

**ME 461 Prelab #1**  
**Fall 2016**  
**Due at the start of class on 09/07/2016**

**Note: For questions 1-6 especially, the windows calculator is a great help but 4, 5 and 6 you should be able to do without the calculator.**

1. What are the decimal values of the following 8-bit unsigned binary integers?
  - a. 0011 1011
  - b. 1110 1001
  - c. 1010 1100
  
2. What are the decimal values of the following 16-bit 2's complement binary integers?
  - a. 0110 1011 0110 0100
  - b. 1000 1101 1001 0100
  - c. 1000 0010 1011 1010
  
3. Convert the following decimal values to 16-bit 2's complement binary numbers.
  - a. -21399
  - b. -67
  - c. 5291
  
4. Write the following 16-bit binary numbers in hexadecimal notation.
  - a. 1000 1101 1110 1001
  - b. 1000 1001 1110 1010
  - c. 1101 1001 0010 1111
  
5. Write the following hexadecimal numbers in binary notation.
  - a. 0x3D5E
  - b. 0x7820
  - c. 0xF684
  
6. Answer the following (Remember the LSB is B0):
  - a. In 5a above is bit B8 high (1) or low (0)?
  - b. In 5b above is bit B12 high or low?
  - c. In 5c list the bits that are high?

7. Find **x** in the given expressions. Assume a, b and x are unsigned 8-bit integers.

Expression	a	b	x
<b>x = a   b</b>	23	12	
<b>x = a % b</b>	41	5	
<b>x = ~a   ~b</b>	120	49	
<b>x = a &amp; b</b>	141	41	
<b>x = a &lt;&lt; b</b>	6	4	
<b>x = a &gt;&gt; b</b>	237	3	
<b>x = a ^ b</b>	113	57	
<b>x = a ++</b>	115	NA	
<b>x = a --</b>	29	NA	
<b>x = a</b> <b>then</b> <b>x += 23</b>	45	NA	

8. Suppose you want to use four switches to provide input signals to your MSP430 2272 microprocessor. Suppose also that you are using the version of the 2272 that uses the DA package and that the switches are connected to the following physical pins of the microprocessor: 3, 6, 29, 30. Write the C code needed to properly configure P2SEL, P2REN, P2DIR and P2OUT registers so that these pins can be used as GPIO inputs, internal pull-up/pull-down resistors enabled, inputs corresponding to physical pins 3 and 6 using pull-down resistors, and inputs corresponding to physical pins 29 and 30 using pull-up resistors.

After this configuration is executed, what register can be read to determine the state of the four switches?

Note 1: You will likely find the lecture notes, MSP430 User's Guide (especially the section about Digital I/O) and the MSP430 2272 Datasheet particularly helpful.

9. Now assume that you also want to configure the switches to use hardware interrupts. Write the C code needed to properly configure the P2IFG, P2IES and P2IE registers so that the GPIO hardware interrupts are enabled, that the interrupt flags corresponding to physical pins 3 and 6 are set on a low-to-high edge, and the interrupt flags corresponding to physical pins 29 and 30 are set on a high-to-low edge.

After configuring these registers, a low-to-high transition occurs on physical pin 6 causing Port 2's interrupt service routine to be executed. What is the line of C code that clears **ONLY** P2IFG's bit corresponding to pin 6 so that your source code is ready for the next interrupt that occurs? What do you think would happen if your code did not clear this bit?