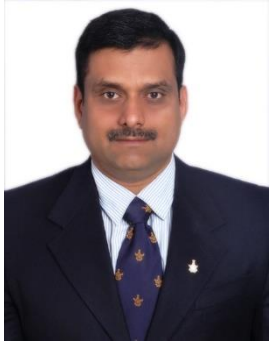
Microprocessors and Interfaces: 2021-22
Lab 4
Addressing Modes in 8086

By Dr. Sanjay Vidhyadharan



Carry, Sign and Overflow Flags

MOV AL,7FH (127_{10} 01111111_2)

ADD AL,00H **07H** (127_{10} 01111111_2) CF=0 SF=0 OF=0

MOV AL,7FH
ADD AL,01H **80H** (-128_{10} 10000000_2) CF=0 SF=1 OF=1

MOV AL,0FFH (-1_{10} 11111111_2)
ADD AL,02H **01H** (1_{10} 00000001_2) CF=1 SF=0 OF=0

MOV AL,0FEH (-2_{10} 11111110_2)
ADD AL,01h **FFH** (-1_{10} 11111111_2) CF=0 SF=1 OF=0

MOV AL,0FEH (-2_{10} 11111110_2)
ADD AL,0FFH **FDH** CF=1 SF=1 OF=0

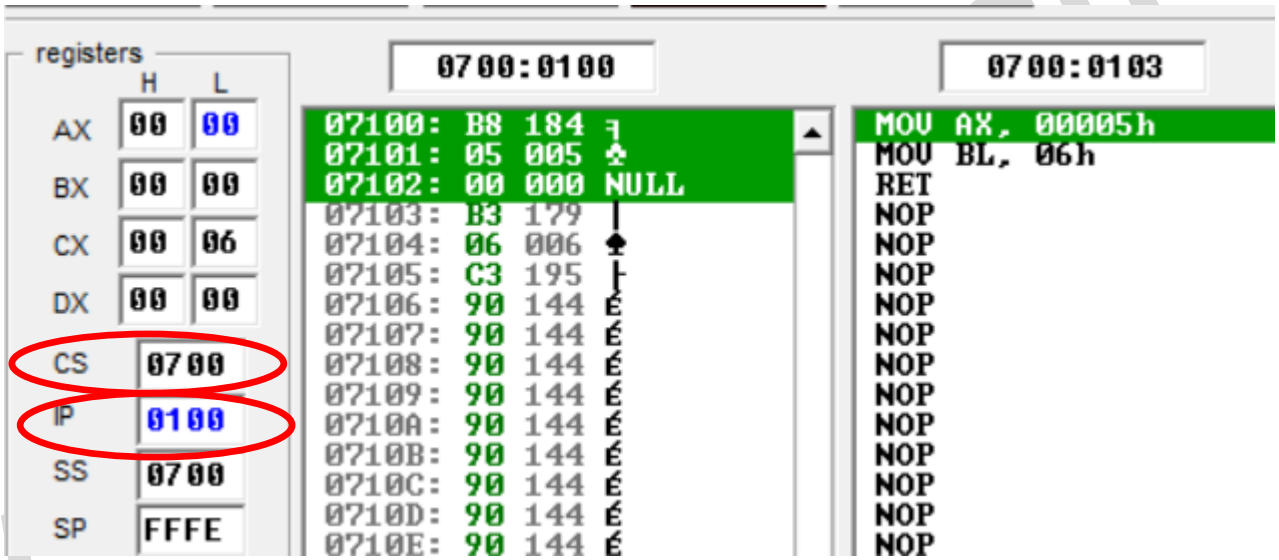
1.1 Immediate Addressing Mode

In this, immediate data is part of instruction, and appears in the form of successive byte or bytes

```
org 100h

MOV AX,0005H
MOV BL,06H

ret
```



BYTE 1					BYTE 2	BYTE 3
				1 BIT	3 BITS	LOW DISP.	HIGH DISP.
OPCODE				W	REG		
1011				1	000	05	00

1.1 Immediate Addressing Mode

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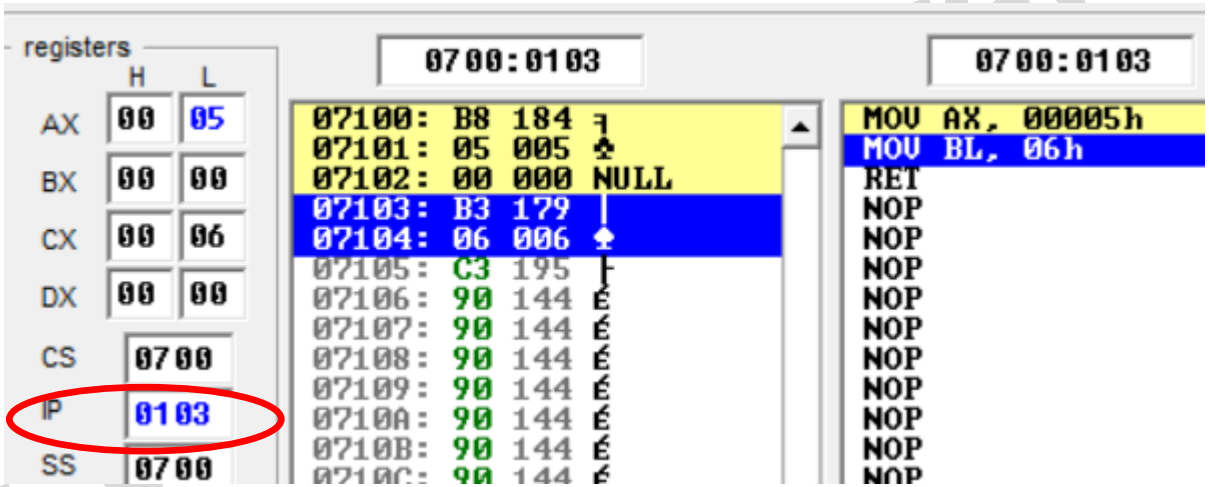


BYTE 1								BYTE 2	BYTE 3
					1 BIT	3 BITS		LOW DISP.	HIGH DISP.
OPCODE					W	REG			
1011					0	011		06	

1.2 Direct Addressing Mode

In this, a 16 bit memory address or an IO address is directly specified in the instruction

Example

```
ORG 100h
MOV AX, 2162H
MOV DS, AX
MOV CX, 24
MOV [481], CX
MOV BX, [481]
ret
```

Address Location Determination

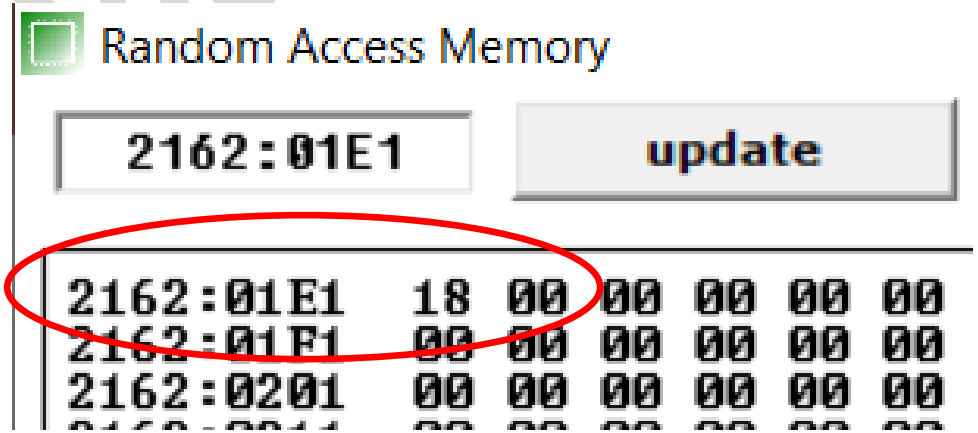
$(481)_{10} \rightarrow (1E1)_{16}$

DS: 2162_{16}

Offset: 481_{10}

Logical Address: 2162:01E1

Physical Address: DS × 10_{16} + offset = $(21801)_{16}$



1.3 Register Addressing Mode

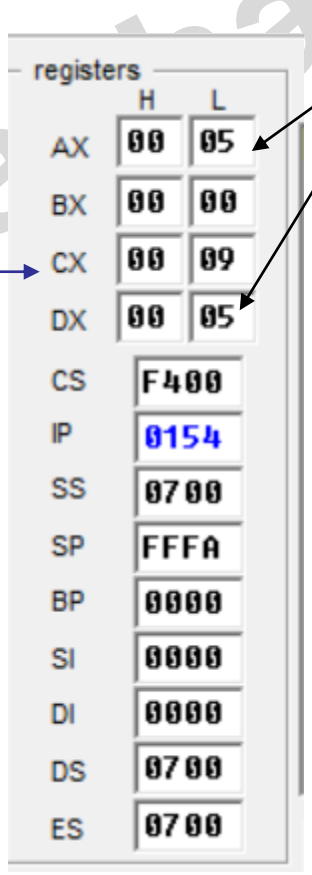
Operands are stored in registers. Transfer of operands are extremely fast since no memory access is required.

All except IP register can be used in this mode.

```
org 100h
MOV AX,0005H
MOV CX,0004H
MOV DX, AX
ADD CX, DX
ret
```

Result

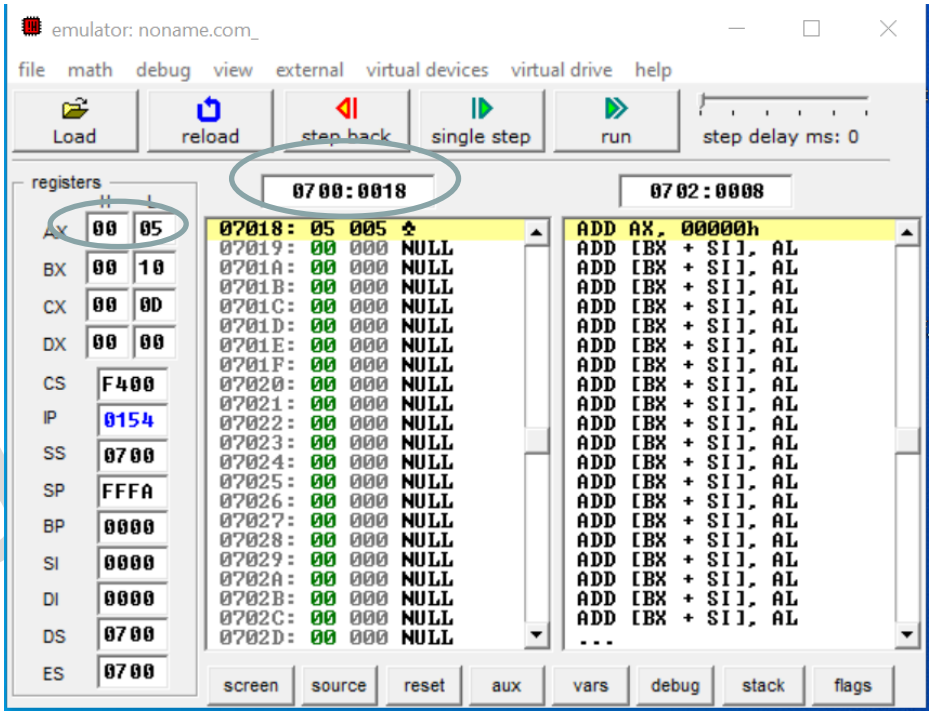
Move data content of Register A to Register D



Content of Register A copied to D

1.4 Base Addressing Mode

```
org 100h
MOV BX,0010H
MOV [0018H],0005H
MOV AX, [BX+08H]
ret
```



DS: 0700h

BX: 0010h

EA: (BX)+08h = 0018h

Logical Address: 0700:0018

Physical Address: 7018h

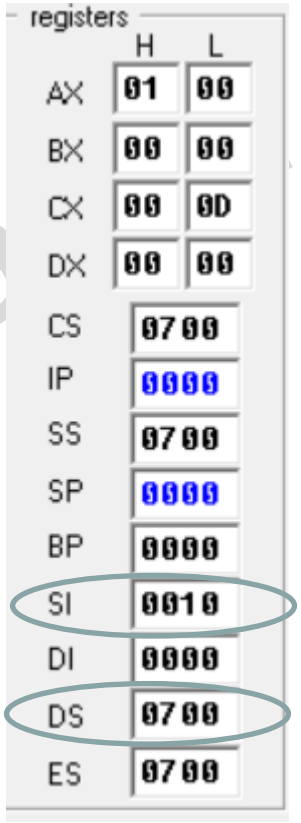
1.5 Indexed Addressing Mode

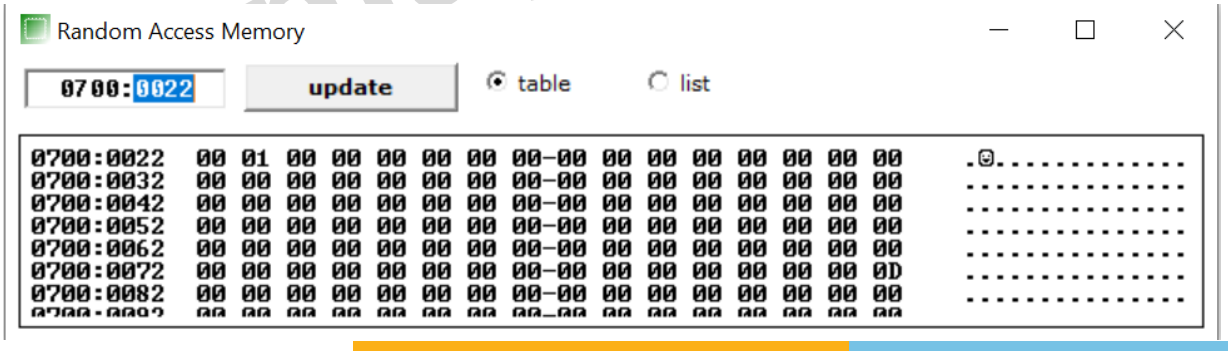
```
org 100h
MOV [0022H], 0100H
MOV SI, 0010H
MOV AX, [SI+012H]
ret
```

DS = 0700h; SI = 0010h

EA = (SI)+012h; BA = DS × 16_{10}

MA = BA + EA; AX ← MA; AL ← MA; AH ← MA + 1; Logical Address: 0700:0022;





1.6 Base Indexed Addressing Mode

```
org 100h
MOV [0033H], 0110H
MOV SI, 0010H
MOV BX, 0011H
MOV AX, [BX+SI+012H]
ret
```

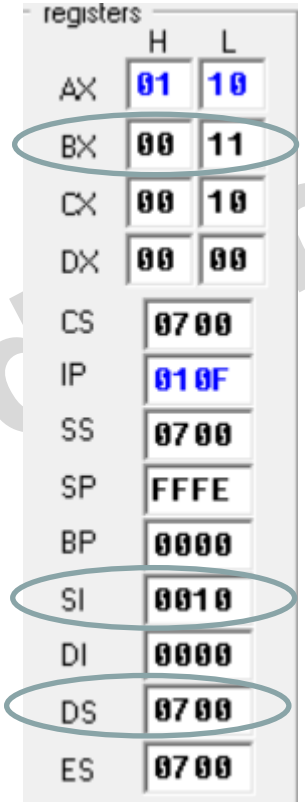
DS = 0700h; SI = 0010h; BX = 0011h

EA = (BX)+(SI)+012h;

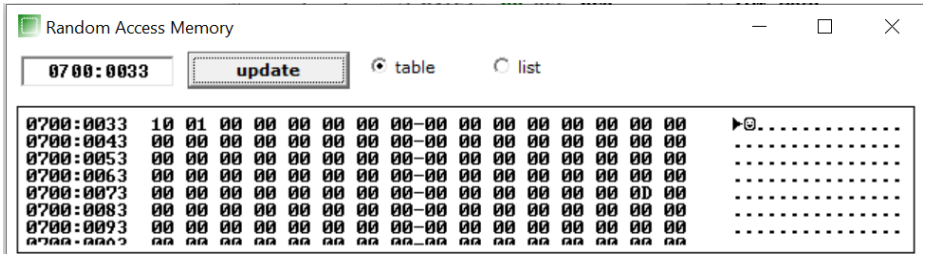
BA = DS × 16_{10}

Logical Address: 0700:0033;

Phycsial Address: 7033h and 7034h



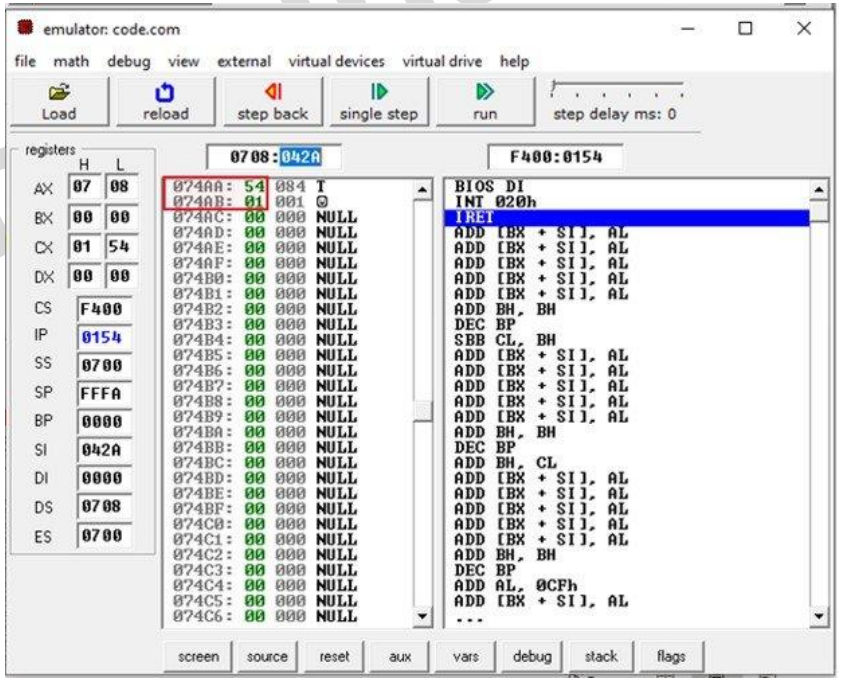
Contents of memory location 0018H moved to AX



• 1.7 Register Indirect Addressing Mode

- The offset address resides in one of these three registers i.e., BX, SI, DI.
- The sum of offset address and the DS value shifted by one position generates a physical address.

```
ORG 100h
MOV AX, 0708h
MOV DS, AX
MOV CX, 0154h
MOV SI, 42Ah
MOV [SI], CX
RET
```

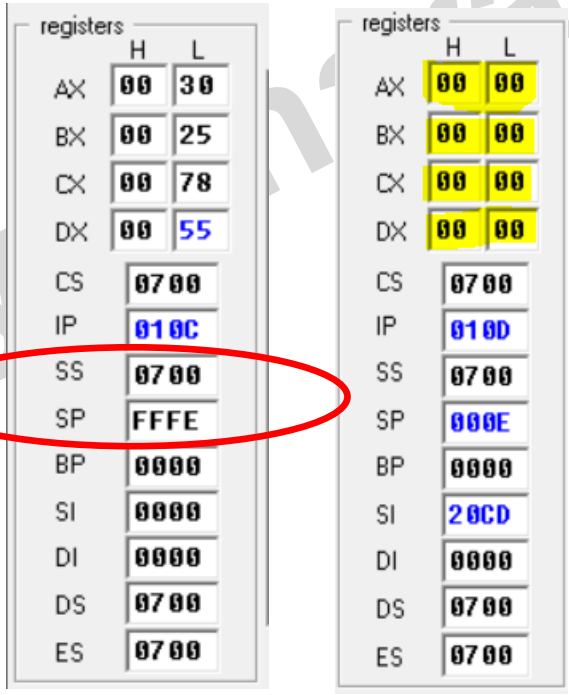


Physical Address: 0708:042Ah

• 1.8 Implied Addressing Mode

- The instruction itself will specify the data to be operated by the instruction.

```
org 100h
MOV BX , 25h
MOV AX,30h
MOV CX,78h
MOV DX,55h
POPA
RET
```



Before POPA

After POPA

POPA command will pop all the general purpose registers.

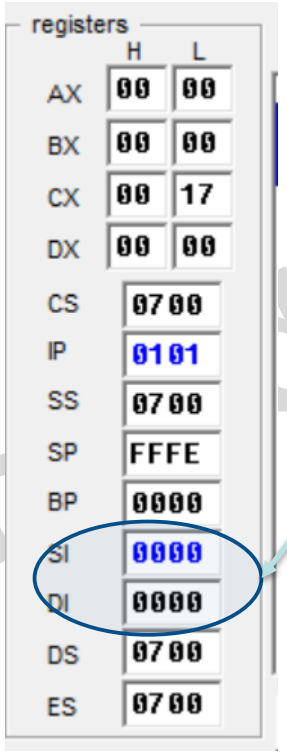
• 1.9 String Addressing Mode

```
ORG 100h

CLD
LEA SI, a1
LEA DI, a2
MOV CX, 5
REP MOVSB

RET

a1 DB 1,2,3,4,5
a2 DB 5 DUP(0)
```



Check the content of SI and DI after each step.

2.0 IO Port Addressing

- It can be either direct or indirect.
- In direct IO port addressing, the IO address is specified in the instruction.
- In indirect IO port addressing, the instruction will specify the name of the register which holds the port address

Direct IO Port Addressing
IN AL,80H; IN AX,80H; OUT 80H,AL; OUT 80H,AX;

Indirect IO Port Addressing
MOV DX,2080H IN AL,DX; IN AX,DX; OUT DX,AL; OUT DX,AX;

Problems

- Load the operand $(16AC)_{16}$ into register BX using immediate, register addressing mode.
- Using direct addressing mode load the data $(4ECB)_{16}$ in the memory location 3000:171E.
- Let DS = 0300h; SI = 3126h and CX = 4A3Ch. What will be the physical address of the memory location?

  MOV [SI], CX

  Justify your answer with an ALP.
- In the example of string addressing mode, replace the command 'MOVSB' by 'MOVSW'. Show the change in SI and DI after each step of execution. Does it still support string addressing mode?
- Assume DS = 3000h; BX = 1234h, ALPHA = 0012h, SI = 1233h. Determine the addressing mode and calculate and verify the physical addressing of the memory location for the following instructions:

  MOV [BX] + ALPHA, AH

  MOV [SI] + ALPHA, AH

Problems

- Assume: DS = 3000h, BX = 1000h, SI = 1234h and ALPHA = 0012h. Find the physical address for the following instruction:

  MOV AL, [BX] [SI] + ALPHA

  Verify your result with an ALP.

- Thankyou