

Assemble and run the following programs using the PIC18 Simulator IDE. Your solution should include a flowchart, the assembler listing, and an annotated screen capture of the simulator showing the final register values.

1. Modify the Data Copy program (IP5-6) to copy only the negative numbers from the SOURCE to a BUFFER starting at 0x20.

SOURCE (Hex): E3, 72, 5D, 81, CC, 34

2. Modify the Highest Temperature program (IP6-4) to count the number of positive readings and copy them to a new table.

BUFFER (Hex): 66, 88, 75, F2, CA, 00

① Modify Data Copy : Copy only negative numbers



MOVLW 6
MOVWF COUNTER

⋮

MOVF TABLAT, W

BNN SKIP

MOVWF POSTINC0

SKIP: DECF COUNTER, F

BNZ NEXT

- E3 SOURCE

+ 72

+ 50

- 81

- CC

+ 34

0x20 E3 BUFFER

0x21 81

0x22 CC

PIC ASSEMBLER LISTING

Line	Address	Opcode	Instruction	
0001	000000		;Line removed by MPASMWIN preprocessor:	Title "HW4-1 Data Copy on1
0002	000000		;Line removed by MPASMWIN preprocessor:	List p=18F452, f =inhx32
0003	000000		;Line removed by MPASMWIN preprocessor:	#include <p18F452.inc>
0004	000000			
0005	000000		BUFFER EQU 0x20	;Begin data registers
0006	000000		COUNTER EQU 0x01	;Counter is REG01
0007	000000		ORG 0x00	;Reset vector
0008	000000	EF10	GOTO START	
0008	000002	F000		
0009	000004			
0010	000004		ORG 0x20	
0011	000020	0E00	START: MOVLW 0x00	;Init PORTC as an output port
0012	000022	6E94	MOVWF TRISC	
0013	000024	0E06	MOVLW 0x06	;Init COUNTER=6
0014	000026	6E01	MOVWF COUNTER	
0015	000028	EE00	LFSR FSR0,BUFFER	;Init FSR0 pointer
0015	00002A	F020		
0016	00002C	0E00	MOVLW UPPER SOURCE	;Init Table Pointer
0017	00002E	6EF8	MOVWF TBLPTRU	
0018	000030	0E00	MOVLW HIGH SOURCE	
0019	000032	6EF7	MOVWF TBLPTRH	
0020	000034	0E50	MOVLW LOW SOURCE	
0021	000036	6EF6	MOVWF TBLPTRL	
0022	000038	0009	NEXT: TBLRD*+	;Copy byte to Table Latch and inc
0023	00003A	50F5	MOVF TABLAT,W	;Copy byte to W
0024	00003C	E701	BNN SKIP	;Check for Negative
0025	00003E	6EEE	MOVWF POSTINC0	;Copy byte to data register and in
0026	000040	0601	SKIP: DECF COUNTER,F	;Decrement counter
0027	000042	E1FA	BNZ NEXT	;Counter=0?
0028	000044	0EFF	MOVLW 0xFF	;Load completion indicator
0029	000046	6E82	MOVWF PORTC	;Turn on all LEDs at PORTC
0030	000048	0003	SLEEP	
0031	00004A			
0032	00004A		ORG 0x50	;Data Bytes
0033	000050	72E3	SOURCE: DB 0xE3,0x72,0x5D,0x81,0xCC,0x34	
0033	000052	815D		
0033	000054	34CC		
0034	000056			
0035	000056		END	

Number of errors = 0

PIC18 Simulator IDE

File Simulation Rate Tools Options Help

Program Location C:\Hayne\ELEC330\Homework\HW4-1.hex

Microcontroller PIC18F452 Clock Frequency 10.0 MHz

Last Instruction SLEEP Next Instruction SLEEP

Instructions Counter 48 Clock Cycles Counter 260

Program Counter and Working Register

PC 000048

W Register (WREG) FF

Real Time Duration 26.00 μ s

Special Function Registers (SFRs)

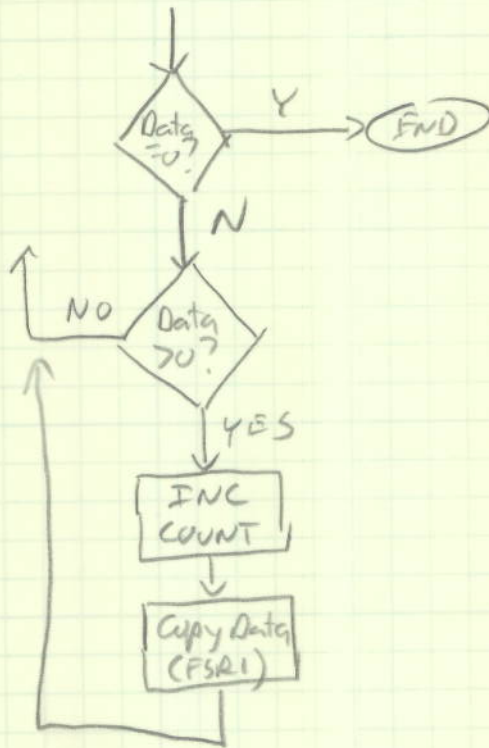
Address and Name	Hex Value	Binary Value
		7 6 5 4 3 2 1 0
FF8h TBLPTRU	00	
FF7h TBLPTRH	00	
FF6h TBLPTRL	56	
FF5h TABLAT	34	
FF4h PRODH	00	
FF3h PRODL	00	
FF2h INTCON1	00	
FF1h INTCON2	F5	
FF0h INTCON3	C0	
FEAh FSR0H	00	
FE9h FSR0L	23	
FE8h WREG	FF	
FE2h FSR1H	00	
FE1h FSR1L	00	
FE0h BSR	00	
FDAh FSR2H	00	

General Purpose Registers (GPRs)

Addr.	Hex Value	Addr.	Hex Value
010h	00	020h	E3
011h	00	021h	81
012h	00	022h	CC
013h	00	023h	00
014h	00	024h	00
015h	00	025h	00
016h	00	026h	00
017h	00	027h	00
018h	00	028h	00
019h	00	029h	00
01Ah	00	02Ah	00
01Bh	00	02Bh	00
01Ch	00	02Ch	00
01Dh	00	02Dh	00
01Eh	00	02Eh	00
01Fh	00	02Fh	00

Buffer

(2) Modify Highest Temp: Count positive + copy



COUNT EQU 0x20
POS EQU 0x21

CLRF COUNT
LFSR FSR1, POS

BZ FINISH ; Data > 0?

BTFSB WREG, 7 ; Data > 70?

BRA NEXT

INCF COUNT, F

MOVF POS, INCL

BRA NEXT

0x10 + 66 BUFFER
- 88
+ 75
- F2
- CA
00

0x21 66 POS ← FSR1
75

0x20 02 Count

IC ASSEMBLER LISTING

Line	Address	Opcode	Instruction	
0001	000000		;Line removed by MPASMWIN preprocessor:	Title "HW4-2: Positive Tem
0002	000000		;Line removed by MPASMWIN preprocessor:	List p=18F452, f =inhx32
0003	000000		;Line removed by MPASMWIN preprocessor:	#include <p18F452.inc>
0004	000000			
0005	000000		BUFFER EQU 0x10	;Define Data Registers
0006	000000		COUNT EQU 0x20	
0007	000000		POS EQU 0x21	
0008	000000			
0009	000000		ORG 0x00	;Reset Vector
0010	000000	EF10	GOTO START	
0010	000002	F000		
0011	000004			
0012	000004		ORG 0x20	
0013	000020	6A20	START: CLRF COUNT	;Init Count
0014	000022	EE00	LFSR FSR0,BUFFER	;Init Pointers
0014	000024	F010		
0015	000026	EE10	LFSR FSR1,POS	
0015	000028	F021		
0016	00002A	50EE	NEXT: MOVF POSTINC0,W	;Copy data byte to WREG
0017	00002C	E005	BZ FINISH	;Data = 0?
0018	00002E	BEE8	BTFSC WREG,7	;Data < 0?
0019	000030	D7FC	BRA NEXT	
0020	000032	2A20	INCF COUNT,F	;Inc count
0021	000034	6EE6	MOVWF POSTINC1	;Copy to new table
0022	000036	D7F9	BRA NEXT	;Go back and check next byte
0023	000038	0003	FINISH: SLEEP	
0024	00003A		END	

Number of errors = 0

PIC18 Simulator IDE

File Simulation Rate Tools Options Help

Program Location C:\Hayne\ELEC330\Homework\HW4-2.hex

Microcontroller PIC18F452 Clock Frequency 10.0 MHz

Last Instruction

SLEEP

Next Instruction

SLEEP

Instructions Counter 31

Clock Cycles Counter 172

Program Counter and Working Register

PC 000038

W Register (WREG) 00

Real Time
Duration

17.20 μ s

Special Function Registers (SFRs)

Address and Name	Hex Value	Binary Value
		7 6 5 4 3 2 1 0
FEAh FSR0H	00	
FE9h FSR0L	16	
FE8h WREG	00	
FE2h FSR1H	00	
FE1h FSR1L	23	
FE0h BSR	00	
FDAh FSR2H	00	
FD9h FSR2L	00	
FD8h STATUS	04	
FD7h TMR0H	00	
FD6h TMR0L	00	
FD5h TOCON	FF	
FD3h OSCCON	00	
FD2h LVDCON	05	
FD1h WDTCON	00	
FD0h RCON	18	

General Purpose Registers (GPRs)

Addr.	Hex Value	Addr.	Hex Value
010h	66	020h	02
011h	88	021h	66
012h	75	022h	75
013h	F2	023h	00
014h	CA	024h	00
015h	00	025h	00
016h	00	026h	00
017h	00	027h	00
018h	00	028h	00
019h	00	029h	00
01Ah	00	02Ah	00
01Bh	00	02Bh	00
01Ch	00	02Ch	00
01Dh	00	02Dh	00
01Eh	00	02Eh	00
01Fh	00	02Fh	00

Buffer

Count

POS