EE 319K Exam 1

Derived from Dr. Ramesh Yerraballi Fall 2008
Edited by Jonathan Valvano Spring 2013

Full Name:_____   *Duration*: 75 minutes

This is a closed book exam; No calculators are allowed; Write answers within the space provided after each question

1. [*20 pts*] Answer the following
   a. Consider the following 8-bit number: `%10011011`
      i. What decimal value does it represent if it is an 8-bit signed integer?

      ii. What decimal value does it represent if it is an 8-bit unsigned integer?

   b. What will be the value of the carry bit **C** after executing the following?
      ```
      LDR  R0,=0x60000000  ;6*2²⁸
      LDR  R1,=0xC0000000  ;12*2²⁸
      ADDS R2,R1,R0
      ```

   c. What will be the value of the overflow bit **V** after executing the following?
      ```
      LDR  R0,=-0x60000000  ;-6*2²⁸
      LDR  R1,=-0x70000000  ;-7*2²⁸
      ADDS R2,R1,R0
      ```

   d. What will be the value of the **R0** register after executing the following?
      ```
      MOV  R0,#0x05
      LSL  R0,R0,#1
      LDR  R1,=0xA0000000
      ORR  R0,R0,R1
      ASR  R0,R0,#1
      ```

2. [*10 pts*] Identify the addressing mode used in each of the following instructions:
   hint: see section 3.3.2 in the book

Instruction	Addressing Mode
LDR R0,[R0]	
ADD R0,R1,R2	
MOV R0,#0x36	
LDR R0,=0x400043FC	
B loop	
PUSH {R0,R1,R2}	

3. [*10 pts*] Assume we have a variable **M** and execute these instructions

```
LDR   R0,=M
LDR   R1,[R0]
MOV   R2,#100
CMP   R1,R2
Bxx   Target
```

In this table enter Yes or No if the branch would occur for each value of M

Bxx	M = 101	M = -1
blo		
bls		
ble		
bgt		
bne		

Hint: M = -1 is the same as M = 0xFFFFFFFF.

4. [*10 pts*] Assume a **BL process** instruction is located at address 0x06AA and the address of the subroutine **process** is 0x06B0.

```
0x000006AA F000F801          BL    Process
0x000006AE BD06              POP   {r1-r2,pc}
                ;subroutine called Process
                Process
0x000006B0 EB001001          ADD   r0,r0,r1,LSL #4
0x000006B4 EB001021          ADD   r0,r0,r1,ASR #4
0x000006B8 4770              BX    lr
```

   a. What is the value of the PC after executing the BL process instruction?

   b. What was pushed on the stack while executing the BL process instruction?

   c. Other than the PC, did the executing the BL process instruction change any other register? If no, say "none", if yes, specify which register and what value did that register become.

5. [*20 pts*] We wish to make PB7 and PB3 as outputs and PB0 an input. You may use the following definitions:

```
GPIO_PORTB_DATA_R   EQU 0x400053FC
GPIO_PORTB_DIR_R    EQU 0x40005400
GPIO_PORTB_AFSEL_R  EQU 0x40005420
GPIO_PORTB_DEN_R    EQU 0x4000551C
SYSCTL_RCGCGPIO_R   EQU 0x400FE608
SYSCTL_RCGCGPIO_GPIOB EQU 0x00000002  ;port B Clock Gating Control
```

a. Write assembly code that makes PB7, PB3 outputs and PB0 an input. Comments are required.

b. Write assembly code that clears PB7 and sets PB3 if PB0 is 0 and sets PB7 and clears PB3 if PB0 is 1. Comments are required.

6. [*20 pts*] Write a C function **SwapGT** that takes two 16-bit unsigned numbers. The inputs exist in memory variables **X** and **Y**. The function swaps the contents of variables **X** and **Y** only when **X>Y**, otherwise it does nothing. You may define additional variables that you can use for doing the swap.
   a. Show the C definitions of these two 16-bit unsigned variables

   b. Show the C definitions of the SwapGT function, which has no formal parameters

```
//*****SwapGT function ********************
     void SwapGT(void){
```

7. [*10 pts*] Answer the following
   d. [*2 pts*] The CortexM processor has a Von Neumann architecture   [**true/false**]

   e. [*2 pts*] The Reset Vector stores the address of the routine, which executes when the power-on or reset button is pressed.   [**true/false**]

   f. [*2 pts*] **GPIO_PORTB_DATA_R** refers to a _____that stores the current state of port B.
        Choose your answer from:
         i.   A register in the CPU
         ii. Memory address in ROM
         iii. A Memory address in the RAM
         iv. External device address

   g. [*2 pts*] The Cortex M4 has 6 buses. On each bus,

           how many *address* lines: _____;

           and how many data lines: _____

   h. [*2 pts*] Freescale computers use big-endian vs. Intel computers which use little-endian representation (a fact). Therefore the following byte: 00100101 (0x28) will represent the decimal value 40 (2x16+8) on Freescale computers and the decimal value 130 (8x16+2) on Intel Computers   [**true/false**]

                    Same appendix as HW4