

Table 1 – Data Transfer Instructions

Mnemonic	Instruction code								Hexa - decimal	Explanation	No. of MC
	D ₇	D ₆	D ₅	D ₄	D ₃	D ₂	D ₁	D ₀			
MOV A, Rn	1	1	1	0	1	n ₂	n ₁	n ₀	E8 ÷ EF	A ← Rn	1
MOV A, direct	1	1	1	0	0	1	0	1	E5	A ← (direct)	1
	a ₇	a ₆	a ₅	a ₄	a ₃	a ₂	a ₁	a ₀	Byte 2		
MOV A, @Ri	1	1	1	0	0	1	1	i	E6 ÷ E7	A ← (Ri)	1
MOV A, #data	0	1	1	1	0	1	0	0	74	A ← data	1
	d ₇	d ₆	d ₅	d ₄	d ₃	d ₂	d ₁	d ₀	Byte 2		
MOV Rn, A	1	1	1	1	1	n ₂	n ₁	n ₀	F8 ÷ FF	Rn ← A	1
MOV Rn, direct	1	0	1	0	1	n ₂	n ₁	n ₀	A8 ÷ AF	Rn ← (direct)	2
	a ₇	a ₆	a ₅	a ₄	a ₃	a ₂	a ₁	a ₀	Byte 2		
MOV Rn, #data	0	1	1	1	1	n ₂	n ₁	n ₀	78 ÷ 7F	Rn ← data	1
	d ₇	d ₆	d ₅	d ₄	d ₃	d ₂	d ₁	d ₀	Byte 2		
MOV direct, A	1	1	1	1	0	1	0	1	F5	(direct) ← A	1
	a ₇	a ₆	a ₅	a ₄	a ₃	a ₂	a ₁	a ₀	Byte 2		
MOV direct, Rn	1	0	0	0	1	n ₂	n ₁	n ₀	88 ÷ 8F	(direct) ← Rn	2
	a ₇	a ₆	a ₅	a ₄	a ₃	a ₂	a ₁	a ₀	Byte 2		
MOV direct1, direct2	1	0	0	0	0	1	0	1	85	(direct1) ← (direct2) Source Destination	2
	a ₇	a ₆	a ₅	a ₄	a ₃	a ₂	a ₁	a ₀	Byte 2		
	a ₇	a ₆	a ₅	a ₄	a ₃	a ₂	a ₁	a ₀	Byte 3		
MOV direct, @Ri	1	0	0	0	0	1	1	i	86 ÷ 87	(direct) ← (Ri)	2
	a ₇	a ₆	a ₅	a ₄	a ₃	a ₂	a ₁	a ₀	Byte 2		
MOV direct, #data	0	1	1	1	0	1	0	1	75	(direct) ← data	2
	a ₇	a ₆	a ₅	a ₄	a ₃	a ₂	a ₁	a ₀	Byte 2		
	d ₇	d ₆	d ₅	d ₄	d ₃	d ₂	d ₁	d ₀	Byte 3		
MOV @Ri, A	1	1	1	1	0	1	1	i	F6 ÷ F7	(Ri) ← A	1
MOV @Ri, direct	1	0	1	0	1	n ₂	n ₁	n ₀	A6 ÷ A7	(Ri) ← (direct)	2
	a ₇	a ₆	a ₅	a ₄	a ₃	a ₂	a ₁	a ₀	Byte 2		
MOV @Ri, #data	0	1	1	1	0	1	1	i	76 ÷ 77	(Ri) ← data	1
	d ₇	d ₆	d ₅	d ₄	d ₃	d ₂	d ₁	d ₀	Byte 2		

Mnemonic	Instruction code								Hexa - decimal	Explanation	No. of MC
	D ₇	D ₆	D ₅	D ₄	D ₃	D ₂	D ₁	D ₀			
MOV DPTR, #data16	1	0	0	1	1	0	0	0	98	DPTR ← data16	2
	d ₁₅	d ₁₄	d ₁₃	d ₁₂	d ₁₁	d ₁₀	d ₉	d ₈	Byte 2		
	d ₇	d ₆	d ₅	d ₄	d ₃	d ₂	d ₁	d ₀	Byte 3		
MOVC A, @A + DPTR	1	0	0	1	0	0	1	1	93	A ← (A + DPTR)	2
MOVC A, @A + PC	1	0	0	0	0	0	1	1	83	A ← (A + PC)	2
MOVX A, @Ri	1	1	1	0	0	0	1	i	E2 ÷ E3	A ← (Ri)	2
MOVX A, @DPTR	1	1	1	0	0	0	0	0	E0	A ← (DPTR)	2
MOVX @Ri, A	1	1	1	1	0	0	1	i	F2 ÷ F3	(Ri) ← A	2
MOVX @DPTR, A	1	1	1	1	0	0	0	0	F0	(DPTR) ← A	2
PUSH direct	1	1	0	0	0	0	0	0	C0	SP ← SP + 1	2
	d ₇	d ₆	d ₅	d ₄	d ₃	d ₂	d ₁	d ₀	Byte 2	(SP) ← (direct)	
POP direct	1	1	0	1	0	0	0	0	D0	(direct) ← (SP)	1
	d ₇	d ₆	d ₅	d ₄	d ₃	d ₂	d ₁	d ₀	Byte 2	SP ← SP - 1	
XCH A, Rn	1	1	0	0	1	n ₂	n ₁	n ₀	C8 ÷ CF	A ↔ Rn	1
XCH A, direct	1	1	0	0	0	1	0	1	C5	A ↔ (direct)	1
	d ₇	d ₆	d ₅	d ₄	d ₃	d ₂	d ₁	d ₀	Byte 2		
XCH A, @Ri	1	1	0	0	0	1	1	i	C6 ÷ C7	A ↔ (Ri)	1
XCHD A, @Ri	1	1	0	1	0	1	1	i	D6 ÷ D7	A _{3 ÷ 0} ↔ (Ri) _{3 ÷ 0}	1

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Table 2 – Mathematical (Arithmetic) Instructions

Mnemonic	Instruction code								Hexa - decimal	Explanation	No. of MC
	D ₇	D ₆	D ₅	D ₄	D ₃	D ₂	D ₁	D ₀			
ADD A, Rn	0	0	1	0	1	n ₂	n ₁	n ₀	28 ÷ 2F	$A \leftarrow A + Rn$	1
ADD A, direct	0	0	1	0	0	1	0	1	25	$A \leftarrow A + (\text{direct})$	1
	a ₇	a ₆	a ₅	a ₄	a ₃	a ₂	a ₁	a ₀	Byte 2		
ADD A, @Ri	0	0	1	0	0	1	1	i	26 ÷ 27	$A \leftarrow A + (Ri)$	1
ADD A, #data	0	0	1	0	0	1	0	0	24	$A \leftarrow A + \text{data}$	1
	d ₇	d ₆	d ₅	d ₄	d ₃	d ₂	d ₁	d ₀	Byte 2		
ADDC A, Rn	0	0	1	1	1	n ₂	n ₁	n ₀	38 ÷ 3F	$A \leftarrow A + Rn + CY$	1
ADDC A, direct	0	0	1	1	0	1	0	1	35	$A \leftarrow A + (\text{direct}) + CY$	1
	a ₇	a ₆	a ₅	a ₄	a ₃	a ₂	a ₁	a ₀	Byte 2		
ADDC A, @Ri	0	0	1	1	0	1	1	i	36 ÷ 37	$A \leftarrow A + (Ri) + CY$	1
ADDC A, #data	0	0	1	1	0	1	0	0	34	$A \leftarrow A + \text{data} + CY$	1
	d ₇	d ₆	d ₅	d ₄	d ₃	d ₂	d ₁	d ₀	Byte 2		
SUBB A, Rn	1	0	0	1	1	n ₂	n ₁	n ₀	98 ÷ 9F	$A \leftarrow A - Rn - CY$	1
SUBB A, direct	1	0	0	1	0	1	0	1	95	$A \leftarrow A - (\text{direct}) - CY$	1
	a ₇	a ₆	a ₅	a ₄	a ₃	a ₂	a ₁	a ₀	Byte 2		
SUBB A, @Ri	1	0	0	1	0	1	1	i	96 ÷ 97	$A \leftarrow A - (Ri) - CY$	1
SUBB A, #data	1	0	0	1	0	1	0	0	94	$A \leftarrow A - \text{data} - CY$	1
	d ₇	d ₆	d ₅	d ₄	d ₃	d ₂	d ₁	d ₀	Byte 2		

Mnemonic	Instruction code								Hexa - decimal	Explanation	No. of MC
	D ₇	D ₆	D ₅	D ₄	D ₃	D ₂	D ₁	D ₀			
INC A	0	0	0	0	0	1	0	0	04	$A \leftarrow A + 1$	1
INC Rn	0	0	0	0	1	n ₂	n ₁	n ₀	08 ÷ 0F	$Rn \leftarrow Rn + 1$	1
INC direct	0	0	0	0	0	1	0	1	05	$(\text{direct}) \leftarrow (\text{direct}) + 1$	1
	a ₇	a ₆	a ₅	a ₄	a ₃	a ₂	a ₁	a ₀	Byte 2		
INC @Ri	0	0	0	0	0	1	1	i	06 ÷ 07	$(Ri) \leftarrow (Ri) + 1$	1
INC DPTR	1	0	1	0	0	0	1	1	A3	$DPTR \leftarrow DPTR + 1$	1
DEC A	0	0	0	1	0	1	0	0	14	$A \leftarrow A - 1$	1
DEC Rn	0	0	0	1	1	n ₂	n ₁	n ₀	18 ÷ 1F	$Rn \leftarrow Rn - 1$	1
DEC direct	0	0	0	1	0	1	0	1	15	$(\text{direct}) \leftarrow (\text{direct}) - 1$	1
	a ₇	a ₆	a ₅	a ₄	a ₃	a ₂	a ₁	a ₀	Byte 2		
DEC @Ri	0	0	0	1	0	1	1	i	16 ÷ 17	$(Ri) \leftarrow (Ri) - 1$	1
MUL AB	1	0	1	0	0	1	0	0	A4	$A \leftarrow (A \times B)_{7 \div 0}$ $B \leftarrow (A \times B)_{15 \div 8}$	4
DIV AB	1	0	0	0	0	1	0	0	84	$A \leftarrow \text{Quotient } (A / B)$ $B \leftarrow \text{Remainder } (A / B)$	4
DA A	1	1	0	1	0	1	0	0	D4	Contents of Accumulator are BCD IF $A_{3 \div 0} > 9$ OR AC = 1 THEN $A_{3 \div 0} \leftarrow A_{3 \div 0} + 6$ AND IF $A_{7 \div 4} > 9$ OR CY = 1 THEN $A_{7 \div 4} \leftarrow A_{7 \div 4} + 6$	1

Table 3 – Logic Instructions

Mnemonic	Instruction code								Hexa - decimal	Explanation	No. of MC
	D ₇	D ₆	D ₅	D ₄	D ₃	D ₂	D ₁	D ₀			
ANL A, Rn	0	1	0	1	1	n ₂	n ₁	n ₀	58 ÷ 5F	A ← A AND Rn	1
ANL A, direct	0	1	0	1	0	1	0	1	55	A ← A AND (direct)	1
	a ₇	a ₆	a ₅	a ₄	a ₃	a ₂	a ₁	a ₀	Byte 2		
ANL A, @Ri	0	1	0	1	0	1	1	i	56 ÷ 57	A ← A AND (Ri)	1
ANL A, #data	0	1	0	1	0	1	0	0	54	A ← A AND data	1
	d ₇	d ₆	d ₅	d ₄	d ₃	d ₂	d ₁	d ₀	Byte 2		
ANL direct, A	0	1	0	1	0	0	1	0	52	(direct) ← (direct) AND A	1
	a ₇	a ₆	a ₅	a ₄	a ₃	a ₂	a ₁	a ₀	Byte 2		
ANL direct, #data	0	1	0	1	0	0	1	1	53	(direct) ←	1
	a ₇	a ₆	a ₅	a ₄	a ₃	a ₂	a ₁	a ₀	Byte 2	(direct) AND data	
	d ₇	d ₆	d ₅	d ₄	d ₃	d ₂	d ₁	d ₀	Byte 3		
ORL A, Rn	0	1	0	0	1	n ₂	n ₁	n ₀	48 ÷ 4F	A ← A OR Rn	1
ORL A, direct	0	1	0	0	0	1	0	1	45	A ← A OR (direct)	1
	a ₇	a ₆	a ₅	a ₄	a ₃	a ₂	a ₁	a ₀	Byte 2		
ORL A, @Ri	0	1	0	0	0	1	1	i	46 ÷ 47	A ← A OR (Ri)	1
ORL A, #data	0	1	0	0	0	1	0	0	44	A ← A OR data	1
	d ₇	d ₆	d ₅	d ₄	d ₃	d ₂	d ₁	d ₀	Byte 2		
ORL direct, A	0	1	0	0	0	0	1	0	42	(direct) ← (direct) OR A	1
	a ₇	a ₆	a ₅	a ₄	a ₃	a ₂	a ₁	a ₀	Byte 2		
ORL direct, #data	0	1	0	0	0	0	1	1	43	(direct) ← (direct) OR data	2
	a ₇	a ₆	a ₅	a ₄	a ₃	a ₂	a ₁	a ₀	Byte 2		
	d ₇	d ₆	d ₅	d ₄	d ₃	d ₂	d ₁	d ₀	Byte 3		

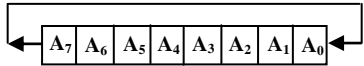
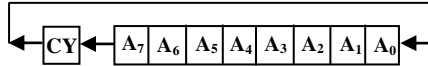
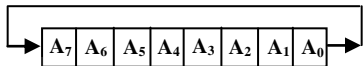
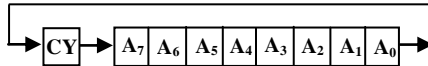
Mnemonic	Instruction code								Hexa - decimal	Explanation	No. of MC
	D ₇	D ₆	D ₅	D ₄	D ₃	D ₂	D ₁	D ₀			
XRL A, Rn	0	1	1	0	1	n ₂	n ₁	n ₀	68 ÷ 6F	A ← A XOR Rn	1
XRL A, direct	0	1	1	0	0	1	0	1	65	A ← A XOR (direct)	1
	a ₇	a ₆	a ₅	a ₄	a ₃	a ₂	a ₁	a ₀	Byte 2		
XRL A, @Ri	0	1	1	0	0	1	1	i	66 ÷ 67	A ← A XOR (Ri)	1
XRL A, #data	0	1	1	0	0	1	0	0	64	A ← A XOR data	1
	d ₇	d ₆	d ₅	d ₄	d ₃	d ₂	d ₁	d ₀	Byte 2		
XRL direct, A	0	1	1	0	0	0	1	0	62	(direct) ← (direct) XOR A	1
	a ₇	a ₆	a ₅	a ₄	a ₃	a ₂	a ₁	a ₀	Byte 2		
XRL direct, #data	0	1	1	0	0	0	1	1	63	(direct) ← (direct) XOR data	2
	a ₇	a ₆	a ₅	a ₄	a ₃	a ₂	a ₁	a ₀	Byte 2		
	d ₇	d ₆	d ₅	d ₄	d ₃	d ₂	d ₁	d ₀	Byte 3		
CLR A	1	1	1	0	0	1	0	0	E4	A ← 0	1
CPL A	1	1	1	1	0	1	0	0	F4	A ← $\overline{A}$	1
RL A	0	0	1	0	0	0	1	1	23		1
RLC A	0	0	1	1	0	0	1	1	33		1
RR A	0	0	0	0	0	0	1	1	03		1
RRC A	0	0	0	1	0	0	1	1	13		1
SWAP A	1	1	0	0	0	1	0	0	C4	A _{7÷4} ↔ A _{3÷0}	1

Table 4 – Control Transfer Instructions

Mnemonic	Instruction code								Hexa - decimal	Explanation	No. of MC
	D ₇	D ₆	D ₅	D ₄	D ₃	D ₂	D ₁	D ₀			
ACALL addr11	a ₁₀	a ₉	a ₈	1	0	0	0	1	Byte 1 Byte 2	PC ← PC + 2 SP ← SP + 1 (SP) ← PC _{7 ÷ 0} SP ← SP + 1 (SP) ← PC _{15 ÷ 8} PC ← page address _ addr11	2
LCALL addr16	0	0	0	1	0	0	1	0	12 Byte 2 Byte 3	PC ← PC + 3 SP ← SP + 1 (SP) ← PC _{7 ÷ 0} SP ← SP + 1 (SP) ← PC _{15 ÷ 8} PC ← addr16	2
RET	0	0	1	0	0	0	1	0	22	PC _{15 ÷ 8} ← (SP) SP ← SP - 1 PC _{7 ÷ 0} ← (SP) SP ← SP - 1	2
RETI	0	0	1	1	0	0	1	0	32	PC _{15 ÷ 8} ← (SP) SP ← SP - 1 PC _{7 ÷ 0} ← (SP) SP ← SP - 1	2
AJMP addr11	a ₁₀	a ₉	a ₈	0	0	0	0	1	Byte 1 Byte 2	PC ← PC + 2 PC ← page address _ addr11	2
LJMP addr16	0	0	0	0	0	0	1	0	02 Byte 2 Byte 3	PC ← addr16	2
SJMP rel	1	0	0	0	0	0	0	0	80 Byte 2	PC ← PC + 2 PC ← PC + rel	2
JMP @A + DPTR	0	1	1	1	0	0	1	1	73	PC ← A + DPTR	2

Mnemonic	Instruction code								Hexa - decimal	Explanation	No. of MC
	D ₇	D ₆	D ₅	D ₄	D ₃	D ₂	D ₁	D ₀			
JZ rel	0	1	1	0	0	0	0	0	60	PC ← PC + 2	2
	r ₇	r ₆	r ₅	r ₄	r ₃	r ₂	r ₁	r ₀	Byte 2	IF A = 0 THEN PC ← PC + rel	
JNZ rel	0	1	1	1	0	0	0	0	70	PC ← PC + 2	2
	r ₇	r ₆	r ₅	r ₄	r ₃	r ₂	r ₁	r ₀	Byte 2	IF A ≠ 0 THEN PC ← PC + rel	
JC rel	0	1	0	0	0	0	0	0	40	PC ← PC + 2	2
	r ₇	r ₆	r ₅	r ₄	r ₃	r ₂	r ₁	r ₀	Byte 2	IF CY = 1 THEN PC ← PC + rel	
JNC rel	0	1	0	1	0	0	0	0	50	PC ← PC + 2	2
	r ₇	r ₆	r ₅	r ₄	r ₃	r ₂	r ₁	r ₀	Byte 2	IF CY = 0 THEN PC ← PC + rel	
JB bit, rel	0	0	1	0	0	0	0	0	20	PC ← PC + 3	2
	b ₇	b ₆	b ₅	b ₄	b ₃	b ₂	b ₁	b ₀	Byte 2	IF (bit) = 1 THEN PC ← PC + rel	
	r ₇	r ₆	r ₅	r ₄	r ₃	r ₂	r ₁	r ₀	Byte 3		
JNB bit, rel	0	0	1	1	0	0	0	0	30	PC ← PC + 3	2
	b ₇	b ₆	b ₅	b ₄	b ₃	b ₂	b ₁	b ₀	Byte 2	IF (bit) = 0 THEN PC ← PC + rel	
	r ₇	r ₆	r ₅	r ₄	r ₃	r ₂	r ₁	r ₀	Byte 3		
JBC bit, rel	0	0	0	1	0	0	0	0	10	PC ← PC + 3	2
	b ₇	b ₆	b ₅	b ₄	b ₃	b ₂	b ₁	b ₀	Byte 2	IF (bit) = 1 THEN	
	r ₇	r ₆	r ₅	r ₄	r ₃	r ₂	r ₁	r ₀	Byte 3		

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Mnemonic	Instruction code								Hexa - decimal	Explanation	No. of MC
	D ₇	D ₆	D ₅	D ₄	D ₃	D ₂	D ₁	D ₀			
CJNE A, direct, rel	1	0	1	1	0	1	0	1	B5 Byte 2 Byte 3	PC ← PC + 3 IF A < (direct) THEN PC ← PC + rel AND CY ← 1 OR IF A > (direct) THEN PC ← PC + rel AND CY ← 0	2
CJNE A, #data, rel	1	0	1	1	0	1	0	0	B4 Byte 2 Byte 3	PC ← PC + 3 IF A < data THEN PC ← PC + rel AND CY ← 1 OR IF A > data THEN PC ← PC + rel AND CY ← 0	2
CJNE Rn, #data, rel	1	0	1	1	1	n ₂	n ₁	n ₀	B8 ÷ BF Byte 2 Byte 3	PC ← PC + 3 IF Rn < data THEN PC ← PC + rel AND CY ← 1 OR IF Rn > data THEN PC ← PC + rel AND CY ← 0	2
CJNE @Ri, #data, rel	1	0	1	1	0	1	1	i	B6 ÷ B7 Byte 2 Byte 3	PC ← PC + 3 IF (Ri) < data THEN PC ← PC + rel AND CY ← 1 OR IF (Ri) > data THEN PC ← PC + rel AND CY ← 0	2
DJNZ Rn, rel	1	1	0	1	1	n ₂	n ₁	n ₀	D8 ÷ DF Byte 2	PC ← PC + 2 Rn ← Rn - 1 IF Rn ≠ 0 THEN PC ← PC + rel	2
DJNZ direct, rel	1	1	0	1	0	1	0	1	D5 Byte 2 Byte 3	PC ← PC + 2 (direct) ← (direct) - 1 IF (direct) ≠ 0 THEN PC ← PC + rel	2
NOP	0	0	0	0	0	0	0	0	00	PC ← PC + 1	1

Table 5 – Bit Oriented Instructions

Mnemonic	Instruction code								Hexa - decimal	Explanation	No. of MC
	D ₇	D ₆	D ₅	D ₄	D ₃	D ₂	D ₁	D ₀			
CLR C	1	1	0	0	0	0	1	1	C3	CY ← 0	1
CLR bit	1	1	0	0	0	0	1	0	C2	(bit) ← 0	1
	b ₇	b ₆	b ₅	b ₄	b ₃	b ₂	b ₁	b ₀	Byte 2		
SETB C	1	1	0	1	0	0	1	1	D3	CY ← 1	1
SETB bit	1	1	0	1	0	0	1	0	D2	(bit) ← 1	1
	b ₇	b ₆	b ₅	b ₄	b ₃	b ₂	b ₁	b ₀	Byte 2		
CPL C	1	0	1	1	0	0	1	1	B3	CY ← $\overline{\text{CY}}$	1
CPL bit	1	0	1	1	0	0	1	0	B2	(bit) ← $\overline{(\text{bit})}$	1
	b ₇	b ₆	b ₅	b ₄	b ₃	b ₂	b ₁	b ₀	Byte 2		
ANL C, bit	1	0	0	0	0	0	1	0	82	CY ← CY AND (bit)	2
	b ₇	b ₆	b ₅	b ₄	b ₃	b ₂	b ₁	b ₀	Byte 2		
ANL C, /bit	1	0	1	1	0	0	0	0	B0	CY ← CY AND $\overline{(\text{bit})}$	2
	b ₇	b ₆	b ₅	b ₄	b ₃	b ₂	b ₁	b ₀	Byte 2		
ORL C, bit	0	1	1	1	0	0	1	0	72	CY ← CY OR (bit)	2
	b ₇	b ₆	b ₅	b ₄	b ₃	b ₂	b ₁	b ₀	Byte 2		
ORL C, /bit	1	0	1	0	0	0	0	0	A0	CY ← CY OR $\overline{(\text{bit})}$	2
	b ₇	b ₆	b ₅	b ₄	b ₃	b ₂	b ₁	b ₀	Byte 2		
MOV C, bit	1	0	1	0	0	0	1	0	A2	CY ← (bit)	1
	b ₇	b ₆	b ₅	b ₄	b ₃	b ₂	b ₁	b ₀	Byte 2		
MOV bit, C	1	0	0	1	0	0	1	0	92	(bit) ← CY	2
	b ₇	b ₆	b ₅	b ₄	b ₃	b ₂	b ₁	b ₀	Byte 2		