MICROPROCESSOR

Tutorials

A
### ASSIGNMENT THREE

2) What's the difference among these symbols Rn, Rx and Ri in the MCS-51 instructions? Give an example for each one.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
<th>Example Instruction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rn</td>
<td>Indicates the Register from R0 to R7 of the selected bank</td>
<td>MOV R5, #55h</td>
</tr>
</tbody>
</table>
| Rx     | Indicates:  
- Any register name of the internal RAM  
- Any Address of the internal RAM location  
  (from 00h to FFh) or (from 0 to 255) | MOV PSW, B  
MOV 40h, 20H |
| @Ri    | Indicates the indirect 8-bit address of internal or external RAM location  
(i = 1 or 0 only) | INC @R0  
DEC @R1 |
7) Clarify the execution of the instruction “PUSH 0AH” and “POP 0BH” with suitable block diagram when SP=1Fh and 30h respectively.

Assume any required values
7) Clarify the execution of the instruction “PUSH 0AH” and “POP 0BH” with suitable block diagram when SP=1Fh and 30h respectively.

Assume any required values

Pop 0BH
11) Draw block diagram and write assembly subprogram to read 2 data-bytes. The first one from the internal program memory at address "0100h" and the second one from the external program memory at address "1200h" and store them into 2 successive external RAM locations starting from address "1000h" using the data transfer instructions of MCS-51.
INCLUDE 8051.mc
org 0
SJMP main
org 30h
main:
CLR A
MOV DPTR, #100h
MOVC A, @A+DPTR

MOV DPTR, #1000h
MOVX  @DPTR, A

;------------------------
CLR A
MOV DPTR, #1200h
MOVC A, @A+DPTR

MOV DPTR, #1001h
MOVX  @DPTR, A

END
EA = 1 internal
EA = 0 external
Based on R5 of AT89C51; write assembly code to achieve the sequence operations for the following block diagram.

Keep the data in R5 without change at the end of subprogram

\[ R_n = R_5 \equiv R_x = 05h \]
MOV P3, #0FFh
MOV A, R5 ; STORE DATA OF R5
MOV 05H, P3
XRL 05H, #A1H
ORL 05H, #20H
ANL 05H, A
MOV P0, 05H
MOV R5, A ; RETRIEVE DATA OF R5
 ASSIGNMENT FIVE

7) Robot has 2 Servo motors; Write assembly program based on MCS-51 to calculate the instantaneous total electrical power and display it on 7-segments. Check your program if the 2 motors consumed power 60 mw and 70 mw.
INCLUDE 8051.mc

MOV P1, #FFH ; make P1 as input port
MOV P2, #FFH ; make P2 as input port

MOV A, P1 ; Read p1 to A (power of motor 1)
MOV B, P2 ; Read p2 to B (power of motor 2)

ADD A, B  ; B + A (total power)
DA A     ; Decimal adjusting

MOV P0, A ; out lower 2 digits to P0
MOV P3.7, C ; out upper digits
\[
\begin{array}{c}
A \quad \text{Binary} \quad \text{HEX} \\
\hline
01100000 \quad 60h \\
+ \\
\text{Reg}_B \quad 01110000 \quad 70h \\
\hline
A \quad 11010000 \quad D0h
\end{array}
\]

\[(A_{0\rightarrow3}) < 9 \quad \text{and} \quad AC \neq 1 \quad \text{then} \quad (A_{0\rightarrow3}) + 0h\]

\[(A_{4\rightarrow7}) > 9 \quad \text{then} \quad (A_{4\rightarrow7}) + 60h\]

\[
\begin{array}{c}
0h \rightarrow AC = 0 \quad \text{and} \quad A_{0\rightarrow3} = 0 \\
\hline
\text{Dh} > 9h \text{ then} \\
(Dh + AC = 0) + 6 = 13h \rightarrow CY = 1 \quad \text{and} \quad A_{4\rightarrow7} = 3 \\
DA \ (A) = 30h
\end{array}
\]
INCLUDE 8051.mc

MOV P1, #FFH  ; make P1 as input port
MOV P2, #FFH  ; make P2 as input port

MOV A, P1    ; Read p1 to A (power of motor 1)
MOV B, P2    ; Read p2 to B (power of motor 2)

ADD A, B     ; B + A (total power)
DA A          ; Decimal adjusting

MOV P0, A    ; out lower 2 digits to P0
MOV P3.7, C  ; out upper digits

P0

P3.7

180
ASSIGNMENT SEVEN

20) Using branching-instructions (LCALL, RET and LJMP) to collect three subprograms for robotic SYSTEM (MOTION, DELAY and ROTATION) in single main assembly program.
org 0
SJMP main
org 30h
main:
ACALL MOTION
ACALL DELAY
ACALL ROTATION
SJMP MAIN
;------------
ROTATION:
;------INSTRUCTIONS
RET
;------------
;------------
DELAY:
;------INSTRUCTIONS
RET
;------------
MOTION:
;------INSTRUCTIONS
RET
END
19) Based on MCS-51 family’s instruction set, calculate the delay time duration for the following subprogram (the frequency of crystal oscillator = 16 MHz).

```
DELAY:
    MOV R3,#200 ; 1 MCs
WAIT_2:
    MOV R5,#250 ; 1 MCs
    NOP ; 1 MCs
    NOP ; 1 MCs
    NOP
    DJNZ R5,Wait_1 ; 2 MCs
    DJNZ R3, Wait_2 ; 2 MCs
    RET ; 2 MCs
```
The answer

Machine cycles for $\text{Wait}_1 = 250(1 + 1 + 1 + 2) = 1250$

Machine cycles for $\text{Wait}_2 = 200(1 + 1250 + 2) = 250600$

Delay time = Total number of machine cycles $\times \frac{12}{\text{Crystal frequency}}$

$= [1 + 250600 + 2] \times \frac{12}{16000000} = 187952 \times 10^{-6}$

$\approx 0.188$ s