AY 2023-2024

ARCHITECTURE AND ORGANIZATION

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UMak - CCS

INTRODUCTION TO ASSEMBLY LANGUAGE: DATA TRANSFER INSTRUCTIONS

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Learning Outcomes:

At the end of the topic session, the students should be able to:

- Define Assembly Language.
- Explain basic terminologies in Assembly Language.
- Perform data transfer instructions.

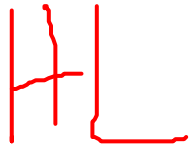
Assembly Language

- Low level programming language that provides direct access to microprocessors and other programmable devices

ML = 0, 1

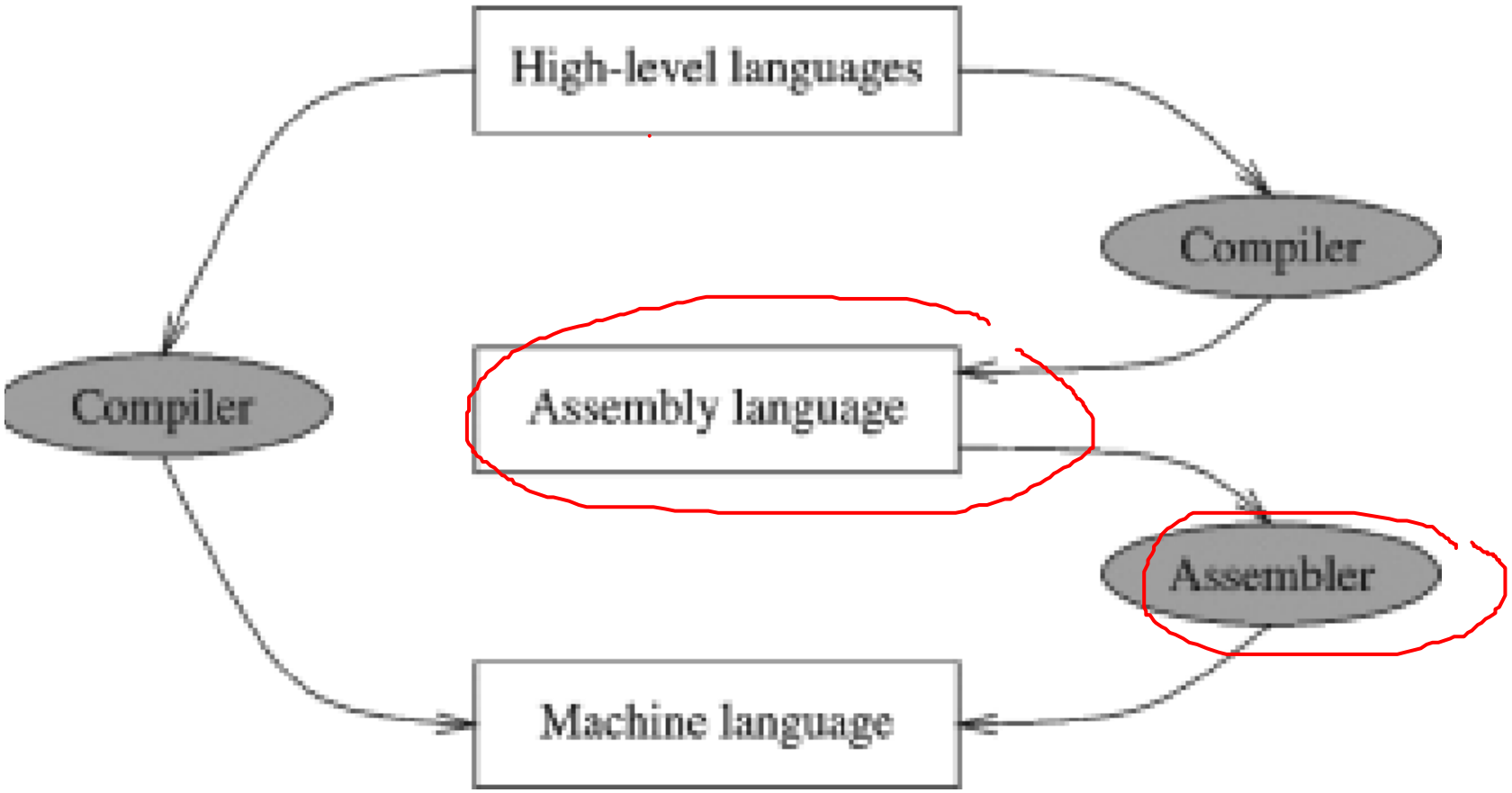
AL =

Utility Programs



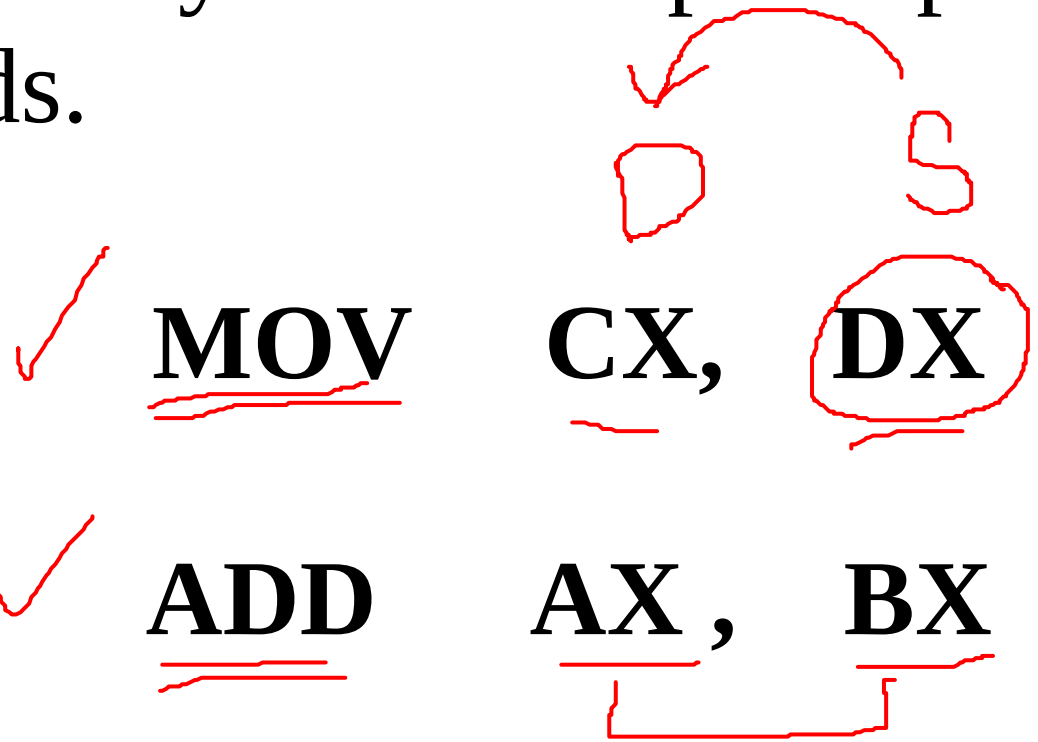
- Assembler – converts source programs from assembly language into machine language
- Linker – combines individual files created by an assembler into a single executable program
- Debugger – allows you to examine registers and memory while the program is running

Language Translators



OPCODE AND OPERAND

An assembly is made up of opcodes and operands.



DATA TRANSFER INSTRUCTIONS

1. MOV INSTRUCTION
2. XCHG INSTRUCTION
3. PUSH INSTRUCTION
4. POP INSTRUCTION

1. MOV INSTRUCTION

FORMAT: MOV D,S

ACTION: D ← [S]

Example:

- MOV AX, BX
- MOV BX, [CX] → PA (Physical Address) = SS X 10H + [X]
- MOV DX, 001EH

Example

Assume the following register content:

AX= 0015H

BX= 0019H

CX= 0012H

DX= 001BH

SS= 2000H

SI= 001EH

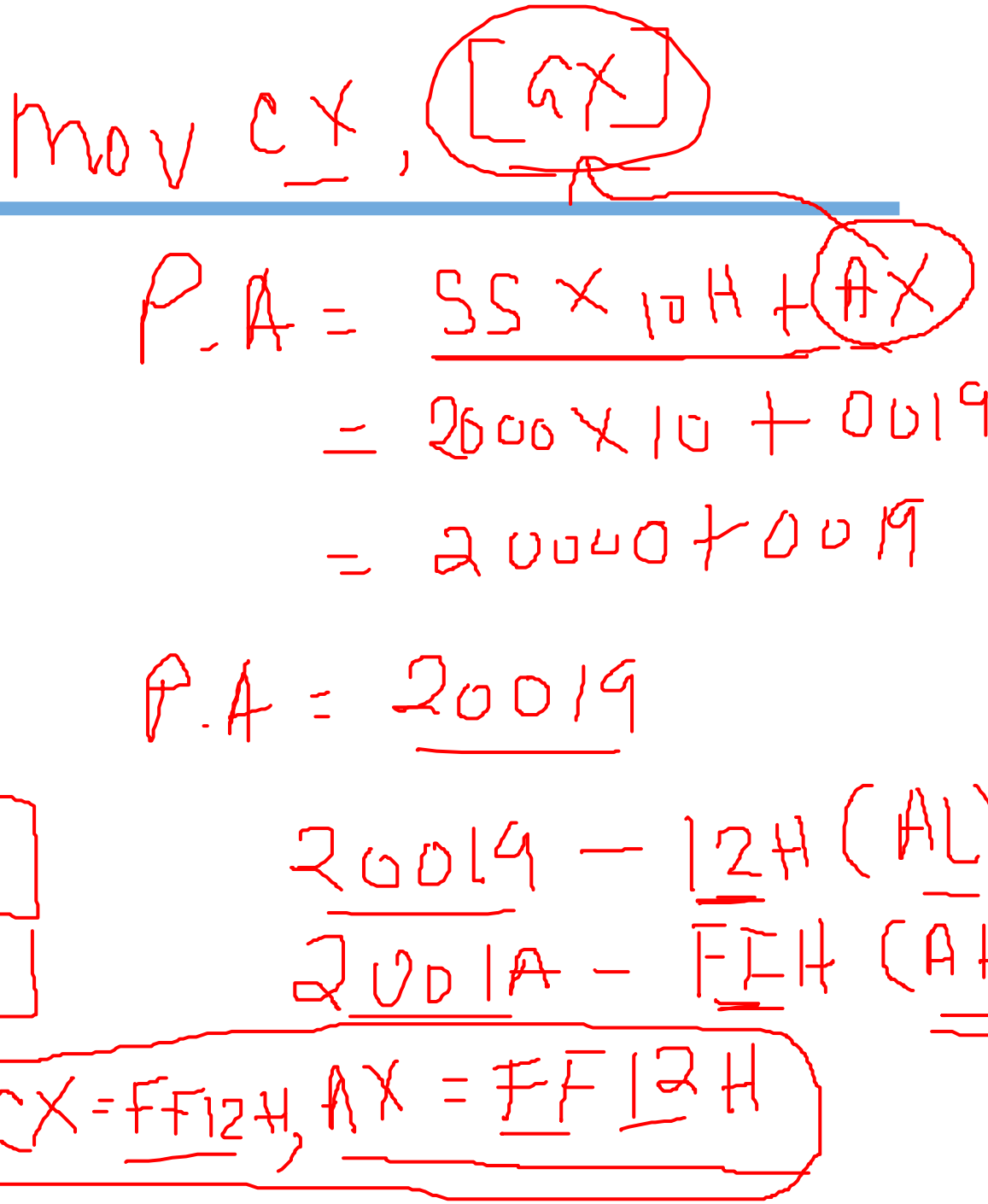
DI= 0017H

Example 1

AX= 0015H
BX= 0019H
CX= 0012H
DX= 001BH

SS= 2000H
SI= 001EH
DI= 0017H

MOV AX, BX
MOV DI, 0005
MOV CX, [AX]



accumulator base count data

(16) AX (16) BX (16) CX (16) DX

ah al bh bl ch cl dh dl

h - higher
l - lower

ah al
AX = 34 56 H

ah = 34 al = 56

dx = 1234

dh = 12
dl = 34

Example 2

AX= 0015H SS= 2000H
BX= 0019H SI= 001EH
CX= 0012H DI= 0017H
DX= 001BH

20012 → 18 (CL)
20013 → 2B (CH)

CX = 2B18H

BX = 2B19H

MOV SI, DI —— SI = 0017H ✓
MOV DX, AX —— DX = 0015H ✓
MOV BX, [CX] —— P.A = 55 X 10H + CX
= 20000 + 0012
P.A = 20012H

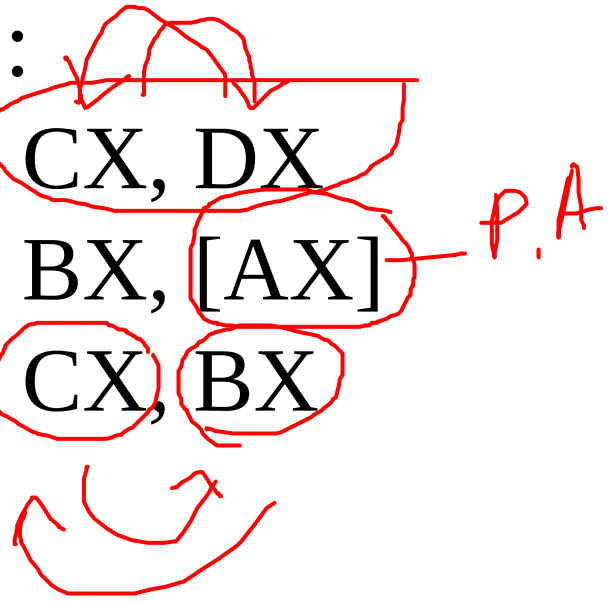
2. XCHG INSTRUCTION

FORMAT: XCHG D,S

ACTION: [D] <-> [S]

EXAMPLE:

```
XCHG CX, DX
XCHG BX, [AX]
XCHG CX, BX
```



Example

Assume the following register content:

AX= 0015H	SS= 2000H
BX= 0019H	SI= 001EH
CX= 0012H	DI= 0017H
DX= 001BH	

Example 1

XCHG CX, DX

XCHG BX, [AX]

XCHG CX, BX

CX = 0012 , DX = 0018

✓ CX = 0018

✓ DX = 0012

CX = 0018H

BX = 95A9H

CX = 95A9H

BX = 0018H

P.A = 55 X 10H + AX

= 20000 + 0015

P-A = 20015

20015 — A9 (AL)

20016 — 95 (AH)

AX = 0019 , BX = 95A9

AX = 95A9H

3. PUSH INSTRUCTION

FORMAT: PUSH REG

ACTION: TOS= SS X 10H + SP

SP= SP – 2

TOS - 1 ← HIGHER BIT

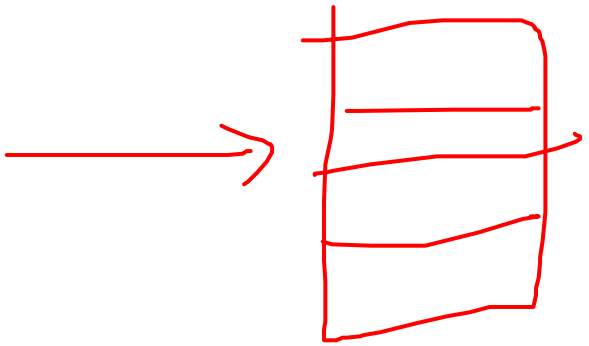
TOS - 2 ← LOWER BIT

EXAMPLE

Assume the following register content:

AX= 0015H	SS= 2000H
BX= 0019H	SI= 001EH
CX= 0012H	DI= 0017H
DX= 001BH	SP= 0035H

PUSH AX = 0015



EXAMPLE

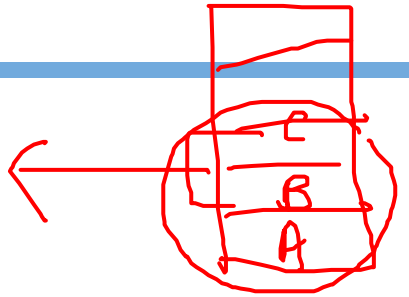
PUSH AX AX= 0015

TOS = SS X 10H + SP
= 20000 + 0035
= 20035

20034 – 60H (AH)
20033 – 21H (AL)

SP = SP-2
= 0035-2
= 0033

4. POP INSTRUCTION



FORMAT: POP REG

ACTION: TOS= SS X 10H + SP

SP= SP + 2

TOS ← LOWER BIT

TOS + 1← HIGHER BIT

EXAMPLE

Assume the following register content:

AX= 0015H	SS= 2000H
BX= 0019H	SI= 001EH
CX= 0012H	DI= 0017H
DX= 001BH	

POP DX

EXAMPLE

POP DX

DX = 061B

TOS = SS X 10H + SP
= 20000 + 0035
= 20035

SP = SP + 2
= 0035 + 2
= 0037

DL — 20035 — 60 (LB)
DH — 20036 — 70 (HB)