ELEC 330 Test 2 Spring 2014
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Name SOLN

1. (3 points each) True/False (circle your choice):

a. T (F) The PIC18 Stack contains 31 registers that are a part of Program Memory.

b. (T) F The hardware technique to eliminate switch bounce uses an S-R Latch to capture the pulse without a bounce.

c. T (F) An Interrupt Service Routine is a group of instructions that performs a task and can be called to perform that task by the main program or another subroutine.

d. (T) F The time multiplex scanning technique sends data to all LEDs simultaneously, but the LEDs are turned on one at a time in sequence with such a frequency that the display appears stable.

e. T (F) The LATB register is used to set PORTB as either an input or output.

2. (10 points) List the two interrupt vectors for the PIC 18 MCU and two internal peripheral sources that can send an interrupt request.

Interrupt Vectors

High Priority 08H

Low Priority 18H

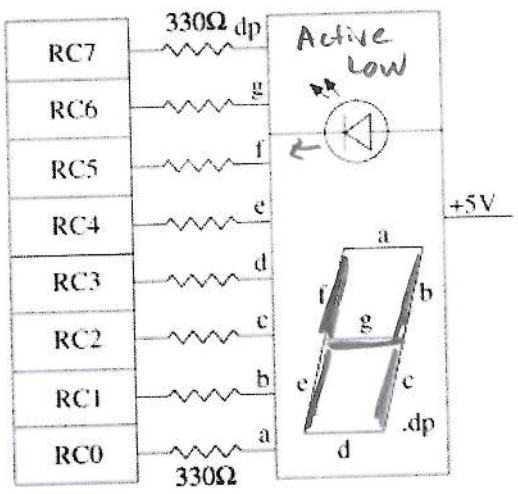
Interrupt Sources

Timers

A/D Converter

Serial I/O

3. (10 points) Given the common anode seven-segment LED connected to PORTC below, write the assembly language instructions to initialize the port and display the letter "H".



dp g f e d c b a
1 0 0 0 1 0 0 1

```
CLRF  TRISC
MOVLW 0x89
MOVWF PORTC
```

4. (15 points) Given that the A/D converter is set up as high priority and that the Serial Communications Transmitter (TX) and Receiver (RC) are set up as low priority, write the assembly language instructions to identify the interrupt sources and call the appropriate interrupt service routines when an interrupt occurs.

	B7	B6	B5	B4	B3	B2	B1	B0
PIR1	PSPIF(1)	ADIF	RCIF	TXIF	SSPIF	CCP1IF	TMR2IF	TMR1IF

```
ORG  0x08      ; High Priority
GOTO ADC-ISR
ORG  0x18      ; Low Priority
BTFSC PIR1,RCIF
GOTO  RC_ISR
BTFSC PIR1,TXIF
GOTO  TX-ISR
GOTO  ; False Alarm, Return
RETFIE
```

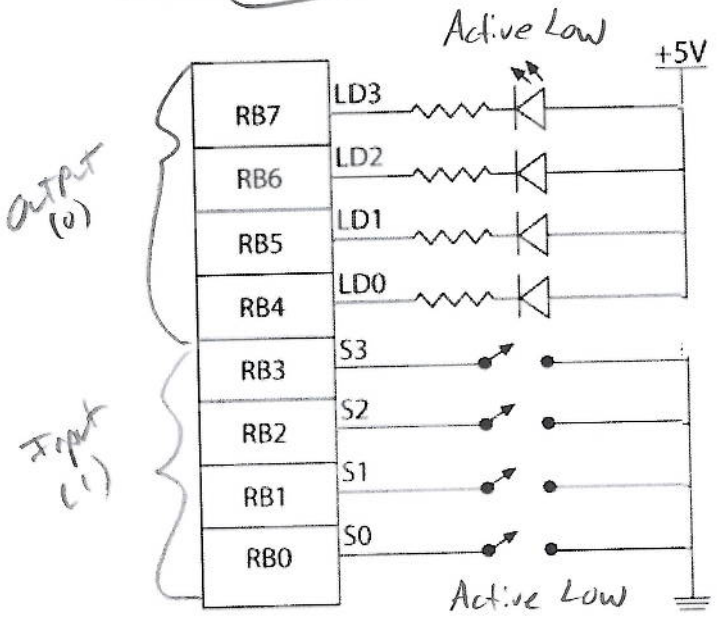
5. (10 points) Given the following PIC18 assembler listing, show the contents of the Stack and Stack Pointer after the execution of the two CALL instructions.

```
----------------------------------------
PIC ASSEMBLER LISTING
Address Opcode  Instruction
----------------------------------------

00004C  D813            RCALL OUTLED
00004E  0E32            MOVLW D'50'
000050  6E11            MOVWF L2REG


000074  5001  OUTLED:   MOVF  BCD0
000076  EC39            CALL  GETCODE
000078  F000
00007A  CFF5            MOVFF TABLAT,PORTC
00007C  FF82


00008A  6E03  GETCODE:  MOVWF TEMP
00008C  0E00            MOVLW UPPER LEDCODE
```

Stack Pointer: 02

Stack	
00004E	1
00007A	2
	3

6. (20 points) Given the switch and LED configuration below, write the assembly language instructions to properly initialize PORTB and then continuously read the input switches and FLASH the corresponding LEDs for the switches that are ON (grounded). Assume the subroutine DELAY is available.



INTCON2

B7	B6	B5	B4	B4	B3
$\overline{\text{RBPU}}$					

$\overline{\text{RBPU}}$ = PORTB pull-up resistor enable bit
0 = Pull-up resistors are enabled
1 = Pull-up resistors are disabled

```
REGB    EQU     0x01
        ORG     0x20
INIT:   MOVLW   B'00001111'
        MOVWF   TRISB
        BCF     INTCON2,7       ; Enable Pull up
LOOP:   MOVFF   PORTB, REGB
        SWAPF   REGB, F
        MOVFF   REGB, PORTB     ; Turn ON LEDs
        CALL    DELAY
        SETF    PORTB           ; Turn OFF LEDs
        CALL    DELAY
        BRA     LOOP
```

7. (20 points) Draw a flowchart for a subroutine that counts the number of negative entries in a data table. The input to the subroutine is a pointer to the table in FSR0. The end of the data table is indicated by the character 00. The output of the subroutine is the count of negative entries in the WREG.