

EECE.3170: Microprocessor Systems Design I

Spring 2016

Homework 6 Solution

Show the result of each PIC 16F1829 instruction in the sequences below. Be sure to show not only the state of updated registers, but also the carry (C) and zero (Z) bits. You should assume that the carry bit is initially 0 for each sequence.

Each sequence is worth 25 points.

a. 1. cblock 0x20

x
endc

movlw 0x05 **W = 0x05**

sublw 0x15 **W = 0x15 - W = 0x15 - 0x05 = 0x10**

clrf x **x = 0x00**

comf x, F **x = ~x = ~0x00 = 0xFF**

xorwf x, F **x = x XOR W = 0xFF XOR 0x10 = 0xEF**

swapf x, W **W = value in x with nibbles swapped = 0xFE**

btfsc x, 7 **Test bit 7 of x and skip next instruction if bit is 0**
→ x = 0xEF = 1110 1111₂ → bit 7 = 1 → do not skip

bsf x, 0 **Set bit 0 of x → x = 1110 1111₂ before set**
→ No change, since bit 0 already is 1

b. cblock 0x20
 A
 B
endc

clrf	A	$A = 0x00$
movlw	0x11	$W = 0x11$
movwf	B	$B = W = 0x11$
addlw	0x34	$W = W + 0x34 = 0x11 + 0x34 = 0x45$
subwf	A, F	$A = A - W = 0x00 - 0x45 = 0xBB$
comf	A, W	$W = \sim A = \sim 0xBB = 0x44$
swapf	A, F	Swap nibbles of A $\rightarrow A = 0xBB$

c. cblock 0x40
 var1
endc

movlw	0x1E	$W = 0x1E$
movwf	var1	$var1 = W = 0x1E$
rrf	var1, F	Rotate var1 1 bit right through carry $\rightarrow (var1, C) = 0001\ 1110\ 0$ rotated right $\rightarrow (var1, C) = 0000\ 1111\ 0$ $\rightarrow var1 = 0x0F, C = 0$
xorwf	var1, W	$W = var1 \text{ XOR } W = 0x0F \text{ XOR } 0x1E$ $= 0000\ 1111 \text{ XOR } 0001\ 1110$ $= 0001\ 0001 = 0x11$
btfss	var1, 4	Test bit 4 of var1; skip next instruction if bit = 1 $\rightarrow var1 = 0x0F = 0000\ 1111$ \rightarrow Bit is 0 \rightarrow <u>do not skip</u>
iorlw	0x06	$W = W \text{ OR } 0x06 = 0x11 \text{ OR } 0x06$ $= 0001\ 0001 \text{ OR } 0000\ 0110$ $= 0001\ 0111 = 0x17$
andwf	var1, F	$var1 = var1 \text{ AND } W = 0x0F \text{ AND } 0x17$ $= 0000\ 1111 \text{ AND } 0001\ 0111$ $= 0000\ 0111 = 0x07$
bcf	var1, 0	Clear bit 0 of var1 $\rightarrow var1 = 0x07 = 0000\ 0111$ \rightarrow After clear, $var1 = 0000\ 0110 = 0x06$

d. cblock 0x70
 num1, num2
 endc

movlw	0xAA	$W = 0xAA$
andlw	0x0F	$W = W \text{ AND } 0x0F = 0xAA \text{ AND } 0x0F = 0x0A$
movwf	num1	$num1 = W = 0x0A$
xorlw	0xFF	$W = W \text{ XOR } 0xFF = 0x0A \text{ XOR } 0xFF = 0xF5$
movwf	num2	$num2 = W = 0xF5$
asrf	num2, F	$num2 = num2 \gg 1$ (keep sign intact) $= 0xF5 \gg 1 = 0x1111\ 0101 \gg 1$ $= 0x1111\ 1010 = 0xFA$ $C = \text{bit shifted out} = 1$
lslf	num1, W	$W = num1 \ll 1 = 0x0A \ll 1$ $= 0000\ 1010 \ll 1 = 0001\ 0100 = 0x14$ $C = \text{bit shifted out} = 0$
xorwf	num2, F	$num2 = num2 \text{ XOR } W = 0xFA \text{ XOR } 0x14 = 0xEE$
comf	num2, W	$W = \sim num2$ (flip all bits of num2) $= \sim 0xEE = 0x11$