CMPEN 472 Spring 2013
Exam I

Name: _____ Student ID number: (last 4 digit) _____

* Please write your name on every page.
* Write your solutions clearly. You may use backside of each page for scratch but the solutions must be shown on the designated place near (or below) each problem.
* For any program you are asked to write, write it as short as possible. In most cases, a shorter program runs quicker and saves memory space; hence, it is more efficient.
* Any subroutine you write, make it transparent to its caller.
* Please ask if any of the problems (and assumptions) are not clear.
* PENALTY applies to long subroutines, its length greater than the suggested length.

1. (9pt) List at least three single instructions that clears all 8 bits of the accumulator B (only B). (Specify operands as well.)

2. (12pt) **a.** Determine how many times the instruction "DECA" in the program below is executed if NUM=100.

```
NUM   EQU    100
DLY   LDAA   #NUM
LOOP  DECA
      BNE    LOOP
      RTS
```

_____ times.

b. How many times the "DECA" instruction be executed if the "BNE" instruction is replaced with "BEQ" instruction?

c. How many times the "DECA" instruction be executed if the NUM is equated to $00 (ie. NUM = 0)?

3. (12pt) Write the addressing mode of each instruction below. Also, write the effective address (show the actual address in Hexadecimal number where the data come from in memory).

Assume the register setting on the right before each instruction execution.

	A	B
D	$ 00	$ 0A
X	$ 0100	
Y	$ 0010	

SP	$ 00FF
PC	$ C000
	CCR

		Addressing Mode	Effective Address
LDAA	$10,X	_____	EA = $_____
LDAA	10,Y	_____	EA = $_____
LDAA	$0100	_____	EA = $_____
LDAA	$10	_____	EA = $_____
LDAA	#$10	_____	EA = $_____
ABA		_____	EA = $ Not applicable, why?

4. (8pt) Assume the following MC68HC11/12 register and condition code setting before an instruction execution.

	A	B
D	$C2	$01
X	$12AB	
Y		

	S	X	H	I	N	Z	V	C
condition code	—	—	—	—	0	0	0	0

What is the content of the accumulator A and the condition code setting after an instruction "CLRA" has been executed?

A $ _____

	S	X	H	I	N	Z	V	C
condition code	—	—	—	—				

What is the content of the accumulator B and the condition code setting after an instruction "LSRB" has been executed?

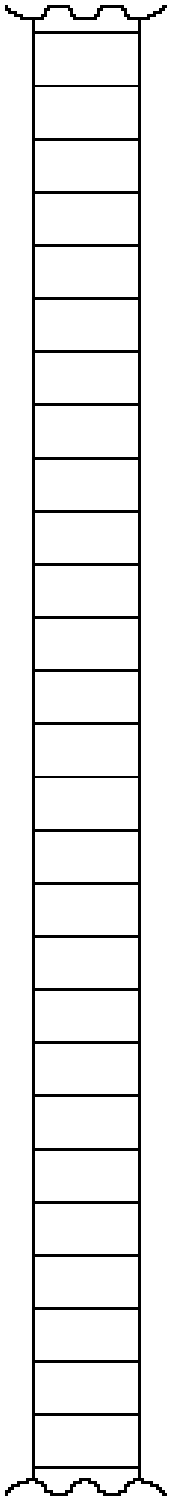
B $ _____

	S	X	H	I	N	Z	V	C
condition code	—	—	—	—			0	

5. (18pt) Show the contents of memory (fill in the memory map on the right) when the following program has been assembled and loaded.

```
                ORG     $0000
                FCB     -10
                FDB     $10
HERE            FCC     "A"
                RMB     2
                FCB     255

                ORG     $0100
START           LDAA    2,Y
                LDAB    HERE
                LDX     $03
```



Above program will change the contents of some registers when execution starting at memory location $0100. Assuming the following MC68HC11/12 register setting before the program execution.

	A	B
D	$ 2C	$ 9F

X	$ 0100
Y	$ 0001

Determine the contents of the registers after the last instruction execution.

	A	B
D	$	$

X	$
Y	$

6. (20pt) Write a short program to copy 12 bytes of data from a SOURCE memory locations to DEST memory locations. Please follow the specifications below:

Source data size: 12 bytes
Source data starting address: $3000
Destination address start: $30A8
Program start address: $3100
Work memory, TEMP: from $3040
Stack memory, StackSP at: $0080

Design your .asm source file a stand−alone program (same as your homework programs). Define the labels SOURCE, DEST, TEMP, StackSP and others if you use them. Initialize the necessary memory locations and registers if they are required for your program to work correctly. Any assumptions you make, state it clearly. You may ask if you have questions. Shorter programs are preferred for grading.

7. (20pt) Convert the following decimal numbers into 8-bit 2's complement numbers and perform the additions/subtractions indicated. Then answer the following questions for the result of each operation. Carry/borrow bit generated? Overflow occurred? Is the 8-bit sum correct? Show your work.

Addition:

```
  (+ 70)
+ (+ 60)
----------
```

C=
V=
Sum Correct? Y/N

```
  (+ 60)
+ ( - 70)
----------
```

C=
V=
Sum Correct? Y/N

Subtraction:

```
  (- 60)
-  (- 70)
----------
```

C=
V=
Sum Correct? Y/N

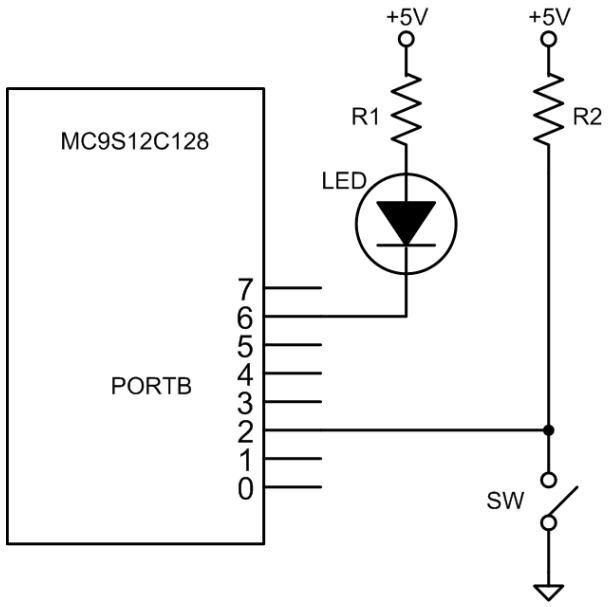
```
  (+ 70)
-  ( - 60)
----------
```

C=
V=
Sum Correct? Y/N

8. (20pt) Assemble the MC9S12C128 assembly language program below which starts at address $3100. Show for each instruction the starting address and the instruction bytes (opcode and operands (if any) in hexadecimal number.

Line	Address	Machine Language	Assembly Language		
1	3100			ORG	$3100
2			StackST:		
3			Entry:		
				LDS	#StackST
				LDAA	#$01
				STAA	2
			mainLoop:	ANDA	1,X+
				NOP	
				BNE	mainLoop
			Done:	SWI	

9. (20pt) Write a program that will run on the MC9S12C128 shown below to light the LED when the switch SW is on. Make the LED light directly indicate the SW state: LED **ON** when SW is **ON** and LED **OFF** when SW is **OFF**. Write a short program including any necessary initialization. Design your .asm source file a stand-alone program (same as the homework programs). Assume ideal switch SW (no switch bouncing). Any additional assumption you make, state it clearly. Please ask if you have questions.



10. We want to generate square wave on bit 0 of the port B on the MC9S12C128 chip.
(20pt) The continuous square wave has the period of 0.1sec: 5V output for 0.05sec and 0V output for 0.05sec assuming 24MHz bus clock. Write the main program and the delay subroutine for this task. Use the memory locations starting at $3100 for your program and at $3000 for the data, if needed. Design your .asm source file as a stand-alone program (same as the homework programs). Write a short program.