

Student Worksheet

Assembly Language Programming
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LAB 2 8051 Programming Registers

Student ID	
Name	
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Tools and Materials

1. MTK51 8051 Microcontroller Trainer Kit

Table 2-1. Location of the 8051 registers

Registers	Location	Function
P0	80H*	Port 0
SP	81H	Stack Pointer
DPL	82H	Data Pointer (Low byte)
DPH	83H	Data Pointer (High byte)
TCON	88H*	Timer Control
TMOD	89H	Timer Mode
TL0	8AH	Timer0 Low byte
TH0	8CH	Timer0 High byte
TL1	8BH	Timer1 Low byte
TH1	8DH	Timer1 High byte
P1	90H*	Port 1
SCON	98H*	Serial Port Control
SBUF	99H	Serial Port Data
P2	A0H*	Port 2
IE	A8H*	Interrupt Enable Register
P3	B0H*	Port 3
IP	B8H*	Interrupt Priority
PSW	D0H*	Program Status Word
ACC	E0H*	Accumulator
B	F0H*	B register
R0	00	R0
R1	01	R1
R2	02	R2
R3	03	R3
R4	04	R4
R5	05	R5
R6	06	R6
R7	07	R7

*bit addressable register. The bit address can find by adding 0-7 to the byte address, e.g. bit 7 of PORT P1 is $90H+07=97H$ (P1.7).

R0-R7 are general purpose registers and the shown locations (00-07) are for BANK0.

Exercises

1. Find the HEX code of below instructions using Table 2-1 and the 8051 instruction sheet.
2. Enter the HEX code to the MTK51 memory and use **Single Step running**. Find the answer below.

Move data one byte from external memory to internal memory				
ADDRESS	HEX code	Label	Instruction	Comment
9000		START	MOV DPTR,#E000H	
			MOVX A,@DPTR	
			MOV R0, A	A=?
			MOV R1,#30H	R1=?
			MOV @R1,A	[30H]=? [E000H]=?

Q. If we change the location from E000H to 9000H, what is the data written to location 30H?

A. _____

Instead of reading the data from external memory and write to the internal memory, write the code that reads data at location 31H (internal) and write it to external memory at location E001H.

Handcode and test it with single step.

ADDRESS	HEX code	Label	Instruction	Comment
9000		START		

Q. After the code has been executed, what is the data at location 31H (internal) and E001H (external)?

A. [31H]=_____ [E001H]= _____

GPIO3 indicates accumulator content in single step running				
ADDRESS	HEX code	Label	Instruction	Comment
9000			MOV A,#0	A=?
		LOOP	INC A	A=?
	80 XX		SJMP LOOP	XX=?

Offset byte calculation can be computed using ALT OFFSET

Finding by hand calculation is done by,

OFFSET=DESTINATION-PC.

The DESTINATION is the location where we will jump to and the PC is current program counter after the jump instruction has been fetched.

For example if the DESTINATION is 9002 and the PC is 9005. The OFFSET will be $9002-9005=-3$. We make the signed number easily using 2's complement notation.

Here is the positive number 3 in 8-bit binary, 0000 0011. We make -3 by 2's complement. $1111\ 1100+1 = 1111\ 1101$ or FA.

Now try read the data from SCON register.

Read SCON and write to accumulator A and B				
ADDRESS	HEX code	Label	Instruction	Comment
9000			MOV A,SCON	A=?
			MOV B,A	B=?

Q. What is the location of the serial control register (SCON)?

A. _____

Change the SCON in above code to TMOD register. Single step the code and answer below question.

Q. What is the value of TMOD register?

A. _____

The SCON and TMOD are the example of registers that used to control the serial port and internal timer. We will learn on later how to use them.

Q. Can you find the instruction MOV A,SCON or MOV A,TMOD in the 8051 instruction sheet? What is the addressing mode that used to access such registers?

A. _____

Using R7 for repeating code				
ADDRESS	HEX code	Label	Instruction	Comment
9000			MOV R7,#0	
		HERE	DJNZ R7,HERE	
			CLR P1.7	

Before pressing the STEP key, press REG. to select user register display for R4-7.

Q. How many times the instruction DJNZ R7 will be repeated?

A. _____

Q. What is the location of bit 7 of the PORT P1? When the LED (P1.7) will be turned ON?

A. _____

Adding 16-bit number using R0 (low byte), R1 (high byte) and DPL, DPH				
$\begin{array}{r} \text{R1 R0} \\ + \\ \text{DPH DPL} \\ \hline \end{array}$				
ADDRESS	HEX code	Label	Instruction	Comment
9000			MOV R0,#FFH	
			MOV R1,#1FH	
			MOV DPL,#1	
			MOV DPH,#0	
			MOV A,DPL	
			ADD A,R0	Cy=?
			MOV R0,A	
			MOV A,DPH	
			ADDC A,R1	Cy=?
			MOV R1,A	

Q. What is the result of addition?

A. R1=_____ R0 = _____

Q. Change the value from 1FFF in R1, R0 and 0001 in DPH,DPL to the new two 16-bit numbers i.e. 2FFF + 9E78.

A. compute by hand calculation (HEX)=_____

2FFF	0010 1111 1111 1111
9E78 +	1001 1110 0111 1000 +

The result by single stepping the code R1, R0(HEX) = _____