MICROPROCESSORS AND INTERFACES: 8086 INSTRUCTIONS SET : PART-1

BY DR. SANJAY VIDHYADHARAN

TYPES OF INSTRUCTIONS

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

TYPES OF INSTRUCTIONS

- 2-Operand Instructions
  (source and destination)
  R⇔R,
  R⇔M,
  R ⇦ Immd data
  M ⇦ Immd data
  ~~M⇔M~~ (not permitted)

- 1-Operand Instructions
  source or destination
  R , M, but not ~~Immd data~~)

- Instructions without any operand

Data Transfer Instructions

DATA TRANSFER INSTRUCTIONS

- General Purpose Data Transfer

  (MOV, XCHG, XLAT, PUSH, POP)
- Input / Output Data Transfer

  (IN, OUT)
- Address Object Data Transfer

  (LEA, LDS, LES)
- Flag Transfer Data Transfer

  (LAHF, SAHF, PUSHF, POPF)

GENERAL PURPOSE DATA TRANSFER

- **MOV DST, SRC**

- Copies the content of source to destination
- Source can be register, memory, or immediate data
- Destination can be register or memory location
- Size of source and destination must be the same

- IMPORTANT: Flags are not affected

DIFFERENT MOV OPTIONS

R ← M

M ← R

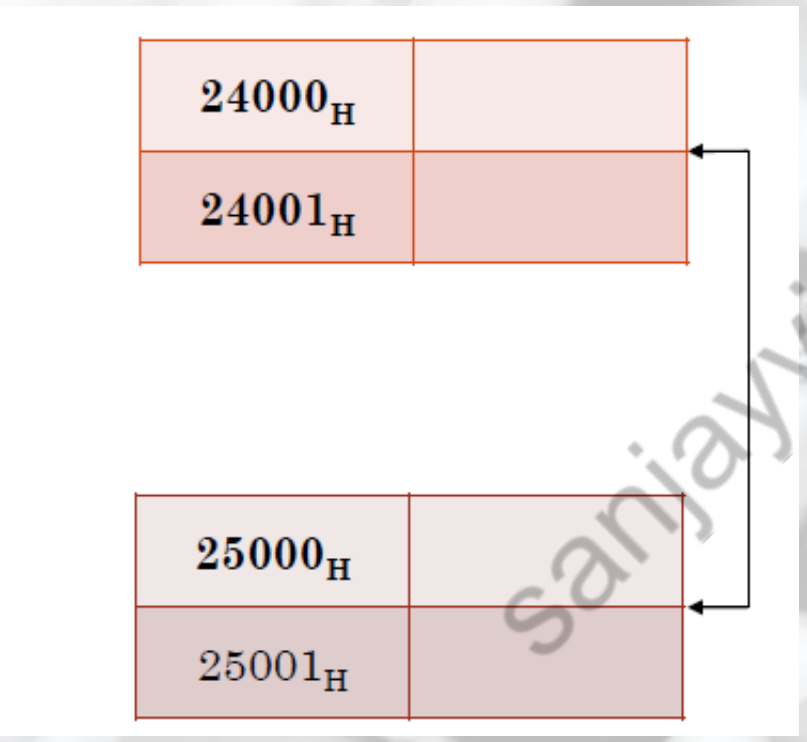
R ← R

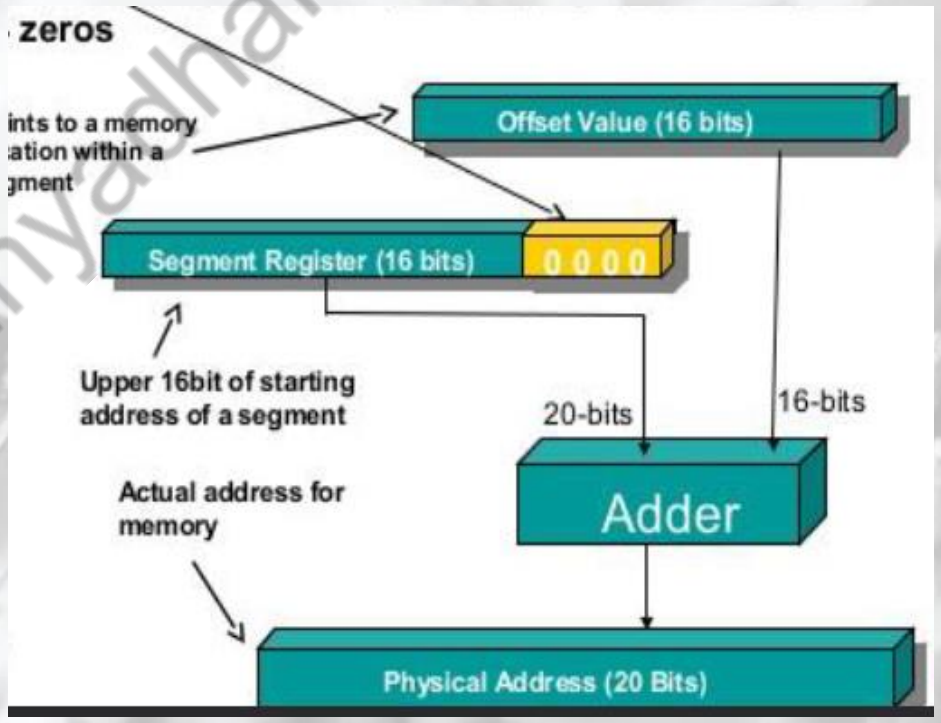
M ← I

R ← I

MOV INSTRUCTIONS

Example 1: Mov the contents (word) at memory location 24000_H with 25000_H





MOV INSTRUCTIONS

```
MOV AX, 2000H
MOV DS, AX
```

- Initialise Segment Register

```
MOV SI, 4000H
MOV DI, 5000H
```

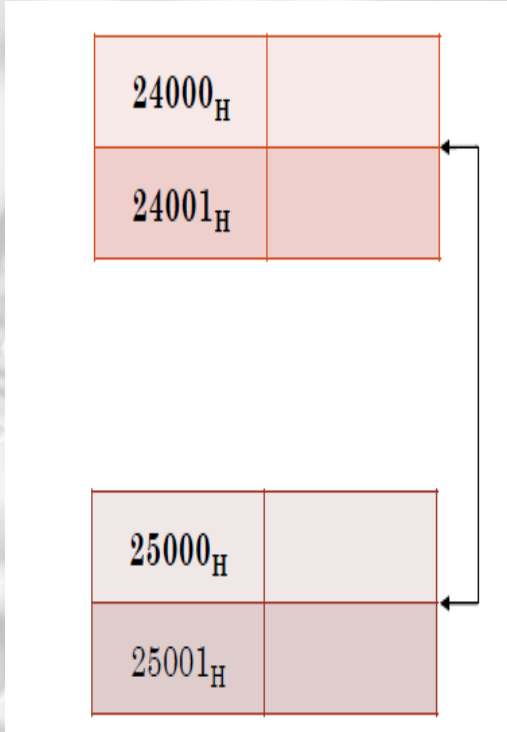
- Initialise Offset Registers

```
MOV BX, [SI]
MOV DX, [DI]
```

- Transfer data from reg to mem temporarily

```
MOV [SI], DX
MOV [DI], BX
```

- Store back the data in mem



XCHG INSTRUCTIONS

XCHG : (exchange)switches the contents of the source and destination operands (byte or word).

Can not exchange the contents of two memory locations directly.

Memory location can be specified as the source or destination.

Segment registers can not be used.

XCHG reg , mem

Machine code format

EXAMPLE

XCHG AX,BX

Before execution AX = 0001H, BX = 0002H

After execution AX = 0002H, BX = 0001H

XLAT

XLAT (translate) replaces a byte in the AL register with a byte from a 256 byte, user-coded translation table.

Register BX is assumed to be pointed to the beginning of the table (i.e. beginning location of the table)

Byte AL is used index in to the table (AL = 0).

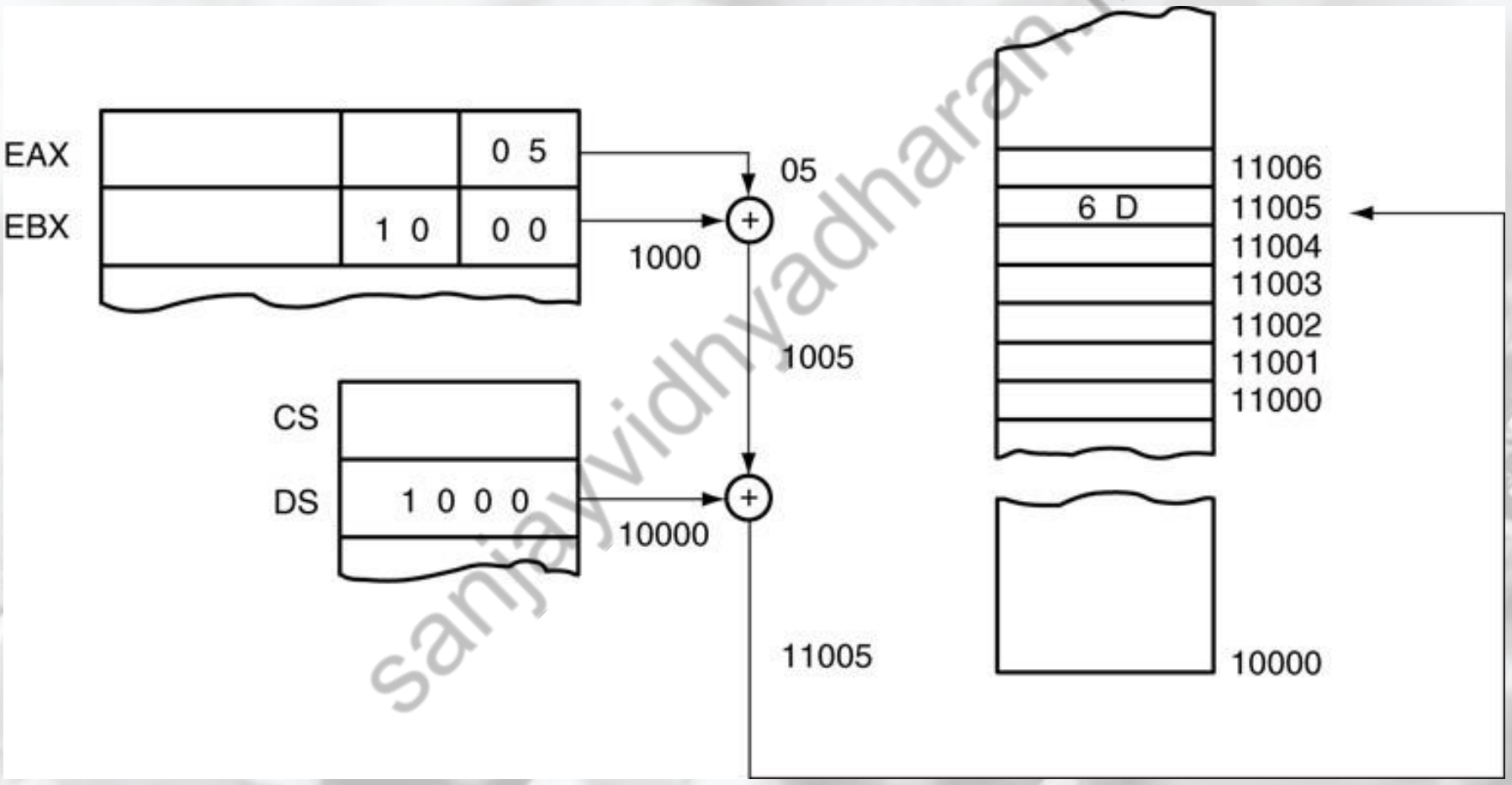
AL is replaced with byte at location [BX]+AL.

XLAT

11010111

Machine code format

XLAT



EXAMPLE(CONTD)....

DS = 2000

Assume BX is pointing beginning location of the table (i.e. BX = 0000 H).

```
MOV AL, 05
XLAT
```

After execution AL is copied with byte located by BX +

AL = 0000 H + 05 H = 0005 H.

PA = DS*10 H+0005 H=20005 H

(i.e. content at location 20005 H is copied into AL = 6D H)

```
MOV AL, 07
XLAT
```

After execution what is the value of AL = ?

20000 H	00	3FH
20001 H	01	06 H
20002 H	02	5B H
20003 H	03	4F H
20004 H	04	66 H
20005 H	05	6D H
20006 H	06	7D H
20007 H	07	27 H
20008 H	08	7F H
20009 H	09	6F H

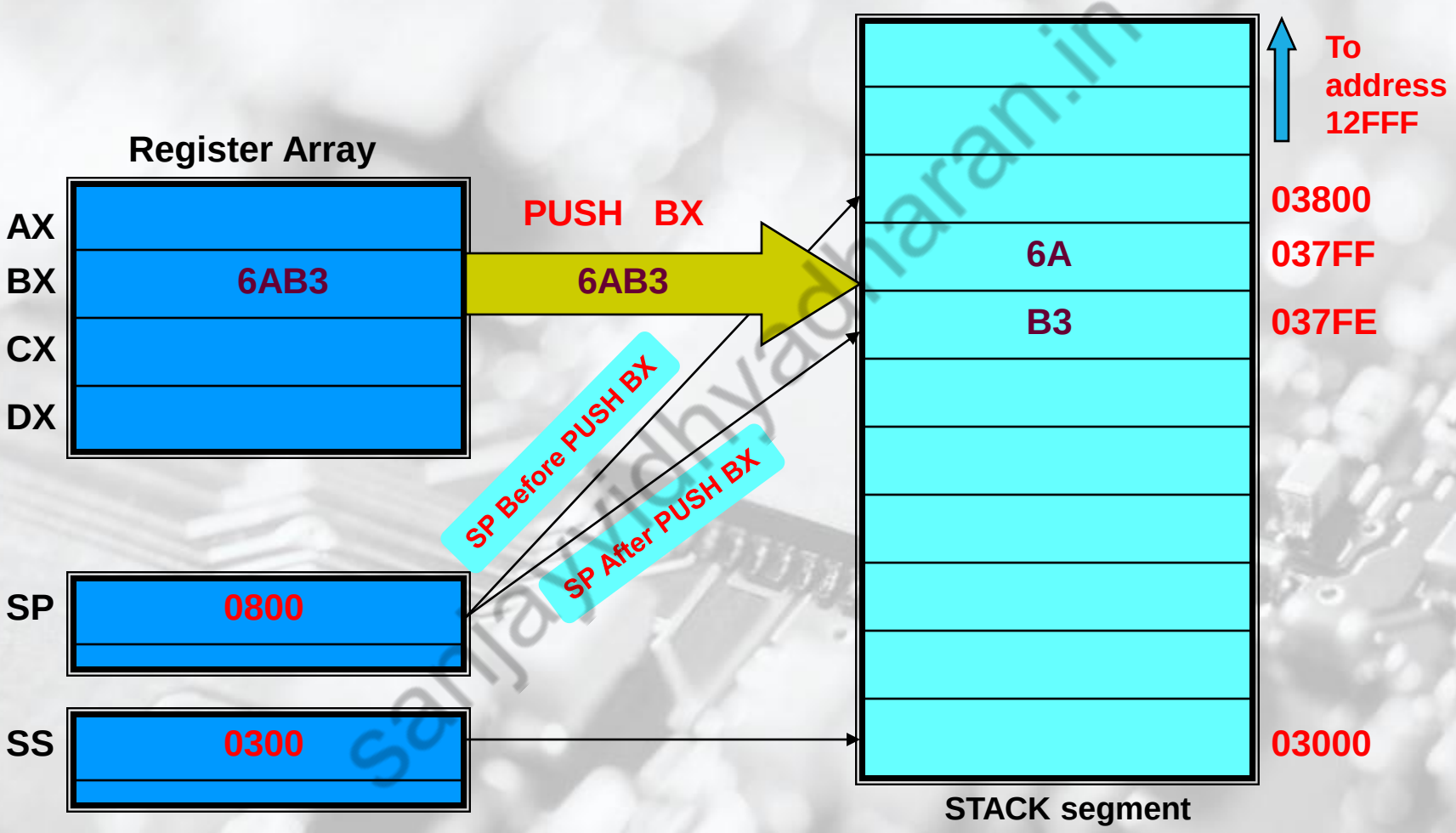
PUSH

- It is used for storing data into temporary memory (stack).
- Pushes the contents of the specified register / memory location on to the stack.
- The stack pointer is decremented by 2 , after each execution.
- The source of the word can be a general purpose register, a segment register, or memory.
- The SS and SP must be initialized before this instruction.
- No flags are affected.

PUSH

- Store data into LIFO stack memory
- 2/4 bytes involved
- Whenever 16-bit data pushed into stack
- Contents of SP register decremented by 2
- MSB moves into memory [SP-1]
- LSB moves into memory [SP-2]

PUSH



PUSH

Push data from

- Registers/Segment Register
- Memory
- Flag Register

PUSH

Always transfers 2 bytes of data to the stack;

- 80386 and above transfer 2 or 4 bytes

PUSHA instruction copies contents of the internal register set, except the segment registers, to the stack.

PUSHA (**push all**) instruction copies the registers to the stack in the following order: AX, CX, DX, BX, SP, BP, SI, and DI.

PUSH

PUSHA instruction pushes all the internal 16-bit registers onto the stack.

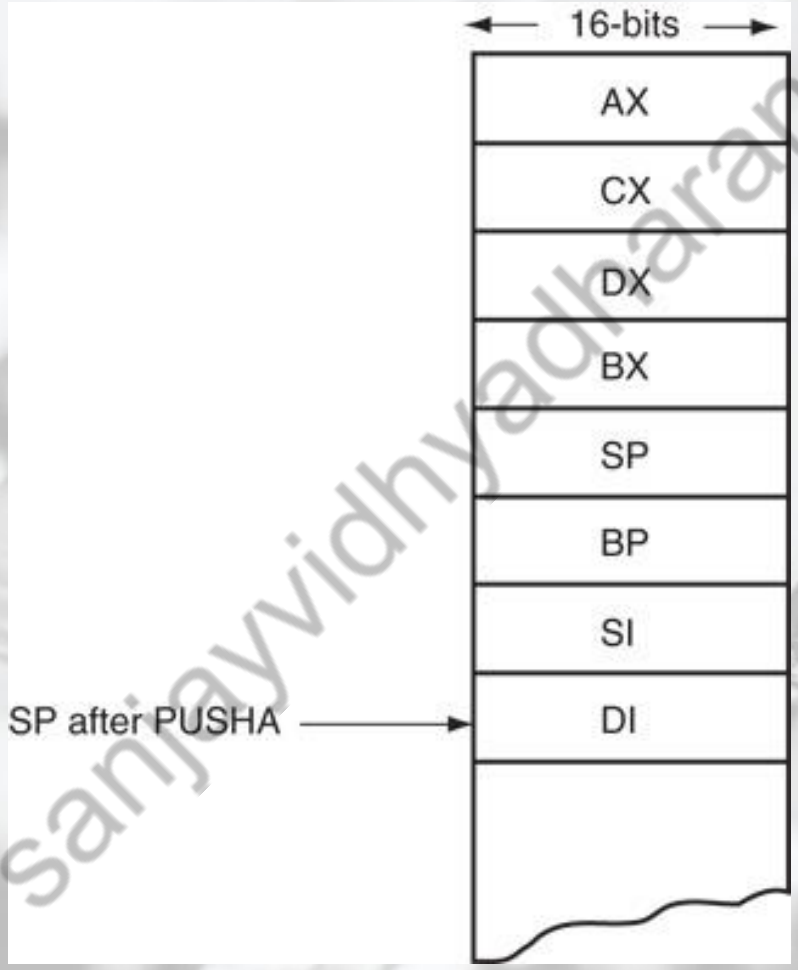
requires 16 bytes of stack memory space to store all eight 16-bit registers

After all registers are pushed, the contents of the SP register are decremented by 16.

PUSHAD instruction places 32-bit register set on the stack in 80386 - Core2.

- PUSHAD requires 32 bytes of stack storage

PUSHA INSTRUCTION, SHOWING THE LOCATION AND ORDER OF STACK DATA.



PUSH Instruction

PUSHF (**push flags**) instruction copies the contents of the flag register to the stack.

PUSHAD instructions push the contents of the 32-bit register set in 80386 - Pentium 4.

PUSHA instructions do not function in the 64-bit mode of operation for the Pentium 4

PUSH

Example-PUSH operation

PUSH AX
PUSH EBX
PUSH DS
PUSH WORD PTR[BX]
PUSHF
PUSHFD
PUSHA
PUSHAD
PUSH 16-imm
PUSHD 32-imm

Directives BYTE PTR, WORD PTR, DWORD PTR

•mov [SI], al ; Store a byte-size value in memory location pointed by SI
suggests that an 8-bit quantity should be moved because AL is an 8-bit register.

•When instruction has no reference to operand size,
mov [SI], 5 ; Error: operand must have the size specified

•To get around this instance, we must use a pointer directive, such as
mov BYTE PTR [SI], 5 ; Store 8-bit value
mov WORD PTR [SI], 5 ; Store 16-bit value
mov DWORD PTR [SI], 5 ; Store 32-bit value

POP

- Performs the inverse operation of PUSH
- The POP instruction removes a word from the top of the stack to the specified 16-bit register or memory location.
- The stack pointer is incremented by 2 after the execution.
- Ex: POP CX

  - copies a word from the top of stack to the CX register and increment SP by 2.
- not available as an immediate POP

POP

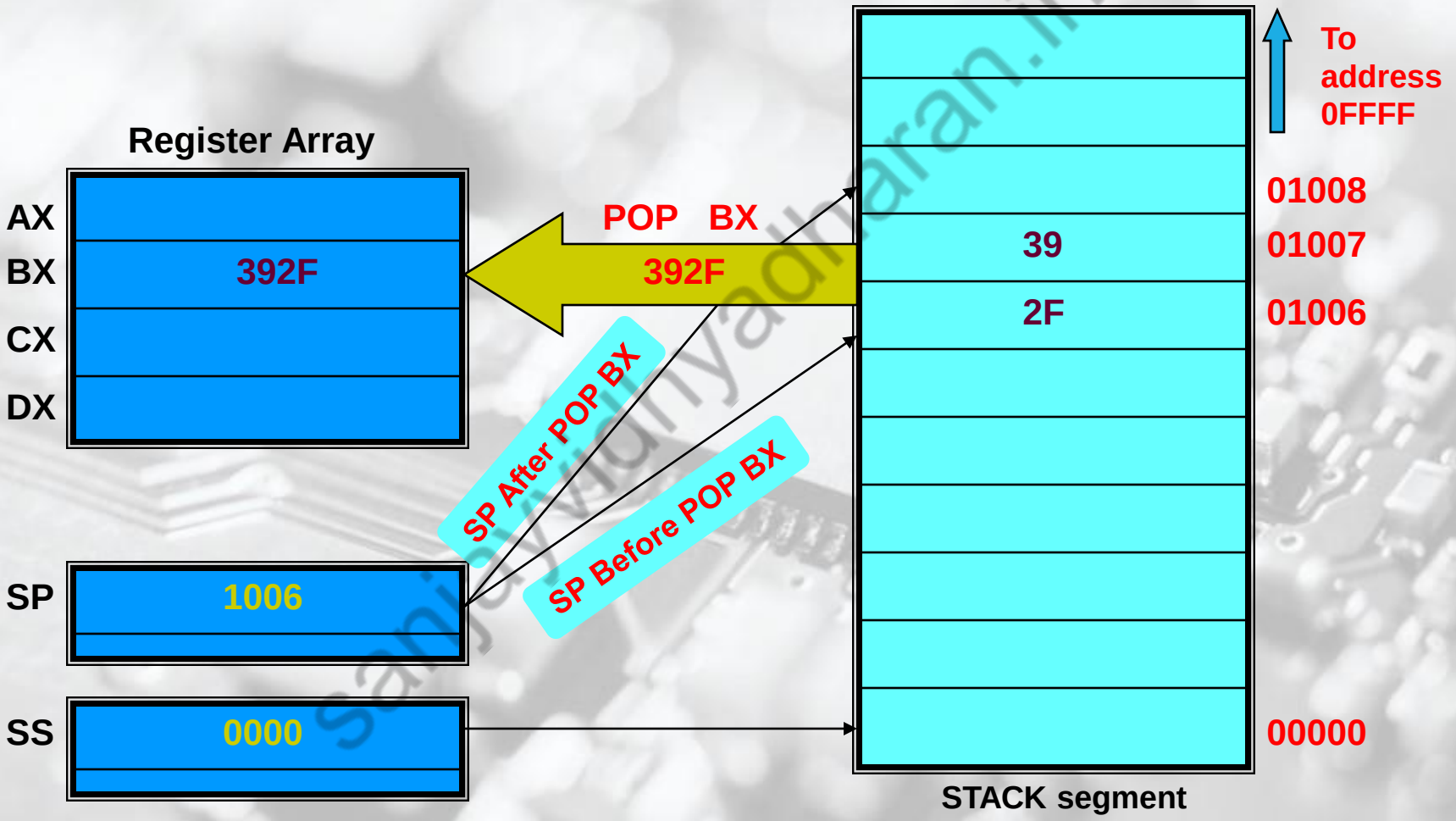
POPF (pop flags) removes a 16-bit number from the stack and places it in the flag register;

- POPFD removes a 32-bit number from the stack and places it into the extended flag register

POPA (pop all) removes 16 bytes of data from the stack and places them into the following registers, in the order shown: DI, SI, BP, SP, BX, DX, CX, and AX.

- reverse order from placement on the stack by PUSHA instruction, causing the same data to return to the same registers

POP



PUSHF

Pushes flag register on to the stack; First the upper byte and then the lower byte is pushed on to it. The SP (stack pointer) is decremented by 2 for each PUSH operation.

The FLAGS themselves are not affected.

PUSHF

10011100

Machine code format

POPF

Transfers a word from the current top of the stack to the FLAG register and increments the SP by 2.

All the flags will be affected.

PUSHF and POPF are used when there is a subprogram.

POPF

Machine code format

THANK YOU