B) Exchange (XCHG)

The XCHG (exchange) instruction exchanges the contents of a register with the contents of any other register or memory location. The XCHG instruction cannot exchange segment registers or memory-to-memory data.

Xchg destination, source

xchg AX,BX

xchg CX,[100]

Not allowed states

Destination	Source
Memory	Memory
Register 8 bit	Register 16 bit
Seg-Register	Seg-Register

Allowed states:

Destination	Source
Accumulator	Register16
Memory	Register
Register	Register
Register	Memory

C) Load Effective Address LEA

There are several load-effective address instructions in the microprocessor instruction set. The **LEA** instruction loads any 16-bit register with the offset address, as determined by the addressing mode selected for the instruction. The **LDS** and **LES** variations load any 16-bit register with the offset address

retrieved from a memory location, and then load either DS or ES with a segment address retrieved from memory.

Mnemonic	Meaning	Format	Operation	Flags affected
LEA	Load effective address	LEA Reg16,EA	EA → (Reg16)	None
LDS	Load register and DS	LDS Reg16,EA	EA → (Reg16) EA+2 → (DS)	None
LES	Load register and ES	LES Reg16,EA	EA → (Reg16) EA+2 → (ES)	None

LEA

The LEA instruction loads a 16- or 32-bit register with the offset address of the data specified by the operand.

By comparing LEA with MOV, we observe that LEA BX,[DI] loads the offset address specified by [DI] (contents of DI) into the BX register; MOV BX,[DI] loads the data stored at the memory location addressed by [DI] into register BX.

Example1:

LEA SI , [BX+DI].

This instruction adds BX to DI and stores the sum in the SI register.

LDS, LES

The LDS and LES instructions load any 16-bit or 32-bit register with an offset address, and the DS, ES segment register with a segment address. These instructions use any of the memory-addressing modes to access a 16-bit or 32-bit section of memory that contains both the segment and offset address.

Example2:

LDS BX, [DI]

This instruction transfers the 16-bit number, addressed by DI in the data segment, into the BX and DS registers.

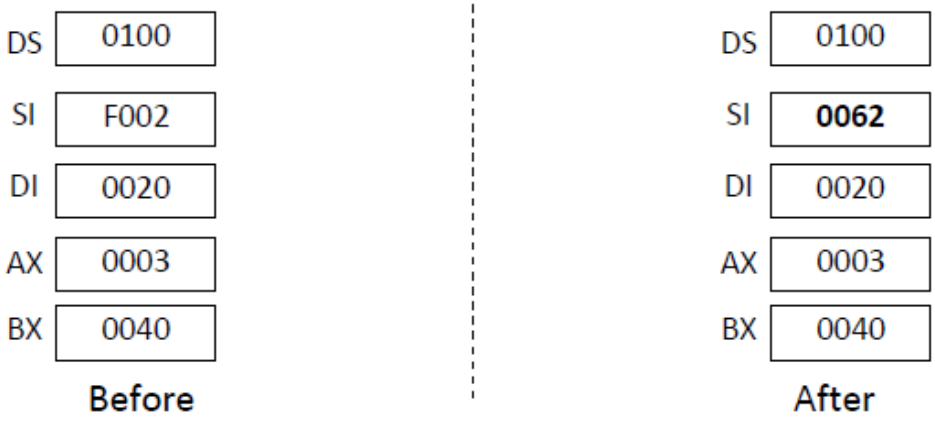
Example3:

For the figure below, what is the result of executing the following instruction?

LEA SI, [DI + BX +2H]

Solution:

SI= (DI) + (BX) + 2H = 0062H



For these three instructions (LEA, LDS and LES) the effective address could be formed of **all** or any various combinations of the three elements in Fig below

$$EA = \begin{Bmatrix} BX \\ BP \end{Bmatrix} + \begin{Bmatrix} DI \\ SI \end{Bmatrix} + \begin{Bmatrix} 8-bit\ displacement \\ 16-bit\ displacement \end{Bmatrix}$$

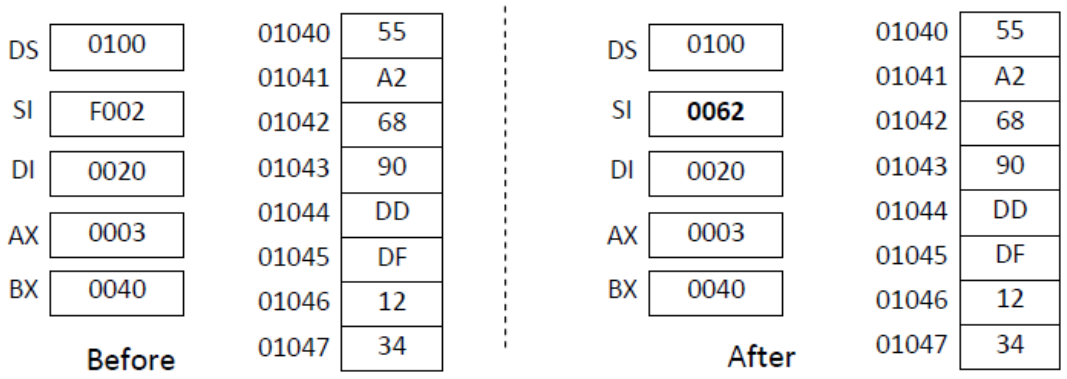
The three element used to compute an effective address

Example 4: For the figure below, what is the result of executing the following instruction?

```
LEASI , [ DI + BX +2H]
```

Solution:

SI= (DI) + (BX) +2H = 0062H



Example 5 :

Instruction Sample		Result
LEA SI , [BX + SI + 55]	Valid	SI= BX + SI + 55
LEA SI , [BX + SI]	Valid	SI= BX + SI
LEA BP , [890C]	valid	BP= 890C
LEA AX , [BX + SI + 20]	Valid	AX = BX + SI + 20
LEA DI , [BP + DI + 55]	Valid	DI = BP + DI + 55
LEA DI , [DI + DI + 55]	Not valid because EA doesn't involve DI twice	
LEA CS , [BP + DI + 55]	Not valid because destination cant be segment register	
LEA IP , [BP +550C]	Not valid because destination cant be instruction pointer	
LEA AX , [CX + DI + 1D]	Not valid because EA doesn't involve CX	
LEA AL , [DI + 103D]	Not valid because destination must be 16 bit	

Example 6:What is the result after executing each one of the next instructions?

```
LEA BP, [F004]
MOV BP, F004
MOV BP, [F004]
```

Solution:

Instruction	Result
`LEA BP, [F004]`	The value F004 will be assigned to the **Base Pointer**
`MOV BP, F004`	The value F004 will be assigned to the **Base Pointer**
`MOV BP, [F004]`	The wordat memory locations F004 and F005 (in the current **Data Segment**) will be assigned to **Base Pointer**

Question

What is the contents of SI after executing the following instruction?

LEA SI, [DI+BX+10h]

Where DI=50h, BX=10h.

ملخص لعمل الايعازات (LEA, LDS, LES)

الكلمة المختزلة	المعنى	الصيغة	العملية	الأعلام المتأثرة
LEA	تحميل عنوان فعال	LEA reg16,mem16	Mem16 → reg16	لا يوجد
LDS	تحميل مسجل و المسجل DS	LDS reg16,mem32	Mem32 → reg16 Mem32+2 → DS	لا يوجد
LES	تحميل مسجل و المسجل ES	LES reg16,mem32	Mem32 → reg16 Mem32+2 → ES	لا يوجد