAs. Files emailed to the TA will not be accepted

- i) A page with your first name, last name and OSU email (pdf or Word format)
- ii) Answers to the quiz questions (pdf or Word format)

- 1) Using 2's compliment representation, the bits of  $(-20)_{10}$  are to be placed in a 16 bit register. Show all the 16 bits in this register.

$$(20)_{10} = 0000\ 0000\ 0001\ 0100$$

$$(-20)_{10} = 1111\ 1111\ 1110\ 1100$$

- 2) Let  $a = (124)_{10}$  and  $b = (-1)_{10}$ , assume that we are using 2's complement representation stored in 8 bit registers. Let  $c = a + b$ .

- i) Show all the binary bits of  $c$

- ii) By using the argument based on "carry out of signed bit" and "carry into the signed bit", determine if there is overflow.

$$(124)_{10} = 0111\ 1100, a = 0111\ 1100$$

$$(1)_{10} = 0000\ 0001$$

$$(-1)_{10} = 1111\ 1111, b = 1111\ 1111$$

carry	11111 100
a	0111 1100
b	1111 1111
	-----
c	0111 1011

Carry into the most significant bit = Carry out of the most significant bit = 1  
Therefore, there is no overflow

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- 3) Express  $(10000000)_2$  as a decimal number,  
i) If the above number is represented in 2's complement representation

In 2's complement representation  $(10000000)_2$  is the largest magnitude negative number that can fit in 8 bits which is equal to **-128**

- ii) If the above number is represented in unsigned numbers representation

$$(10000000)_2 = 2^7 = \mathbf{128}$$

- 4) Answer the following questions about the Launchpad used in our class.

- i) What is the name of the microcontroller on the launchpad?

**MSP430FR6989 or MSP430FR6989IPZ**

- ii) What is the size of the FRAM used in the microcontroller?

**131072 Bytes = 128 KB**

**48000 Bytes** is also an acceptable answer (this is the part of FRAM you can use in your program)

- iii) What is the size of the RAM used in the microcontroller?

**2048 Bytes = 2 KB**

- 5) Answer the following questions about the Launchpad used in our class.

- i) Which pin is the green LED connected to? **P9.7**

- ii) Which pin is the push button, S2, connected to? **P1.2**

- iii) What is the voltage required to operate the MCU? **3.3V**

**(1.8V to 3.6V) is also an acceptable answer**

- 6) The bits, 11100010, are stored in an 8 bit register to represent a signed binary number in 2's complement representation. Use the method of bit shifting to divide this number by 16. The result is to be stored in an 8 bit register. Show all the bits in this register.

$$16 = 2^4$$

Move the binary point to the left by four digits and discard the fractional part to get 1110. Now pad with four 1's to get **1111 1110**

- 7) A switch is connected to a pin of a microcontroller so that the pin registers a logical 0 if the switch is pressed and a logical 1 if the switch is not pressed. Is this an "active high" or "active low" switch? **Active Low**
- 8) What is the Word length of our MCU? **2 Bytes = 16 Bits**
- 9) What does the acronym GPIO stand for? **General Purpose Input Output**
- 10) What are the total number of pins on the MCU package used in our class? **100**