EE 308 – Homework 2

Due Feb. 1, 2009

1. Write an instruction sequence to swap the contents of memory locations 0x1000 and 0x1001.

2. Write an instruction sequence which adds the contents of accumuator B to the 16-bit number stored at locations $1000 and $1001, and stores the 16-bit result in addresses $1002 and $1003. Treat the value stored in B as a signed number. (Hint: use the `SEX` instruction.)

3. Consider the following program from Lab 2:

```
prog:   equ     $2000
data:   equ     $1000

        org     prog
        ldab    #29
        ldaa    #235
        sba
        std     result
        swi

        org     data
result: ds.w    1
```

   (a) Hand-assemble the program. That is, figure out what the op codes of the instructions are, and where they will be located in memory.

   (b) How many cycles will it take the MC9S12 to execute this program. (Do not include the `swi` instruction.)

   (c) How long will it take an MC9S12 with a 24 MHz E clock to execute this program?

   (d) Determine the state of the N, Z, V and C bits after each instruction has been executed. (Assume that, when the program starts, all these bits are zero.)

   (e) What will be the contents of addresses 0x1000 and 0x1001 after the program executes?

4. Consider the following program fragment:

```
        ldy     #1000
loop1:  ldx     #25000
loop2:  dbne    x,loop2
        dbne    y,loop1
        swi
```

   (a) How many instruction cycles will it take the MC9S12 to execute the following program? (Do not consider the `swi` instruction.)

   (b) How many seconds will this take the MC9S12 with an 24 Mhz E-clock? (You should give the answer to the nearest microsecond.)

5. An MC9S12 has the following data in its memory:

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
20D0	10	23	3B	7C	10	04	86	80	B7	10	25	3B	FC	10	18	F3
20E0	20	F5	FD	10	18	86	40	B7	10	23	3B	FC	10	12	DD	02
20F0	86	02	B7	10	23	3B	7C	10	03	86	40	B7	10	25	3B	86

Determine the contents of the A and X register after executing the following code fragments. (Before the first instruction, the X register has 0x0000.) List the value in hexadecimal. Also, indicate what addressing mode is used, and what the effective address of the instruction is. (Assume that the first instruction is at address 0x2000.)

(a) `ldaa #37`

(b) `ldaa $20E7`

(c)
```
ldx $20E0
ldaa -2,X
```

(d)
```
ldx #$20E0
ldaa -2,X
```

(e)
```
ldx #$20E0
ldaa 2,+X
```

(f)
```
ldx #$20E0
ldaa 2,X+
```