Lec-27

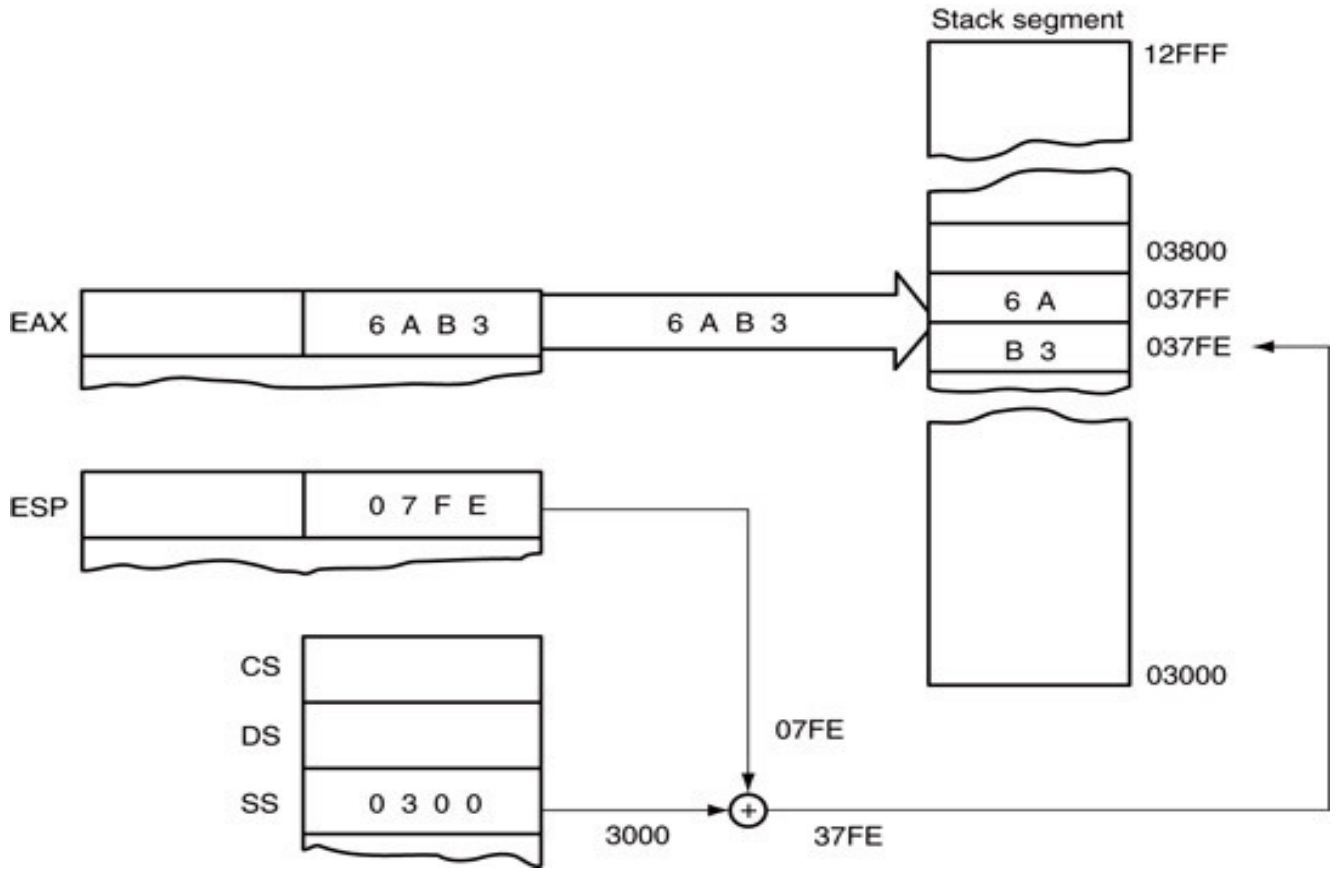
Instruction Set / 8086

LABEL	OP CODE	OPERAND	COMMENT
NEXT:	ADD	AL, 07H	; ADD a number

- **Data Transfer Instructions**
- **Arithmetic Instructions**
- **Logical Instructions**
- **Branch and Program control Instructions**

Data transfer Instructions

- MOV – R/M
- Segment MOV instructions
- PUSH
- POP

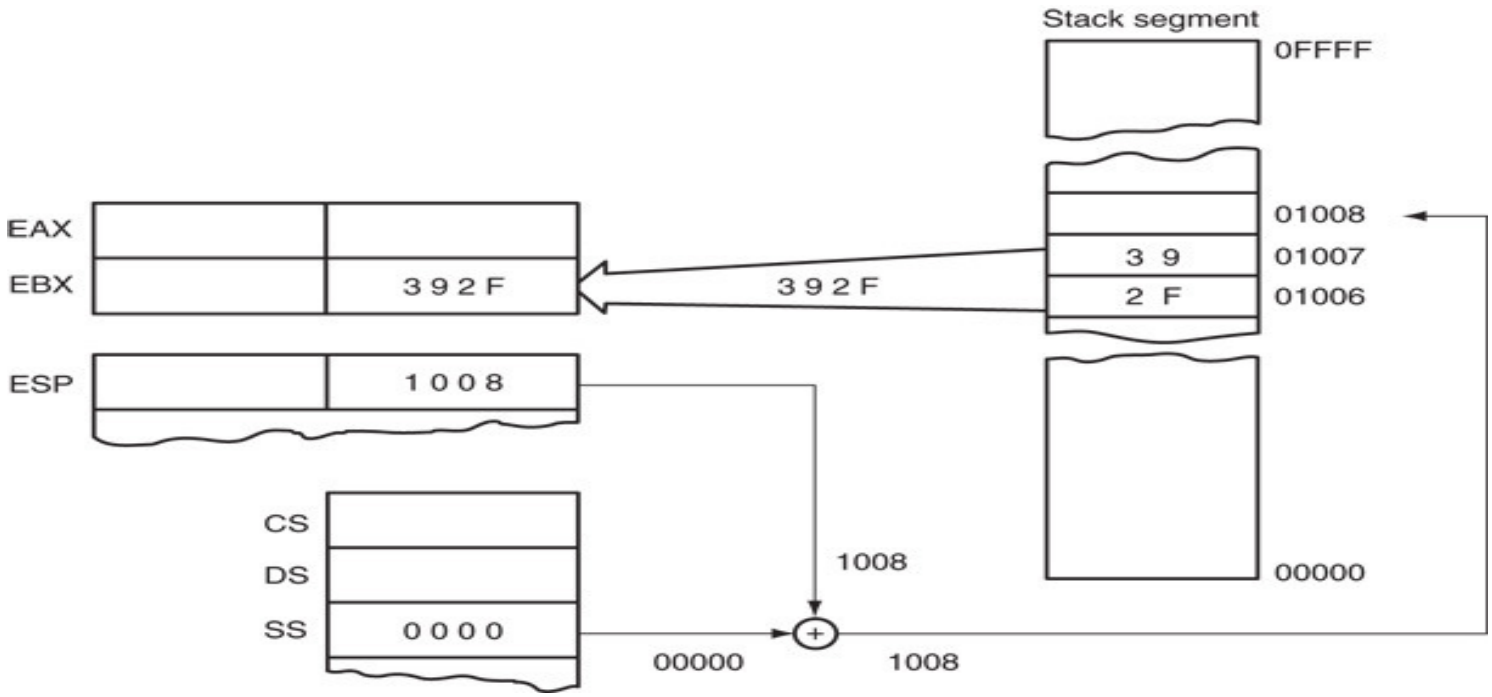

Stack segment
12FFF
03800
037FF
037FE
03000
EAX
6 A B 3
6 A B 3
6 A
B 3
ESP
0 7 F E
CS
DS
SS
0 3 0 0
07FE
3000
37FE

Data Transfer Instructions

- PUSH
- PUSHF: Flag register
- PUSHD
  - 6A if immediate date are 00 to FF H
  - 68 if immediate date are 0100 to FFFF H
  - Ex: PUSH 8, PUSH ’A’

Data Transfer Instructions

- POP
- POPF: removes 16-bit no. from the stack top to Flag
- POP CS? ---unpredictable


Stack segment
0FFFF
01008
3 9
01007
2 F
01006
00000
EAX
EBX
3 9 2 F
3 9 2 F
ESP
1 0 0 8
CS
DS
SS
0 0 0 0
1008
00000
1008

Data transfer Instructions

- **LEA:**
  - **Loads any 16 bit reg. with offset address specified by any addressing mode.**
  - **LEA SI,DATA1 Loads SI with offset address DATA1**
  - **LEA AX,NUMB Loads AX with offset address of NUMB**
  - **LEA BX,[DI] loads offset address specified by [DI] into BX reg**
  - **LEA with operand as displacement = Directive OFFSET (3 bytes)**
  - **Ex. MOV BX,OFFSET LIST = LEA BX,LIST -**
  - **Loads offset address of memory location LIST into BX**
  - **MOV DI,OFFSET DATA2 ?**
  - **OFFSET can only use with simple operands**
  - **OFFSET can't use with [DI] or LIST[SI] But efficient than LEA**
  - **LEA BX,[DI]**
  - **LEA SI,[BX+DI]**
  - **If [BX]= 1000 & [DI] = 2000 then offset =[BX]+[DI]=3000H hence, SI=3000H**
  - **then SI=3000H**
  - **If BX= 1000 & DI = FF00H**
  - **then SI=10F00H=0F00H (Drops any carry out of 16 bit sum- Modula 64K sum)**

Data transfer Instructions

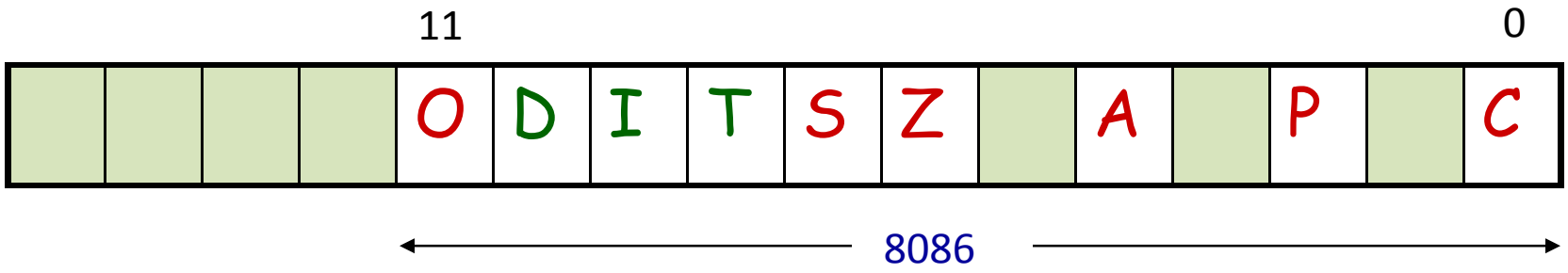
- LDS
  - Loads any 16 bit reg. with offset address retrieved from memory location.
  - And then loads DS with seg address retrieved from memory.
  - Ex. LDS BX,[DI]
  - Default seg=DS=1000 & [DI]=1000
  - BX from addresses 11000H and 11001H
    DS from locations 11002H and 11003H.

- LES
  - Loads any 16 bit reg. with offset address retrieved from memory location.
  - And then loads ES with seg address retrieved from memory.

STRING DATA TRANSFERS

- Five string data transfer instructions: LODS, STOS, MOVS, INS, and OUTS.
- Each allows data transfers as a single byte, word, or doubleword.
- Before the string instructions are presented, the operation of the D flag-bit (direction), DI, and SI must be understood as they apply to the string instructions.

The Direction Flag



- The direction flag (D, located in the flag register) selects the auto-increment or the auto-decrement operation for the DI and SI registers during string operations.
  - used only with the string instructions
- The CLD instruction clears the D flag
- The STD instruction sets it .
  - CLD instruction selects the auto-increment mode
  - STD selects the auto-decrement mode

DI and SI

- During execution of string instruction,
- memory accesses occur through DI and SI registers.
- DI offset address accesses data in the extra segment for all string instructions that use it
- SI offset address accesses data by default in the data segment

LODS

- Loads AL, AX, with data at segment offset address indexed by the SI register.
- 1 is added to or subtracted from SI for a byte-sized LODS
- 2 is added or subtracted for a word-sized LODS.
- LODSB AL=DS:[SI]; SI=SI+1
- LODSW AX=DS:[SI]; SI=SI+2
- If DS=1000H, D=0?
- AX is loaded from memory 11000 & 11001.

The operation of the LODSW instruction if DS=1000H, D=0,11000H, 11001H = A0. This instruction is shown after AX is loaded from memory 11000 & 11001.