CMPEN 472 Sample
EXAM II

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) is not clear.
- PENALTY applies to long subroutines, its length greater than the suggested length.

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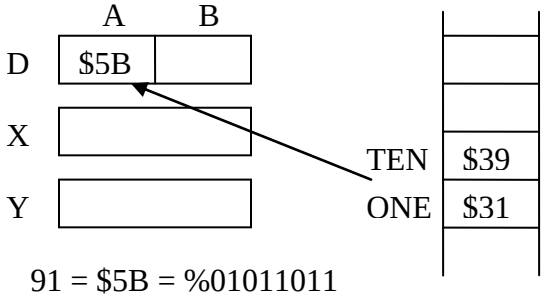
1. (15pt) Write a short subroutine to convert the two digit decimal number input from a key-board to a binary number and place the result in the accumulator A. Assume that the key-board inputs are received through MC9S12C128's SCI port and they are stored in the memory locations labeled TEN and ONE. The key-board inputs are always two digit decimal number from 00 to 99. Design your subroutine as short as possible. Your subroutine must be transparent to its caller.

EAMPLE:



91 = $5B = %01011011

2. (15pt) Two unsigned binary numbers are received from the port A of the MC9S12C128 and they are stored on the stack. The two numbers are needed to be sorted in ascending order. Given the main program below, write a short subroutine which will **SORT** the two numbers stored on the stack.

```
MAIN:   ●
        ●
        ●
        LDAA    PORTA
        PSHA
        ●
        ●
        ●
        LDAA    PORTA
        PSHA
        JSR     SORT
        PULA
        STAA    MIN
        PULA
        STAA    MAX
        ●
        ●
        ●
```

3. (15pt) When executing the MC9S12C128 program shown below, show the contents of the memory locations and the registers. The contents of the memory locations and the registers before the program execution are shown below. Show the changed contents of the memory locations and the registers at the time of 'NOP' instruction. Write all numbers in hexadecimal format.

```
Program:
  1                          ORG   $3900
  2 3900 CF38 1C             LDS   #$381C
  3 3903 1639 08             JSR   SUB1
  4 3906 A7                  NOP
  5 3907 3F                  SWI
  6
  7 3908 34            SUB1  PSHX
  8 3909 08                  INX
  9 390A A644                LDAA  4,Y
 10 390C FD38 1C             LDY   $381C
 11 390F 1639 14             JSR   SUB2
 12 3912 30                  PULX
 13 3913 3D                  RTS
 14
 15 3914 B7C5         SUB2   EXG   D,X
 16 3916 6E88                STX   8,SP
 17 3918 3D                  RTS

Memory:
     3800 1234 5678 90AB CDEF 1122 3344 5566 7788
     3810 381C 101B 1234 5678 9ABC 1008 1234 5678
     3820 1234 5678 90AB CDEF AABB CCDD EEFF 11BB

Register:
     D=$1234      X=$001A      Y=$3812      SP=$3800
```

Changed Memory:

3800:

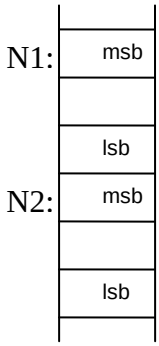
3810:

3820:

Changed Register:

4. (15pt) We want to generate square wave on bit 4 of the port B on the MC9S12C128 chip. The continuous square wave has the period of 0.5sec: 5V output for 0.25sec and 0V output for 0.25sec assuming 24MHz bus clock, 4MHz external resonator (same setting as the homework on CSM-12C128 board. Write the main program and the interrupt service routine for this task using the **Real Time Interrupt** feature. Use the memory locations starting at $3100 for your program and at $3000 for the data, if needed. Design your main.asm source file as a stand-alone program (same as the homework programs) including any necessary initialization.

5. (15pt) Write a short subroutine to add two 24 bit numbers in memory locations labeled N1 and N2. Store the result in N1. Design your subroutine as short as possible. Your subroutine must be transparent to its caller.



6. (15pt) Write a short subroutine 'putchar' to correctly send a byte data through MC9S12C128's SCI port. Use accumulator A for the data passing: A = character to send through the SCI port.

7. (15pt) Write a short subroutine 'printmsg' to print a line of text message on a Hyper Terminal connected to MC9S12C128's SCI port. Assume the message text always ends with ASCII null character 0 and the register X points to the first character to print. Also assume that your 'putchar' subroutine above is correctly working.

8. (15pt) When executing the MC9S12C128 program shown below, show the HyperTerminal window display.

```
        ORG     $3100
        LDS     #$3100
        LDAA    #$65
        LDAB    #$43
        LDX     #256
        IDIV
        TBA
        JSR     putchar
        XGDX
        TBA
        JSR     putchar
Loop:   BRA     Loop
```