EEE316 MICROPROCESSORS
PRE-LABORATORY REPORT

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LAB. NUMBER : **2**

OBJECTIVES OF THE LABORATORY ASSIGNMENT:

Objectives of this lab are examining the I/O port operation using a MPLAB simulator and understanding how to turn the LEDs on with given delay intervals. Also, calculating the delay time and how to call delay.

CODE AND COMMENTS:

1.

```
org 0h
    ;initialization steps
     BANKSEL ANSELC ; going anselc bank
     CLRF ANSELC ; reset anselc
     CLRF TRISC ; portc is output
     MOVLW 0X00 ; clear wreg
     MOVWF PORTC ; moving portc
     ; loop
COUNT    EQU 0X25 ; COUNT = 25H
     MOVLW .40 ; loading d'40' to wreg for 40 times loop
     MOVWF COUNT ; moving value to 25h loc
AGAIN    INCF PORTC,F ; every step portc will increase 1H
     CALL DELAY ; calling delay
     DECF COUNT,F ; checking if 25h loc is zero
     BNZ AGAIN ; if it is not zero, go to AGAIN
     ;------------delay subroutine
DELAY   MOVLW .255 ; outer loop is starting
    MOVWF 0X0C ; 0x0C is 255
LOOP_1  MOVLW .255 ; intermediate loop starts
    MOVWF 0X0D ; 0x0D is 255
LOOP_0  NOP ; inner loop starts
    NOP ; wasting 1 us 9 times
    NOP
    NOP
    NOP
    NOP
    NOP
    NOP
    NOP
    DECFSZ 0X0D,F
    GOTO LOOP_0 ; repeat until 0x0D is zero
    DECFSZ 0X0C,F
    GOTO LOOP_1 ; repeat until 0x0C is zero
    RETURN ; return to caller
    END ; end of asm file
```

2.

```
org 0h
     ;initialization steps
     BANKSEL ANSELD
     CLRF ANSELD
     CLRF TRISD ; portd is output
     BANKSEL ANSELB
     CLRF ANSELB
     CLRF TRISB ; portd is output
     BANKSEL ANSELC
     CLRF ANSELC
     CLRF TRISC ; portdc is output
LOOP     MOVLW 0X55 ; wreg = 55h
     MOVWF PORTB ; put 55h on port b pins
     MOVWF PORTC ; put 55h on port c pins
     MOVWF PORTD ; put 55h on port d pins
     CALL DELAY ; putting delay
     MOVLW 0XAA ; wreg = AAh
     MOVWF PORTB ; put AAh on port b pins
     MOVWF PORTC ; put AAh on port c pins
     MOVWF PORTD ; put AAh on port d pins
     CALL DELAY ; putting delay
     GOTO LOOP ; for infinite loop
    ;------------delay subroutine
DELAY    MOVLW .15 ; first loop is starting
     MOVWF 0x01 ; 0x01 is 15
LOOP_3   MOVLW .255 ; second loop starts
     MOVWF 0x02 ; 0x02 is 255
LOOP_2   MOVLW .255 ; third loop starts
     MOVWF 0x03 ; 0x02 is 255
LOOP_1   NOP ; wasting 1 us 2 times
     NOP
     DECF  0x03,F ; repeat until 0x03 is zero
     BNZ LOOP_1
     DECF 0x02,F ; repeat until 0x02 is zero
     BNZ LOOP_2
     DECF 0x01,F ; repeat until 0x01 is zero
     BNZ LOOP_3
     RETURN ; return to caller
     END ; end of asm file
```

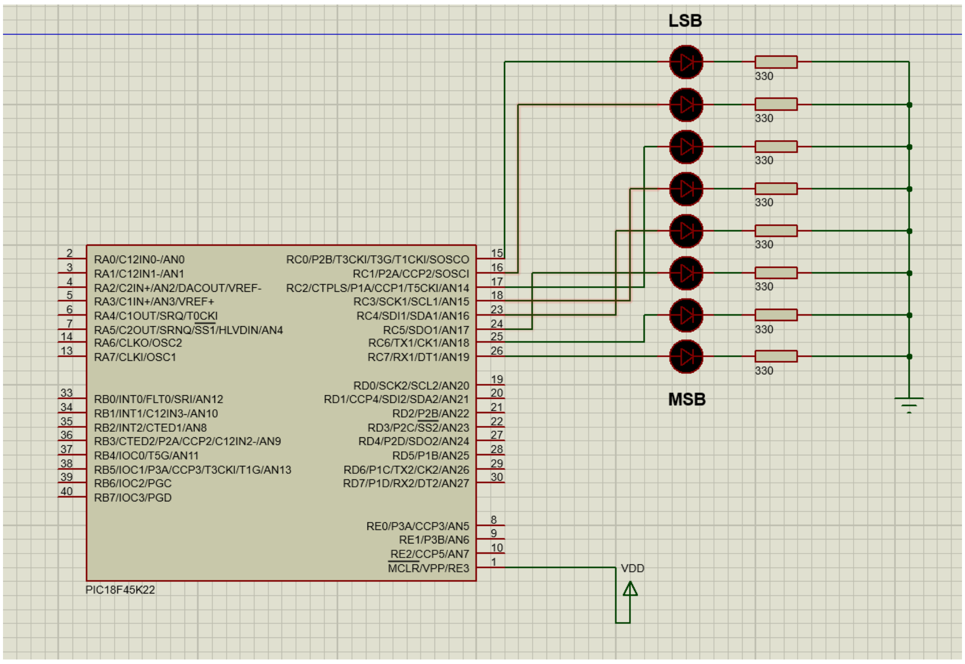
3.

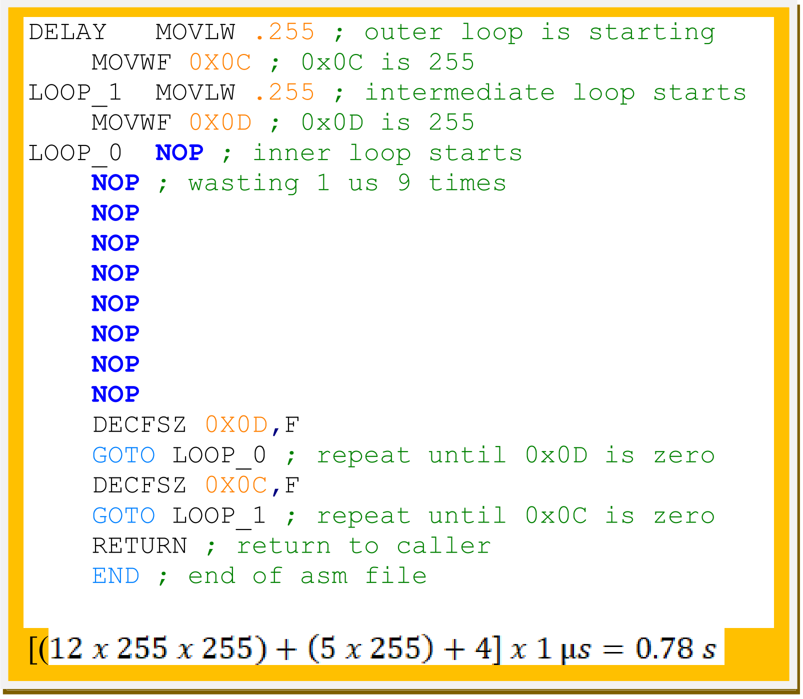
```
     org 0h
     BANKSEL ANSELC ;Prepare port a and b
     CLRF ANSELC
     BANKSEL ANSELB
     CLRF ANSELB
     SETF TRISC ;set portc as input
     CLRF TRISB     ; b as output.
AGAIN   BTFSS PORTC,0   ; checking portc rc0 pin
    BRA AGAIN       ; if it is zero go to AGAIN, otherwise continue
    CALL DELAY  ; putting 0.5 s delay
LOOP    BSF PORTB,0     ; set portb rb0
    CALL DELAY      ; putting 0.5 s delay
    BCF PORTB,0 ; clear portb rb0
    BSF PORTB,1     ; set portb pb1
    CALL DELAY      ; putting 0.5 delay
    BCF PORTB,1     ; clear portb rb1
    GOTO LOOP       ; loop to make red-yellow-red-yellow
     ;-----------delay subroutine
DELAY   MOVLW .255 ; outer loop is starting
    MOVWF 0X0C ; 0x0C is 255
LOOP_1  MOVLW .255 ; intermediate loop starts
    MOVWF 0X0D ; 0x0D is 255
LOOP_0  NOP ; inner loop starts
    NOP ; wasting 1 us 5 times
    NOP
    NOP
    NOP
    DECFSZ 0X0D,F
    GOTO LOOP_0 ; repeat until 0x0D is zero
    DECFSZ 0X0C,F
    GOTO LOOP_1 ; repeat until 0x0C is zero
    RETURN ; return to caller
    END ; end of asm file
```

Explanations:

Question-1 :

Our aim is to increase Port C bits from 0 to 40 in decimal. We put 0.8 s delay for every increment. To understand that bits are increasing we build 8 led connected to Port C. You can see the circuit and delay calculation below;



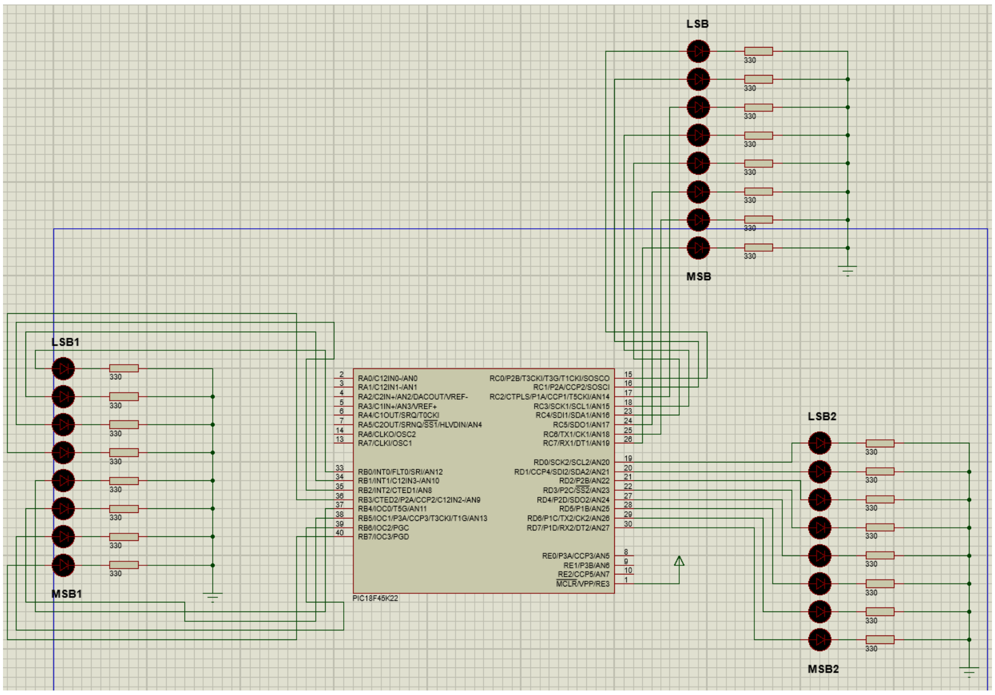


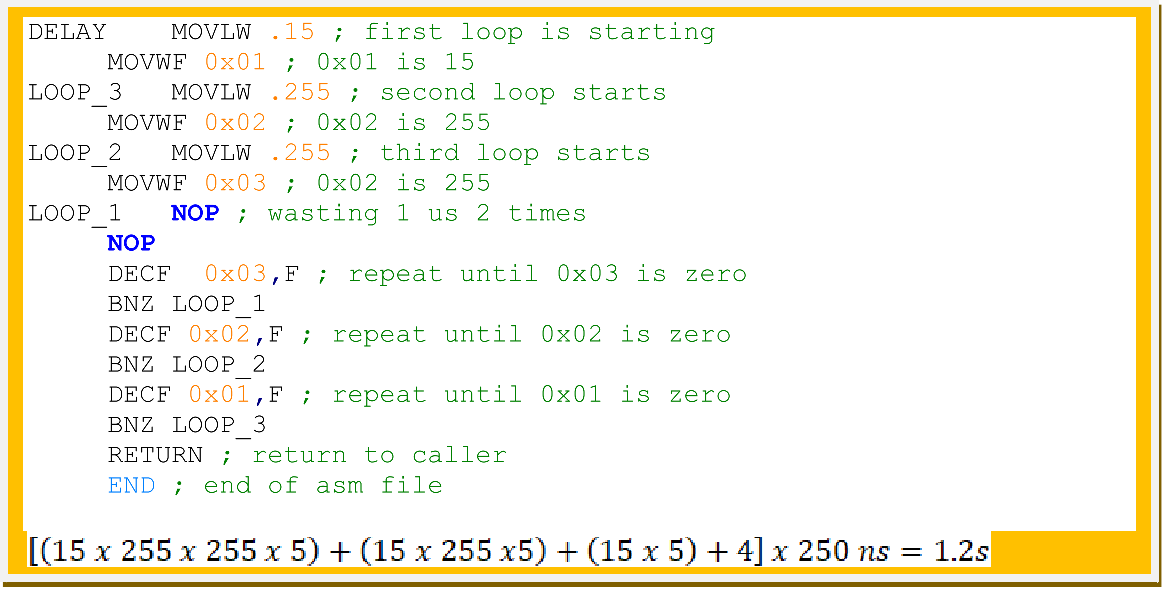
```
DELAY   MOVLW .255 ; outer loop is starting
    MOVWF 0X0C ; 0x0C is 255
LOOP_1  MOVLW .255 ; intermediate loop starts
    MOVWF 0X0D ; 0x0D is 255
LOOP_0  NOP ; inner loop starts
    NOP ; wasting 1 us 9 times
    NOP
    NOP
    NOP
    NOP
    NOP
    NOP
    NOP
    DECFSZ 0X0D,F
    GOTO LOOP_0 ; repeat until 0x0D is zero
    DECFSZ 0X0C,F
    GOTO LOOP_1 ; repeat until 0x0C is zero
    RETURN ; return to caller
    END ; end of asm file
```

$[(12\ x\ 255\ x\ 255) + (5\ x\ 255) + 4]\ x\ 1\ \mu s = 0.78\ s$

QUESTION-2 :

Our aim is to toggle all the bits of PORTB, PORTC and PORTD continuously by sending 55H and AAH to these ports and putting 1.2 s delay for each toggle. You can see the circuit and delay calculation below;



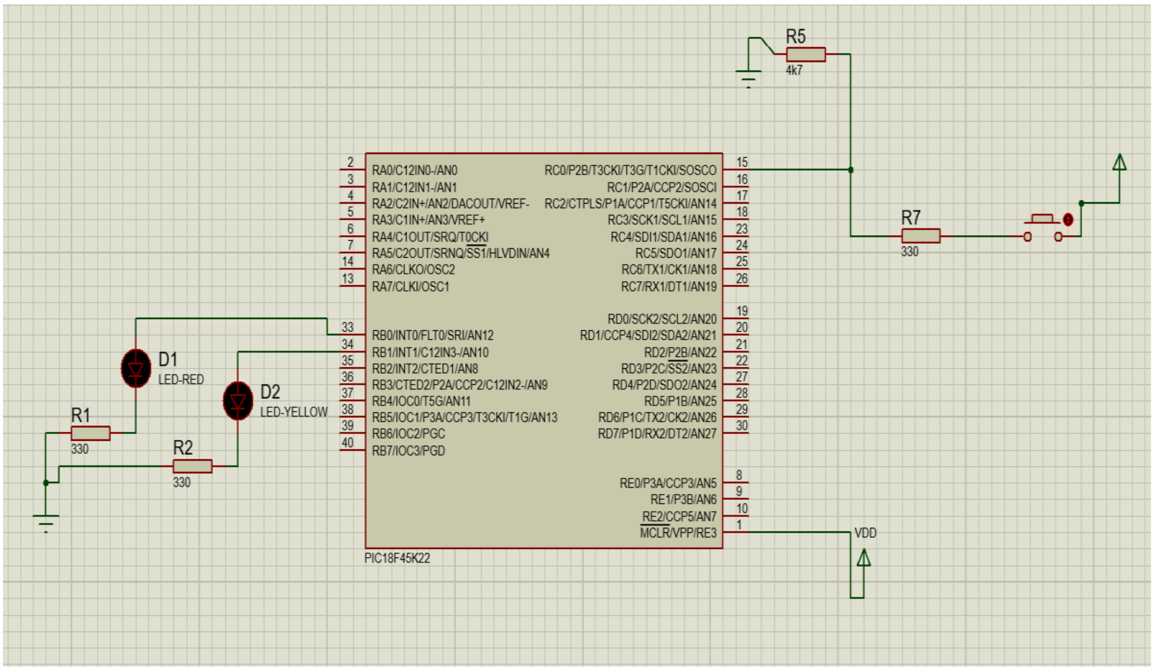


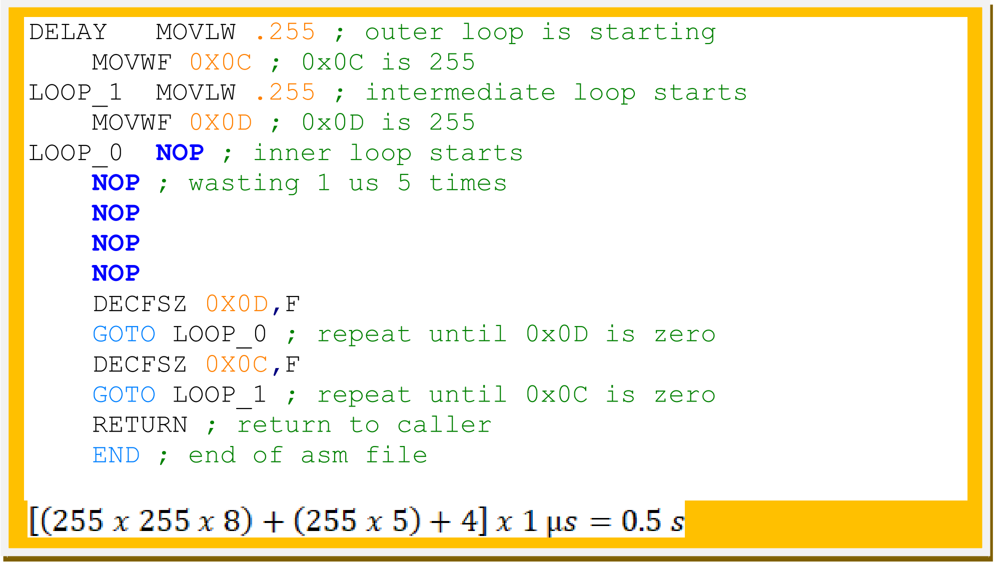
```
DELAY     MOVLW .15 ; first loop is starting
     MOVWF 0x01 ; 0x01 is 15
LOOP_3    MOVLW .255 ; second loop starts
     MOVWF 0x02 ; 0x02 is 255
LOOP_2    MOVLW .255 ; third loop starts
     MOVWF 0x03 ; 0x02 is 255
LOOP_1    NOP ; wasting 1 us 2 times
     NOP
     DECF  0x03,F ; repeat until 0x03 is zero
     BNZ LOOP_1
     DECF 0x02,F ; repeat until 0x02 is zero
     BNZ LOOP_2
     DECF 0x01,F ; repeat until 0x01 is zero
     BNZ LOOP_3
     RETURN ; return to caller
     END ; end of asm file
```

$[(15\ x\ 255\ x\ 255\ x\ 5)+(15\ x\ 255\ x5)+(15\ x\ 5)+4]\ x\ 250\ ns=1.2s$

QUESTION-3 :

Our aim is to see when we press the button connected to RC0, red LED turns on, and turns off after 0.5s. When red LED turns off, yellow LED turns on and turns off after 0.5s. You can see circuit and delay calculation below;





```
DELAY    MOVLW .255 ; outer loop is starting
     MOVWF 0X0C ; 0x0C is 255
LOOP_1   MOVLW .255 ; intermediate loop starts
     MOVWF 0X0D ; 0x0D is 255
LOOP_0   NOP ; inner loop starts
     NOP ; wasting 1 us 5 times
     NOP
     NOP
     NOP
     DECFSZ 0X0D,F
     GOTO LOOP_0 ; repeat until 0x0D is zero
     DECFSZ 0X0C,F
     GOTO LOOP_1 ; repeat until 0x0C is zero
     RETURN ; return to caller
     END ; end of asm file
```

$$[(255\ x\ 255\ x\ 8) + (255\ x\ 5) + 4]\ x\ 1\ \mu s = 0.5\ s$$

Note:

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