ECE 331 Spring 2013 Homework 6

Due Monday Feb 18 at the beginning of class.

1. What values are in memory locations $2155 and $2156 after the following program segment is executed?

```
LDD   #$403D
LDX   #$2155
STD   0,X
BSET  0,X,$44
BCLR  1,X,$21
```

2. Prepare a flowchart or pseudocode for an algorithm that will implement the following actions. Note that you do not need actual ASM code, just an outline for the algorithm.
   - Initialize accA to known values
   - Sequentially read 8-bit data values from memory starting at $4680, and
     i. when a value $FF is read, stop reading values
     ii. whenever a negative number is read, subtract 1 from value in accA
     iii. whenever a zero value is read, add one to value in accA
   - Clear accB before ending

3. Write a program segment using directives that will initialize memory locations $2040 through $2043 with decimal numbers 232, 15, 169 and 23, respectively. You only need to show the necessary lines of code, not a full functional program.

4. For the following program segment:

```
LDAA    #$45
SUBA    #$44
```

   a) Evaluate the numeric result assuming S2C numbers.
   b) Determine the values of CCR flags C, V, Z, and N.
   c) Specify which of these branch instructions would be taken or not taken:
   BEQ, BNE, BMI, BPL, BVS, BVC, BHS, BHI, BLS, BLO

5. For the code below, identify the number of machine code bytes in each line. Then, calculate the relative offset required for the BRA instruction. Express the offset as a hexadecimal that would be stored as a machine code operand. Complete these tasks by hand using the instruction tables and show your work.

```
      LDAA  #$10
TOP   LDX   $3315
      STAA  $01,X
      INX
      BRA   TOP
```

6. The program segment below was written so that the loop will repeat until the value in accB is 0.
   a) What label (L1, L2, etc) should replace "ZZ" in the "BEQ ZZ" statement in order for a value of $00 to be stored at $2800?
   b) What is the hex value of the BEQ relative offset operand that would be generated by the assembler?
   c) When this loop is completed, what value is stored in $280F?

```
        LDAB    #$05
L1      TSTB
L2      BEQ     ZZ
L3      LDAA    #$FF
L5      DECA
L4      DECB
L6      BRA     L1
L7      STAB    $2800
L8      STAA    $280F
```

7. What time delay is provided by the following delay loop if the clock frequency is 2MHz? You must first determine how many clock cycles are in each instruction, then decide which instructions are repeated within the loop and which are not. Once you know the total number of cycles within this program segment, you can precisely determine the delay time.

```
LP1     LDAA    #$E0
        LDX     #$60E8
LP2     LDAB    #$FF
        DECB
        ROR     B,X
        DECA
        BEQ     DUN
        BRA     LP2
DUN     END
```

8. Write a program segment delay loop that will create a 0.1sec delay when the clock frequency is 1MHz. Show your calculations and your code.

9. Complete PC Lab 2 Exercise 2-5. Write the code as specified in PC Lab 2 and verify proper operation using an HC12 ASM simulator. Once the code is functioning properly, print the final .ASM code and submit with your homework. **Copying someone else's code is not permitted.**