

EE 2004

Week 4 Tutorial

Solution

1. Status register

```
10.  MyReg equ 0x20
11.
12.  ;-----
13.
14.          ORG          0x0000
15.          goto Main    ;go to start of main code
16.
17.  ;-----\
18.  ;Start of main program
19.
20.  Main:      movlw 0x57
21.            addlw 0x44
22.
23.            movlw 0x81
24.            movwf MyReg, A
25.            movlw 0x89
26.            addwfc MyReg, W, A
27.
28.            movlw 0x78
29.            subwf MyReg, W, A
30.
31.            movlw 0x99
32.            xorwf MyReg, W, A
33.
34.            movlw 0x0F
35.            iorwf MyReg, W, A
36.
37.  ;*****
38.  ;End of program
39.  ;
40.          END
```

Determine the N, OV, C, DC and Z flags by hand after the execution of the bold lines in the above code fragment and then use MPLAB to verify your results.

Line 21

$$\begin{array}{r} 57 \\ 44 \\ \hline 9B \end{array}$$

$$DC = 0$$

$$C = 0$$

$$Z = 0$$

$$N = 1$$

$$OV = 1 \quad (\because \text{pos} + \text{pos} = \text{neg})$$

Line 26

$$\begin{array}{r} 81 \\ .89 \\ \hline 0A \end{array}$$

$$DC = 0$$

$$C = 1$$

$$Z = 0$$

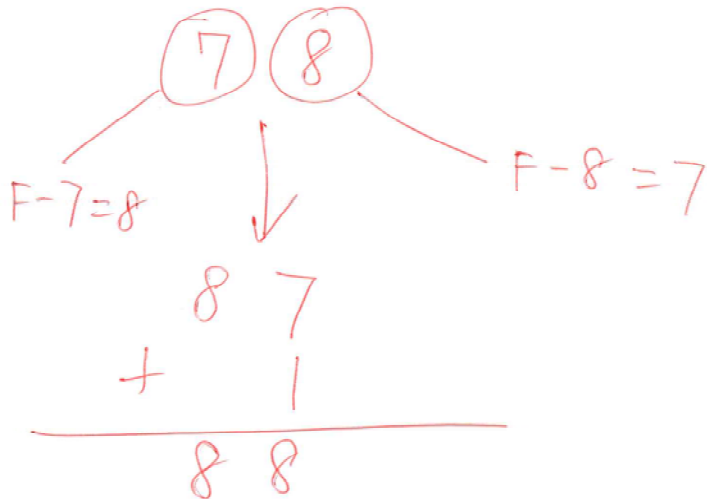
$$N = 0$$

$$OV = 1 \quad (\because \text{neg} + \text{neg} = \text{pos})$$

Line 29

subwf doing $81 - 78$

need to obtain 2's complement for 78



∴ We work with $0A + 88$

$$\begin{array}{r} 81 \\ .88 \\ \hline 09 \end{array}$$

DC = 0

C = 1

Z = 0

N = 0

OV = 1 (∵ neg + neg = pos)

Note that only N and Z are affected by xorwf and iorwf

Line 32

99 xor 81

99 → 10011001

81 → 10000001

00011000

DC, C and OV are inherited from

Line 29, i.e., DC=0

C=1

N=0

OV=1

Z=0

Line 35

81 → 10000001

ior

0F → 00001111

10001111

N=1

DC=0

Z=0

C=1

OV=1

2. BCD addition

Generate a MPLAB IDE project as in Tutorial MPLAB for Week 3. Write a program to perform an addition of the decimal numbers 4780 and 3599.

```
LIST P=18F4520 ;directive to define processor
#include <P18F4520.INC>
;processor specific variable definitions

;-----
CBLOCK 0x000
HighByte
LowByte
endc

ORG      0x0000
bra     Main ;go to start of main code

;-----
;Start of main program

Main:    clrf    HighByte, A
         clrf    LowByte, A
         movlw   0x80
         addlw   0x99
         daw
         movwf   LowByte, A

         movlw   0x47
         movwf   HighByte, A
         movlw   0x35
         addwfc   HighByte, F, A
         movf    HighByte, W, A; Note here we need to move the
                                ;result to WREG for daw to adjust
         daw
         movwf   HighByte, A
         bra     $; prevent the program to getting further

;*****
;End of program
;

END
```

Code\Tutorial4\Tutorial4c.asm

```

;-----
Main:  clrf  HighByte, A
      clrf  LowByte, A
; Low Byte
      movlw 0x80
      addlw 0x99
      daw
      movwf LowByte, A
; High Byte
      movlw 0x47
      movwf HighByte, A
      movlw 0x35
      addwfc HighByte, F, A

```

Add SFR
STATUS
Add Symbol
_BOREN_NOSLP_2L

Update	Address	Symbol Name	Value
	FE8	WREG	0x79
	FD8	STATUS	0x09
	000	A	0x00
	001	ADCS1	0x79

Watch 1
Watch 2
Watch 3
Watch 4

Code\Tutorial4\Tutorial4c.asm

```

      clrf  LowByte, A
; Low Byte
      movlw 0x80
      addlw 0x99
      daw
      movwf LowByte, A
; High Byte
      movlw 0x47
      movwf HighByte, A
      movlw 0x35
      addwfc HighByte, F, A
      movf  HighByte, W, A; Note here we need to move the
;result to WREG for daw to adjust
      daw

```

Add SFR
STATUS
Add Symbol
_BOREN_NOSLP_2L

Update	Address	Symbol Name	Value
	FE8	WREG	0x35
	FD8	STATUS	0x09
	000	A	0x47
	001	ADCS1	0x79

Watch 1
Watch 2
Watch 3
Watch 4

Code\Tutorial4\Tutorial4c.asm

```

      movwf LowByte, A
; High Byte
      movlw 0x47
      movwf HighByte, A
      movlw 0x35
      addwfc HighByte, F, A
      movf  HighByte, W, A; Note here we need to move the
;result to WREG for daw to adjust
      daw
      movwf HighByte, A
      bra  $; prevent the program to getting further
;*****
;End of program

```

Add SFR
STATUS
Add Symbol
_BOREN_NOSLP_2L

Update	Address	Symbol Name	Value
	FE8	WREG	0x83
	FD8	STATUS	0x00
	000	A	0x83
	001	ADCS1	0x79

Watch 1
Watch 2
Watch 3
Watch 4