

Chapter 2. Problems

"All programming problems should include design pseudo code either as a separate design document on embedded comments in the code."

1S. What is the difference between program and data memory? Is there any benefit in keeping the data memory path and program memory separate? Explain your answer.

Solution

Program memory is reserved for executable codes while the data memory is used for storing data. Having separate Memory allows for increased speed through parallelism.

1U. Does the PICmicro example used in the class material (18F1220) have on-board program or data memory? If yes, how much of each type is on-board.

Solution

2S. What are the different types of PICmicro instructions? Briefly explain each type of instruction.

Solution

- * Byte-Oriented operations
- * Bit-Oriented operations
- * Control Operations
- * Literal Operations
- * Memory-Block Operations

2U. How many bytes are required to represent each of the following instructions:

BRA
GOTO
MOVLW
ADDWF

Solution

3S. Write the machine code equivalent to the following Instruction set:

Loop:	MOVLW	0x0F
	ADDWF	0x40,1,0
	BSF	0x40,3

Solution

<u>Machine Code (Hex)</u>			
0E0F	Loop:	MOVLW	0x0F
2640		ADDWF	0x40,1,0
8740		BSF	0x40,3

Note: "a" is assumed to be one.

3U. Write the machine code equivalent to the following Instruction set:

Loop:	MOVWF	0x43	
	ADDLW	.23	; note "." Ensure the number is in decimal
	BCF	0x43,3	

Solution

4S. Write the following C code in PICmicro assembly language:

```
unsigned char temp;  
temp = temp + 3;
```

Solution

```
temp    equ    0x80                ; Assign temp to a GPR location  
  
        MOVF    temp,0  
        ADDLW    3  
        MOVWF    temp
```

4U. Write the following C code in PICmicro assembly language:

```
unsigned char First, Step;  
First = 25;  
Step = First + 1;
```

Solution

5S. What are the start and end address of PICmicro on-board program memory?

Solution

- * On board program memory starts from 0000h to 0FFFh
- * Program memory can be expanded to 1FFFFFFh

5U. What are the start and end address of PICmicro on-board data memory?

Solution

6S. Describe the function performed if program memory containing the following data at the time of reset:

<u>Address</u>	<u>Content</u>
0x000	0xEF94
0x002	0xF000
0x004	0x0012
...	...
0x128	0x0E01
0x12A	ADDWF 0x49,1
0x12C	0xD7FD
0x12E	0xD7F4
0x130	0x6EF6

Solution

<u>Address</u>	<u>Content</u>	<u>Assembly Code</u>
0x000	0xEF94	GOTO Loop
0x002	0xF000	
0x004	0x0012	
...	...	
0x128	0x0E01	Loop: MOVLW 0x1
0x12A	ADDWF 0x49,1	ADDWF 0x49,1
0x12C	0xD7FD	BRA LOOP
0x12E	0xD7F4	0xD7F4
0x130	0x6EF6	0x6EF6

6U. Describe the function performed if program memory contains the following data at the time of reset:

<u>Address</u>	<u>Content</u>
0x000	0xEFA1`
0x002	0xF000
0x004	0x0012
...	...
0x142	0x0E01
0x144	ADDWF 0x49,1
0x146	0xD7FD
0x148	0xD7F4
0x14A	0x6EF6

Solution

7S. Write an assembly code segment that implements the following C language code segment:

```
// Assume oper1 and oper2 are one byte each and are stored in registers 0x43 and 0x54
If ((oper1 + oper2) > 255){
    oper1 = 0x12;
    oper2 = 0x20;
}
```

Solution

MOVF	0x43,0	
ADDWF	0x54,0	
BNC	SKIP	; Test < 255 by checking for no carry
MOVLW	0x12	
MOVWF	0x43,1	
MOVLW	0x20	

MOVWF 0x54,1
SKIP:

7U. Write an assembly code segment that implements the following C language code segment:

```
// Assume oper1 and oper2 are one byte each and are stored in registers 0x47 and 0x62
If ((oper1 + oper 2) == 0){
    oper1 = 0x24;
    oper2 = 0x06;
}
```

Solution

8S. Using only instructions presented in this chapter, write a program that will increment register 0x43 from its current value until it reaches 255.

Solution

```
LOOP:    INCF    0x43,1
          BNC     LOOP
          DECF    0x43,1
```

8U. Write a PIC micro assembly code segment that adds the numerical equivalent of your birthday, month and 2 digit birth year. Move the resulting sum to Wreg. Include the following in your solution:

- a) Your birth date
- b) Assembly code
- c) Machine code

Solution

9S. If using a=0 (BSR is ignored) what is the range of data memory allocated to GPR and SFR?

Solution: (note: all addresses are in hex)

for a=1 (default):

GPR is located at 080 – 0FFh and accessible at 080 –0FFH (for BFS<3:0>=0 which is default)

GPR is located at 400 – 4FFh and accessible at 080 –0FFH (for BFS<3:0>=4 which is default)

SFR is located at F00 - FFFh (always)

for a=0:

GPR is located at 000 – 07Fh and accessible at 080-0FFH(always)

SFR is located and accessible at F80 - FFFh (always)

9U. If using a=1 (BSR is set 2) what is the range of data memory allocated to GPR and SFR, and from what location are they accessible?

Solution