



**Ministry of Higher Education & Scientific Research  
University of Technology  
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# **Microprocessor**

## **Lecture 17:**

**DATA TRANSFER & ARITHMETIC INSTRUCTIONS**

# 8085 INSTRUCTION SET

## INSTRUCTION DETAILS

An instruction is a binary pattern designed inside a micro processor to perform specific function .these instructions can be classified into:

1. Data transfer operations.
2. Arithmetic operations.
3. Logic operations.
4. Branch operations.
5. Machine control operations.

### • DATA TRANSFER INSTRUCTIONS

Opcode	Operand	Example	Description
<b>MOV</b> Copy from source to destination	Rd, Rs M, Rs Rd, M	MOV B, C or MOV B, M	This instruction copies the contents of the source register into the destination register; the contents of the source register are not altered. If one of the operands is a memory location, its location is specified by the contents of the HL registers.
<b>MVI</b> Move immediate 8-bit	Rd, data M, data	MVI B, 57 <sub>H</sub> or MVI M, 57 <sub>H</sub>	The 8-bit data is stored in the destination register or memory. If the operand is a memory location, its location is specified by the contents of the HL registers.
<b>LDA</b> Load accumulator	16-bit address	LDA 2034 <sub>H</sub>	The contents of a memory location, specified by a 16-bit address in the operand, are copied to the accumulator. The contents of the source are not altered.

<b>Opcode</b>	<b>Operand</b>	<b>Example</b>	<b>Description</b>
<b>STA</b> Store accumulator direct	16-bit address	STA 4350 <sub>H</sub>	The contents of the accumulator are copied into the memory location specified by the operand. This is a 3-byte instruction, the second byte specifies the low-order address and the third byte specifies the high-order address.
<b>LXI</b> Load register pair immediate	Reg. pair, 16-bit data	LXI H, 2034 <sub>H</sub>	The instruction loads 16-bit data in the register pair designated in the operand.
<b>LHLD</b> Load H and L registers direct	16-bit address	LHLD 2040 <sub>H</sub>	The instruction copies the contents of the memory location pointed out by the 16-bit address into register L and copies the contents of the next memory location into register H. contents of source memory locations are not altered.
<b>LDAX</b> Load accumulator indirect	B/D Reg. pair	LDAX B	The contents of the designated register pair point to a memory location. This instruction copies the contents of that memory location into the accumulator. The contents of either the register pair or the memory location are not altered.
<b>STAX</b> Store accumulator indirect	Reg. pair	STAX B	The contents of the accumulator are copied into the memory location specified by the contents of the operand (register pair). The contents of the accumulator are not altered.
<b>SHLD</b> Store H and L registers direct	16-bit address	SHLD 2470 <sub>H</sub>	The contents of register L are stored into the memory location specified by the 16-bit address in the operand and the contents of H register are stored into the next memory location by incrementing the operand. The contents of registers HL are not altered. This is a 3-byte instruction, second byte specifies the low-order address and the third byte specifies the high-order address.

<b>Opcode</b>	<b>Operand</b>	<b>Example</b>	<b>Description</b>
<b>XCHG</b> Exchange H and L with D and E	none	XCHG	The contents of register H are exchanged with the contents of register D, and the contents of register L are exchanged with the contents of register E.
<b>SPHL</b> Copy H and L registers to the stack pointer	none	SPHL	The instruction loads the contents of the H and L registers into the stack pointer register, the contents of the H register provide the high-order address and the contents of the L register provide the low-order address. The contents of the H and L registers are not altered.
<b>XTHL</b> Exchange H and L with top of stack	none	XTHL	The contents of the L register are exchanged with the stack location pointed out by the contents of the stack pointer register. The contents of the H register are exchanged with the next stack location (SP+1); however, the contents of the stack pointer register are not altered.
<b>PUSH</b> Push register pair onto stack	Reg. pair	PUSH B or PUSH A	The contents of the register pair designated in the operand are copied onto the stack in the following sequence. The stack pointer register is decremented and the contents of the high order register (B, D, H, A) are copied into that location. The stack pointer register is decremented again and the contents of the low-order register (C, E, L, flags) are copied to that location.
<b>POP</b> Pop off stack to register pair	Reg. pair	POP H or POP A	The contents of the memory location pointed out by the stack pointer register are copied to the low-order register (C, E, L, status flags) of the operand. The stack pointer is incremented by 1 and the contents of that memory location are copied to the high-order register (B, D, H, A) of the operand. The stack pointer register is again incremented by 1.

Opcode	Operand	Example	Description
<b>OUT</b> Output data from accumulator to a port with 8-bit address	8-bit port address	OUT F8 <sub>H</sub>	The contents of the accumulator are copied into the I/O port specified by the operand.
<b>IN</b> Input data to accumulator from a port with 8-bit address	8-bit port address	IN 8C <sub>H</sub>	The contents of the input port designated in the operand are read and loaded into the accumulator.

## • ARITHMETIC INSTRUCTIONS

Opcode	Operand	Example	Description
<b>ADD</b> Add register or memory to accumulator	R M	ADD B or ADD M	The contents of the operand (register or memory) are added to the contents of the accumulator and the result is stored in the accumulator. If the operand is a memory location, its location is specified by the contents of the HL registers. All flags are modified to reflect the result of the addition.
<b>ADC</b> Add register to accumulator with carry	R M	ADC B or ADC M	The contents of the operand (register or memory) and the Carry flag are added to the contents of the accumulator and the result is stored in the accumulator. If the operand is a memory location, its location is specified by the contents of the HL registers. All flags are modified to reflect the result of the addition.
<b>ADI</b> Add immediate to accumulator	8-bit data	ADI 45H	The 8-bit data (operand) is added to the contents of the accumulator and the result is stored in the accumulator. All flags are modified to reflect the result of the addition.

<b>Opcode</b>	<b>Operand</b>	<b>Example</b>	<b>Description</b>
<b>ACI</b> Add immediate to accumulator with carry	8-bit data	ACI 45H	The 8-bit data (operand) and the Carry flag are added to the contents of the accumulator and the result is stored in the accumulator. All flags are modified to reflect the result of the addition.
<b>DAD</b> Add register pair to H and L registers	Reg. pair	DAD H	The 16-bit contents of the specified register pair are added to the contents of the HL register and the sum is stored in the HL registers. The contents of the source register pair are not altered. If the result is larger than 16 bits, the CY flag is set. No other flags are affected.
<b>SUB</b> Subtract register or memory from accumulator	R M	SUB B or SUB M	The contents of the operand (register or memory) are subtracted from the contents of the accumulator, and the result is stored in the accumulator. If the operand is a memory location, its location is specified by the contents of the HL registers. All flags are modified to reflect the result of the subtraction.
<b>SBB</b> Subtract source and borrow from accumulator	R M	SBB B or SBB M	The contents of the operand (register or memory) and the Borrow flag are subtracted from the contents of the accumulator and the result is placed in the accumulator. If the operand is a memory location, its location is specified by the contents of the HL registers. All flags are modified to reflect the result of the subtraction.
<b>SUI</b> Subtract immediate from accumulator	8-bit data	SUI 45H	The 8-bit data (operand) is subtracted from the contents of the accumulator and the result is stored in the accumulator. All flags are modified to reflect the result of the subtraction.
<b>SBI</b> Subtract immediate from accumulator with borrow	8-bit data	SBI 45H	The 8-bit data (operand) and the Borrow flag are subtracted from the contents of the accumulator and the result is stored in the accumulator. All flags are modified to reflect the result of the subtraction.
<b>INR</b>	R	INR B or	The contents of the designated register or

<b>Opcode</b>	<b>Operand</b>	<b>Example</b>	<b>Description</b>
Increment register or memory by 1	M	INR M	memory)are incremented by 1 and the result is stored in the same place. If the operand is a memory location, its location is specified by the contents of the HL registers.
<b>INX</b> Increment register pair by 1	R	INX H	The contents of the designated register pair are incremented by 1 and the result is stored in the same place.
<b>DCR</b> Decrement register or memory by 1	R M	DCR B or DCR M	The contents of the designated register or memory are decremented by 1 and the result is stored in the same place. If the operand is a memory location, its location is specified by the contents of the HL registers.
<b>DCX</b> Decrement register pair by 1	R	DCX H	The contents of the designated register pair are decremented by 1 and the result is stored in the same place.
<b>DAA</b> Decimal adjust accumulator	none	DAA	The contents of the accumulator are changed from a binary value to two 4-bit binary coded decimal (BCD) digits. This is the only instruction that uses the auxiliary flag to perform the binary to BCD conversion, and the conversion procedure is described below. S, Z, AC, P, CY flags are altered to reflect the results of the operation. If the value of the low-order 4-bits in the accumulator is greater than 9 or if AC flag is set, the instruction adds 6 to the low-order four bits. If the value of the high-order 4-bits in the accumulator is greater than 9 or if the Carry flag is set, the instruction adds 6 to the high-order four bits.