ECE 331 Spring 2013   **Homework 10**

Due Mon April 1 at the <u>beginning</u> of class.

1. Manually track through the instruction sequence of the LST file below and observe how the stack is affected. List the values in the all register file registers and stack memory when the program reaches the SWI instruction. The table below shows how you can display your results (but you are not required to use this specific table).

```
4000  86 0A                    LDAA    #$0A
4002  C6 FB                    LDAB    #$FB
4004  CE 1111                  LDX     #$1111
4007  CD EEEE                  LDY     #$EEEE
400A  CF 5000                  LDS     #$5000
400D  16 4014                  JSR     FIRST
4010  16 401A                  JSR     SECOND
4013  3F                       SWI     ;main stops here
                ;subroutines
4014  36         FIRST         PSHA
4015  37                       PSHB
4016  30                       PULX
4017  16 401A                  JSR     SECOND
401A  34         SECOND        PSHX
401B  31                       PULY
401C  3D                       RTS
```

REGISTER FILE			STACK	
register	*value*		*value*	*address*
A				
B				
iX				
iY				
SP				
				(bottom)

2. Answer the following questions related to *exceptions* in microcontrollers
    a) What is an *exception*?
    b) What are the two types of exceptions?
    c) What the main functional difference between the two types of exceptions.
    d) How do you determine (what indicates) the priority of an exception?
    e) Which specific exception has the highest priority?

3. a) What are the two main categories *resets*. Give two examples of each for the HC12.
    b) Which category of reset is very similar to an interrupt? In what way are they similar?

4. a) What are the two main categories of *interrupts*? Give two examples of each for the HC12.
    b) What is the main difference between these categories of interrupts?

5. For the HC12 interrupt system
   a) What indicator shows if the non-maskable interrupt system is active?
   b) What AMS instruction would turn off the non-maskable interrupt system?
   c) What indicator shows if the maskable interrupts are enabled/disabled?
   d) How do you enable maskable interrupts?
   e) How do you disable maskable interrupts?

6. IRQ' and XIRQ' are both interrupt pins on the HC12 microcontroller. What is the difference between them?

7. Answer the following questions related to interrupt service routines (ISR)
   a) What information is stored in a reset/interrupt *vector*?
   b) When an interrupt occurs, what is the first action taken by a microcontroller?
   c) What actions are automatically performed by hardware after an interrupt occurs and before an interrupt service routine begins?
   d) What actions should be performed by a properly defined interrupt service routine?
   e) In what order are the CPU register values automatically pushed onto the stack before executing an ISR?