EE 308

Exam 1

February 24, 2010

Name: _____

You may use any of the handouts from the Freescale data books and one page of notes. No calculators allowed. Show all work. Partial credit will be given. No credit will be given if an answer appears with no supporting work.

1. Fill in the blanks in this table. The numbers are stored in an 8-bit register.

Hex	Binary	Unsigned Decimal	Signed Decimal
B2	10110010	178	-78
2F	00101111	47	+47
93	10010011	147	-109
D6	11010110	214	-42

2. The following operations are done in accumulator A of an 9S12. Indicate the answer in accumulator A, and the state of the flags after the operations.

	32 + 7B	89 + AD	27 + F2	55 - 7C	89 - 7D
Acc. A	AD	36	19	D9	0C
C	0	1	1	1	0
V	1	1	0	0	1
N	1	0	0	1	0
Z	0	0	0	0	0

3. Below are some data in the 9S12 memory:

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
2000	CF	40	00	18	0F	72	00	01	FE	20	15	6E	2B	04	30	F8
2010	7C	10	02	FE	10	00	08	8E	00	18	26	EF	20	EA	CD	00
2020	00	CC	00	01	04	05	07	19	EE	B7	C6	04	35	F9	3D	DD

Reverse assemble the first eight instructions, starting at address $2000. Write down the mnemonic and operand for the instructions. Indicate the addressing mode used.

I have done one instruction for you; you need to do the next seven.

Instruction Address	Mnemonic	Operand	Addressing Mode
$2000	`lds`	`#$4000`	IMM
$2003	TBA	—	INH
$2005	INC	$0001	EXT
$2008	LDX	$2015	EXT
$200B	STX	5,-X	IDX
$200D	DBNE	A,-08 (goes to $2008	REL
$2010	STD	$1002	EXT
$2013	LDX	$1000	EXT

4. Using the same data in the 9S12's memory as in Problem 3, indicate the values in the registers after the 9S12 executes the following instructions. Also write down the number of cycles needed to execute each instruction. Show what will be in the registers (in hex) after each of the instructions. If the instruction does not change a register, you may leave that entry blank.

Instruction	D		X	Y	SP	Addressing Mode	Effective Address	Cycles
	A	B						
	AA	25	ABCD	1234	2020			
`ldx #$2008`			2008			IMM	$2001	2
`ldy $2008`				FE20		EXT	2008	3
`ldd 5,-x`	18	OF	2003			IDX	2003	3
`sba`	09					INH	—	2
`pulx`			00CC		2022	INH	$2020	3
`negb`		F1				INH	—	1

The `pulx` instruction is inherent, but it does have an effective address – the address is the contents of the stack pointer ($2020). The answer of no effective address is acceptable.

5. An MC9S12 executes the following set of instructions:

```
                        org    $2000

1 2000                  LDS    #$3C00
2 2003                  LDAA   #$A2
3 2005                  PSHA
4 2006                  DES
5 2008                  LDX    #$89C4
6 200B                  BSR    foo
  200D                  ...

                        org $2040
7 2040    foo:          LEAS   -4,SP
8 2042                  STX    2,SP
```

Show the value of the stack pointer and the stack frame (as much as you can tell) after the MC9S12 executed the `STX 2,SP` instruction.

Inst 1 puts $3C00 into SP
Inst 2 puts $A2 into ACCA
Inst 3 subtracts 1 from SP ($3BFF –> SP), puts $A2 into $3BFF
Inst 4 subtracts 1 from SP ($3BFE –> SP), don't know whats at $3BFE
Inst 5 puts $89C4 into X
Inst 6 subtracts 2 from SP ($3BFC –> SP), puts return addr ($200D) into $3BFC, $3BFD
Inst 7 subtracts 4 from SP ($3BF8 –> SP), don't know whats in $3BF8 to $3BFB
Inst 8 puts contents of X ($89C4) into SP + 2 and SP + 3 ($3BFA, $3BFB)

When done, SP is $3BF8

Addr	Value
3BF8	??
3BF9	??
3BFA	89
3BFB	C4
3BFC	20
3BFD	0D
3BFE	??
3BFF	A2