Lab Report

TERM: **Spring 2022**

Module: **EE1616 Electronic Workshop**

CLASS: 34092102

BRUNEL ID: 2161047

NAME: Xukang Liu

TUTOR: Guoquan Li

June 2022

PIC Lab 2: PICmicro Basic Programming

0   Aims (5 Marks)

● To further understand this software and assembly language of PICmicro.

● To learn how to work with 7-segments output.

1   Task 1 (10 Marks)

Address /	Name	Hex	Decimal	Binary	Char
005	PORTA	0x00	0	00000000	'.'
006	PORTB	0x0F	15	00001111	'.'
007	PORTC	0x00	0	00000000	'.'
008	PORTD	0x00	0	00000000	'.'
009	PORTE	0x00	0	00000000	'.'
00A	PCLATH	0x00	0	00000000	'.'
00B	INTCON	0x02	2	00000010	'.'
00C	PIR1	0x00	0	00000000	'.'
00D	PIR2	0x00	0	00000000	'.'
00E	TMR1	0x0000	0	00000000 00000000	'..'
00E	TMR1L	0x00	0	00000000	'.'
00F	TMR1H	0x00	0	00000000	'.'
010	T1CON	0x00	0	00000000	'.'
011	TMR2	0x00	0	00000000	'.'
012	T2CON	0x00	0	00000000	'.'
013	SSPBUF	0x00	0	00000000	'.'
014	SSPCON	0x00	0	00000000	'.'
015	CCPR1	0x0000	0	00000000 00000000	'..'
015	CCPR1L	0x00	0	00000000	'.'
016	CCPR1H	0x00	0	00000000	'.'
017	CCP1CON	0x00	0	00000000	'.'
018	RCSTA	0x00	0	00000000	'.'
019	TXREG	0x00	0	00000000	'.'
01A	RCREG	0x00	0	00000000	'.'
01B	CCPR2	0x0000	0	00000000 00000000	'..'
01B	CCPR2L	0x00	0	00000000	'.'
01C	CCPR2H	0x00	0	00000000	'.'
01D	CCP2CON	0x00	0	00000000	'.'

These are the data of SFR, and the binary of "PORTB" is "00001111".

	Line	Address	Opcode	Label	DisAssy
	1	0000	0186	START	CLRF PORTB
	2	0001	1683		BSF STATUS, 0x5
	3	0002	0186		CLRF PORTB
	4	0003	1283		BCF STATUS, 0x5
	5	0004	1406	LOOPIT	BSF PORTB, 0x0
	6	0005	1486		BSF PORTB, 0x1
	7	0006	1506		BSF PORTB, 0x2
⇨	8	0007	1586		BSF PORTB, 0x3
	9	0008	1206		BCF PORTB, 0x4
	10	0009	1286		BCF PORTB, 0x5
	11	000A	1306		BCF PORTB, 0x6
	12	000B	1386		BCF PORTB, 0x7
	13	000C	2804		GOTO 0x4

These are the data of "program memory".
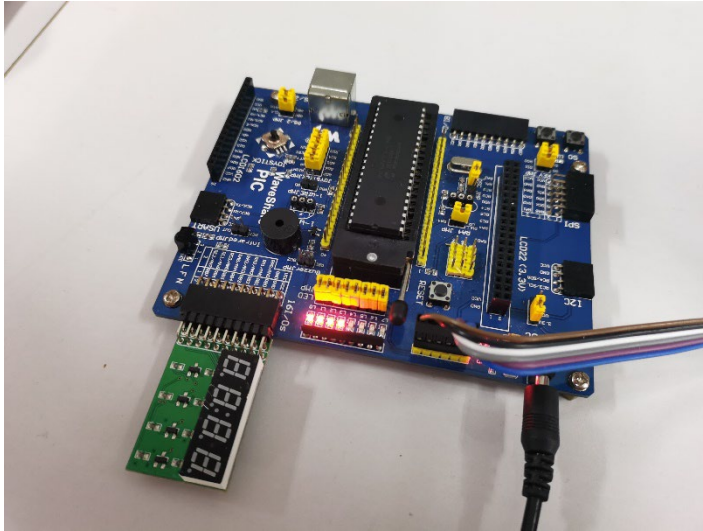
This is my result of task 1. Because I only set pin 0~3 of PORTB to 1, so only four LEDs are on.

2 Task 2 (20 Marks)

```
DELAY MOVLW 255
 MOVWF COUNT1
CLRF COUNT2
MOVWF COUNT2
DELAY1 DECFSZ COUNT1,F
GOTO DELAY2
GOTO COMPLETE
DELAY2 DECFSZ COUNT2,F
GOTO DELAY2
GOTO DELAY1

COMPLETE RETURN
```
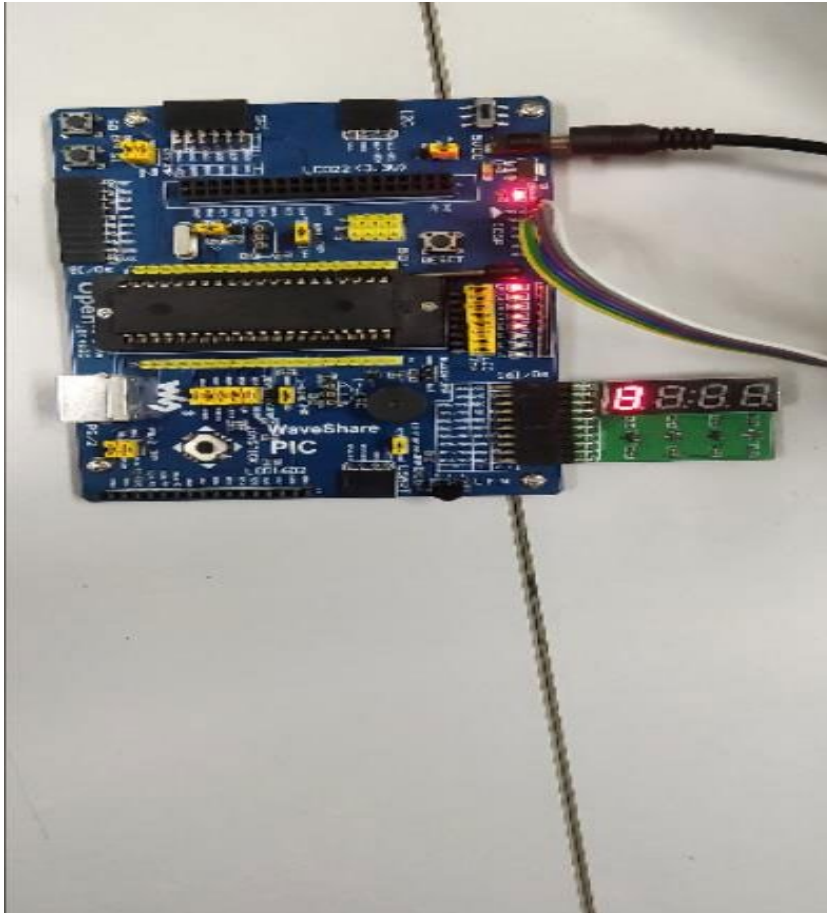
This is my delay subroutine.

3 Task 3 (20 Marks)

```
; Table for decoding 7-segment display (common anode type)
TABLE ADDWF PCL,F
RETLW B'11000000' ;0
RETLW B'11111001' ;1
RETLW B'10100100' ;2
RETLW B'10110000' ;3
RETLW B'10011001' ;4
RETLW B'10010010' ;5
RETLW B'10000010' ;6
RETLW B'11111000' ;7
RETLW B'10000000' ;8
RETLW B'10010000' ;9
```

This is my "TABLE" subroutine.

This is my result. Because I haven't set any delay subroutines, so it will continuously output 0~9. But the frequency is too fast, so I can just see the "8" on the 7-segments LCD.

4 Task 4 (20 Marks)

```
#include "p16f877a.inc"
; __config 0xFF32
__CONFIG _FOSC_HS & _WDTE_OFF & _PWRTE_ON & _BOREN_OFF & _LVP_OFF & _CPD_OFF &
_WRT_OFF & _CP_OFF
;RES_VECT CODE 0x0000 ; processor reset vector


; Define variables
W EQU 0
Z EQU 2
PCL EQU H'02'
PORTA EQU H'05'
PORTB EQU H'06'
COUNT EQU H'21'
COUNT1 EQU H'20' ; define a new variable
COUNT2 EQU H'22' ; define a new variable
STATUS EQU H'03'
TRISA EQU H'85'
TRISB EQU H'86'
OPTION_REG EQU H'81'

; Initialization
ORG 0 ; Program Counter to 0
CLRF PORTB ;
CLRF COUNT ;
BSF STATUS,5 ; BANK1
MOVLW 0x07 ; Hexidecimal value H'07'
MOVWF H'9F' ; Setup the ADCON1 register to make PORTA as digital
CLRF TRISA ; PORTA as output
CLRF TRISB ; PORTB as output
MOVLW B'00000110' ;set timer ratio 1:128
MOVWF OPTION_REG
BCF STATUS,5 ; PAGE0
MOVLW 0X01 ; select the first digit of 7 segment display, 0X02-04 can be used to select 2nd to 4th
digit
MOVWF PORTA ;

;Main codes
LOOP INCF COUNT,F
MOVLW 0X0A
SUBWF COUNT,W
BTFSC STATUS,Z
CLRF COUNT
MOVF COUNT,W
CALL TABLE
MOVWF PORTB
CALL DELAY
GOTO LOOP

; Table for decoding 7-segment display (common anode type)
TABLE ADDWF PCL,F
```

4

```
RETLW B'11000000' ;0
RETLW B'11111001' ;1
RETLW B'10100100';2
RETLW B'10110000';3
RETLW B'10011001';4
RETLW B'10010010';5
RETLW B'10000010';6
RETLW B'11111000';7
RETLW B'10000000';8
RETLW B'10010000' ;9

DELAY MOVLW 255
MOVWF COUNT1
CLRF COUNT2
MOVWF COUNT2
DELAY1 DECFSZ COUNT1,F
GOTO DELAY2
GOTO COMPLETE
DELAY2 DECFSZ COUNT2,F
GOTO DELAY2
GOTO DELAY1
COMPLETE RETURN

END
```

5 Task 5 (20 Marks)

```
1    #include "p16f877a.inc"
2    ; __config 0xFF32
3    __CONFIG _FOSC_HS & _WDTE_OFF & _PWRTE_ON & _BOREN_OFF & _LVP_OFF & _CPD_OFF & _WRT_OFF & _CP_OFF
4    ;RES_VECT CODE 0x0000 ; processor reset vector
5    ; Define variables
6    W EQU 0
7    Z EQU 2
8    PCL EQU H'02'
9    PORTA EQU H'05'
10   PORTB EQU H'06'
11   COUNT EQU H'21'
12   COUNT1 EQU H'20'  ; define a new variable
13   COUNT2 EQU H'22'  ; define a new variable
14   STATUS EQU H'03'
15   TRISA EQU H'85'
16   TRISB EQU H'86'
17   OPTION_REG EQU H'81'
18   ; Initialization
19   ORG 0 ; Program Counter to 0
20   CLRF PORTB ;
21   CLRF COUNT ;
22   BSF STATUS,5 ; BANK1
23   MOVLW 0x07 ; Hexidecimal value H'07'
24   MOVWF H'9F' ; Setup the ADCON1 register to make PORTA as digital
25   CLRF TRISA ; PORTA as output
26   CLRF TRISB ; PORTB as output
27   MOVLW B'00000110' ;set timer ratio 1:128
28   MOVWF OPTION_REG
29   BCF STATUS,5 ; PAGE0
30   LOOP
31   MOVLW 0X01 ; select the first digit of 7 segment display, 0X02-04 can be used to select 2nd to 4th digit
32   MOVWF PORTA ;
```

```
33      LOOP  INCF COUNT, F
34            MOVLW 0X0A
35            SUBWF COUNT, W
36            BTFSC STATUS, Z
37            CLRF COUNT
38            MOVF COUNT, W
39            CALL TABLE
40            MOVWF PORTB
41            CALL DELAY
42            GOTO LOOP
43            ; Table for decoding 7-segment display (common anode type)
44            TABLE ADDWF PCL, F
45            RETLW B'11000000'  ;0
46            RETLW B'11111001'  ;1
47            RETLW B'10100100' ;2
48            RETLW B'10110000' ;3
49            RETLW B'10011001' ;4
50            RETLW B'10010010' ;5
51            RETLW B'10000010' ;6
52            RETLW B'11111000' ;7
53            RETLW B'10000000' ;8
54            RETLW B'10010000'  ;9
55
56            DELAY MOVLW 255
57            MOVWF COUNT1
58            CLRF COUNT2
59            MOVWF COUNT2
60            DELAY1 DECFSZ COUNT1, F
61            GOTO DELAY2
62            GOTO COMPLETE
63            DELAY2 DECFSZ COUNT2, F
64            GOTO DELAY2
65            GOTO DELAY1
66            COMPLETE RETURN
67            END
68
```
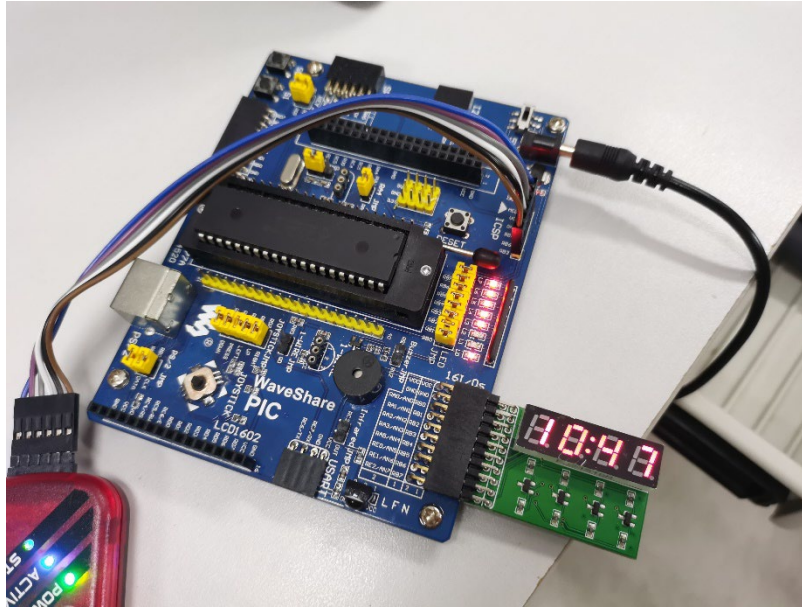
This is my code.

I use 255 as my delay number.

$$\text{Delay} = 1 + 1 + 1 + 1 + \big((254 \times 3 + 2) \times 254 \times 3\big) + 2 + 2 = 582176\mu s = 0.582176s$$

The last number of my Brunel ID is "1047", so the result is correct.

6 Conclusions (5 Marks)

During this experimental class, I further learned PIC16F877 assembly language programming. I can use assembly language to perform 7-segments LCD. Unfortunately, there are many codes I can't identify. So, I am very confused when I write assembly language. So I need more time to learn after class.