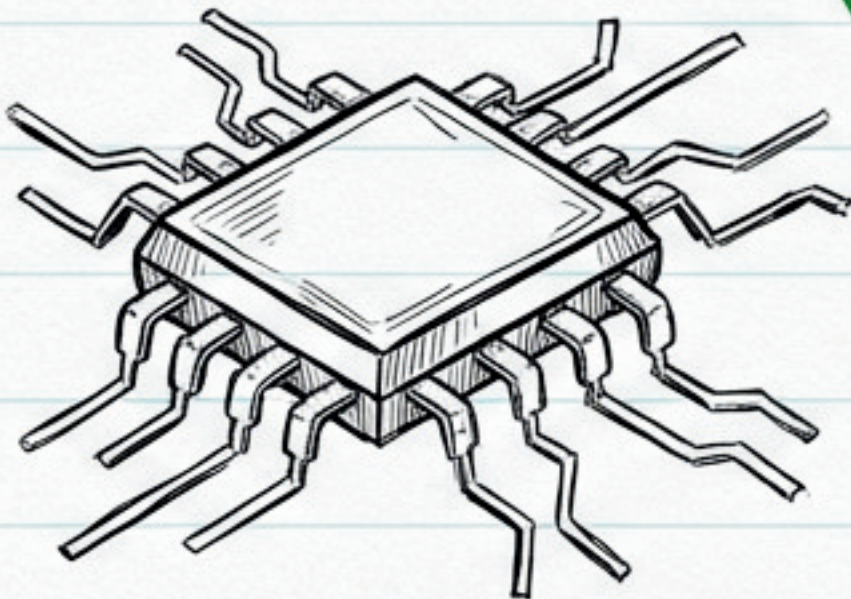


CSA 7103T

COMPUTER SYSTEM ARCHITECTURE

Comprehensive Study Notes

- ✓ Microprocessor Systems & Bus Organization
- ✓ CPU Organization & Addressing Modes
- ✓ 8085 Microprocessor (Architecture, Pins, Instructions)
- ✓ 8086 Microprocessor & Assembly Basics



Notes created by
Kamal Kishor
(HandNotes)

1. INTRODUCTION TO MICROPROCESSOR SYSTEMS

1.1 What is a Computer System?

Caveat: A computer system is an electronic device that accepts data as input, processes it according to instructions, stores it, and produces output.

1. Input Unit – Keyboard, mouse, scanner
2. Central Processing Unit (CPU)
3. Memory Unit
4. Output Unit – Monitor, printer

1.2 What is a Microprocessor?

Caveat: A microprocessor is a single integrated circuit (IC) that contains the CPU of a computer. It performs arithmetic, logical, and control operations.

Example:
8085, 8086

1.3 Microprocessor-Based System

Caveat: A microprocessor system consists of:

- Microprocessor
- Memory (RAM & ROM)
- Input/Output devices
- System buses

2. BUS ORGANIZATION

2.1 What is a Bus?

A bus is a group of parallel wires used to transfer data between components.

2.2 Types of Buses

- **Data Bus**

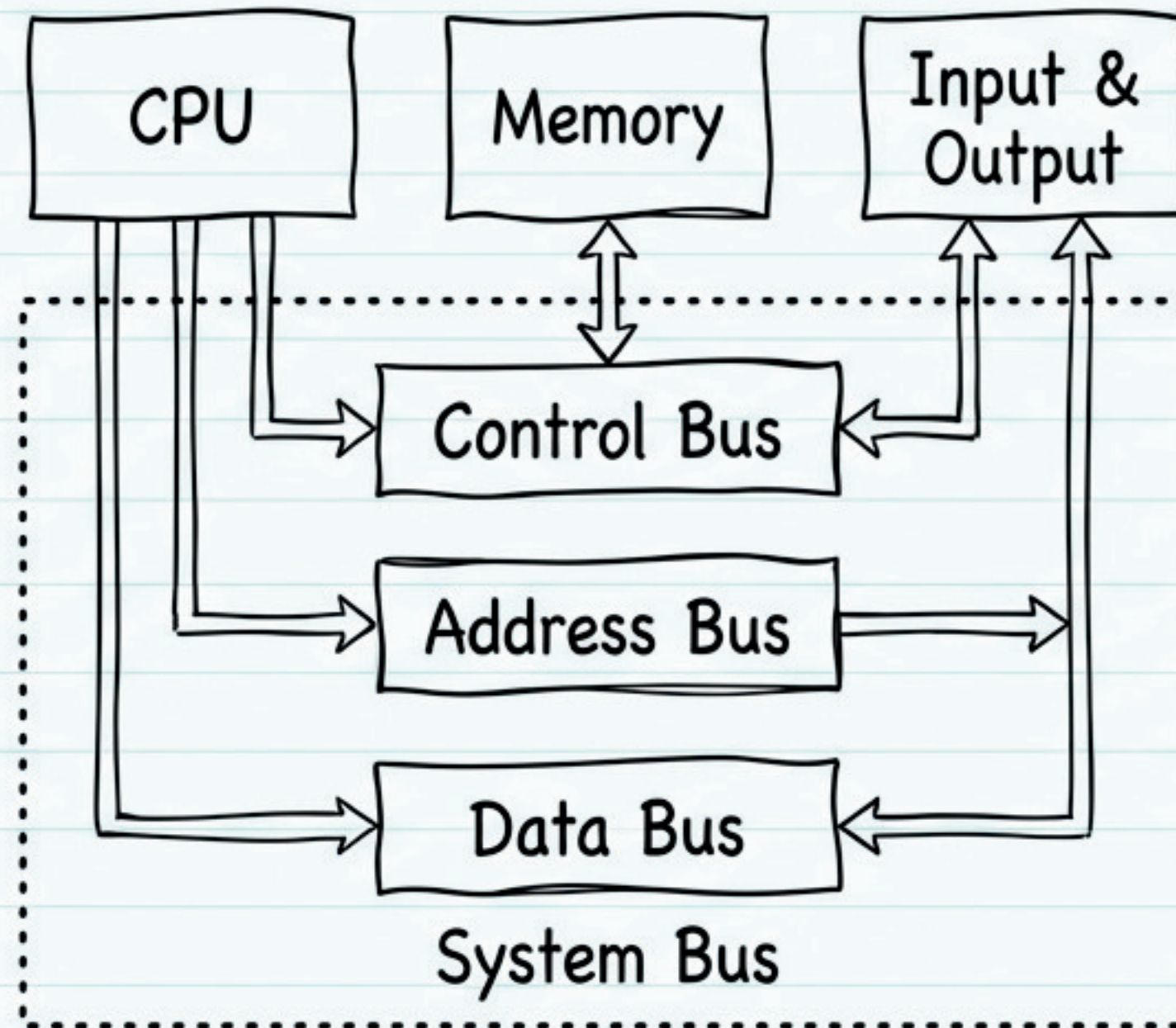
- Transfers actual data
- Bidirectional
- Width determines data size (8-bit, 16-bit)

- **Address Bus**

- Transfers address of memory or I/O
- Unidirectional
- Determines memory size

- **Control Bus**

- Transfers control signals
- Examples:
Read, Write, Interrupt, Clock



3. CPU ORGANIZATION

3.1 Main Parts of CPU

1. ALU (Arithmetic Logic Unit)
 2. Control Unit
 3. Registers
-

3.2 Arithmetic Logic Unit (ALU)

Performs:

- Addition
 - Subtraction
 - AND, OR, XOR
 - Comparison
-

3.3 Registers

Registers are high-speed memory units inside CPU.

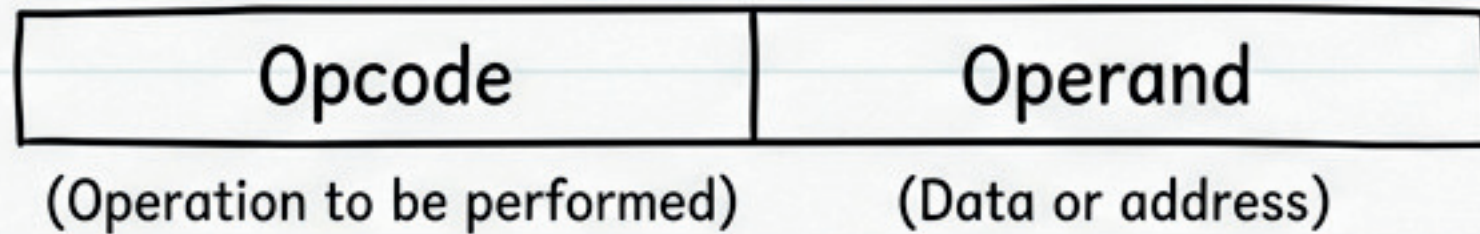
- Types of Registers: {
- Accumulator
 - Program Counter (PC)
 - Stack Pointer (SP)
 - General Purpose Registers

4. INSTRUCTION FORMAT

4.1 What is an Instruction?

An instruction tells the CPU what operation to perform.

4.2 Instruction Format



4.3 Types of Instruction Format

1. One Address Instruction
2. Two Address Instruction
3. Three Address Instruction

5. STACK ORGANIZATION

5.1 What is Stack?

A stack is a memory structure that works on **LIFO** (Last In First Out) principle.

5.2 Stack Operations

PUSH – Insert data

POP – Remove data



5.3 Stack Pointer (SP)

- Holds the address of top of stack
- Automatically updated

6. SUBROUTINES

6.1 What is a Subroutine?

A subroutine is a small program that performs a specific task and can be reused.

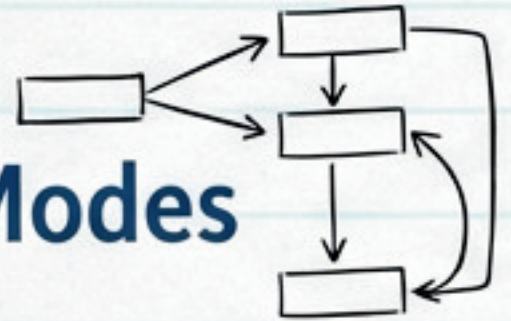
6.2 Advantages

- ✓ Saves memory
- ✓ Modular programming
- ✓ Easy debugging

7. ADDRESSING MODES

7.1 What is Addressing Mode?

Addressing Mode defines how the operand is accessed.



7.2 Types of Addressing Modes

1. Direct Addressing — Address is directly specified
2. Indirect Addressing — Address is stored in a register
3. Immediate Addressing — Data is part of instruction
4. Indexed Addressing — Effective address = Base + Index
5. Relative Addressing — Address = PC + Offset

8. ADDRESSING FORMATS

8.1 One Address Format

Single operand

Example:
ADD A

8.2 Two Address Format

Source and destination

Example:
MOV A, B

8.3 Three Address Format

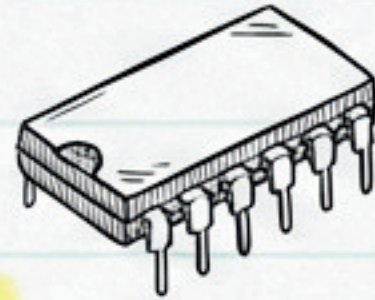
Two operands + result

(Used in high-level architectures)

9. 8085 MICROPROCESSOR

9.1 Introduction to 8085

- 8-bit microprocessor
- 16-bit address bus
- Can address 64 KB memory



9.2 Architecture of 8085

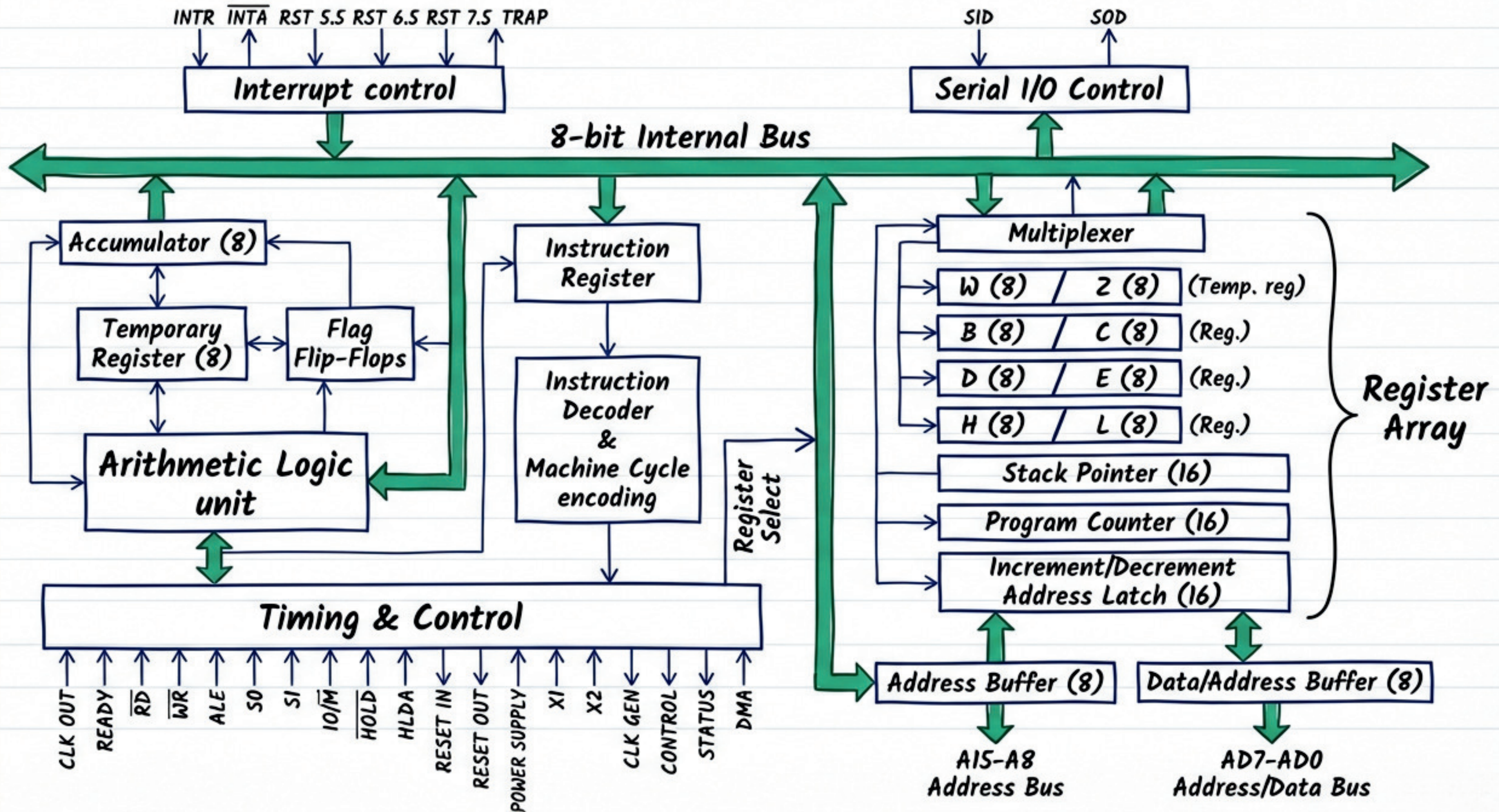
Main blocks:

- ALU (Arithmetic Logic Unit)
- Register Array
- Instruction Decoder
- Timing & Control Unit

Detailed Architecture
Diagram Next Page



Fig. 8085 Architecture



9.3 Registers of 8085

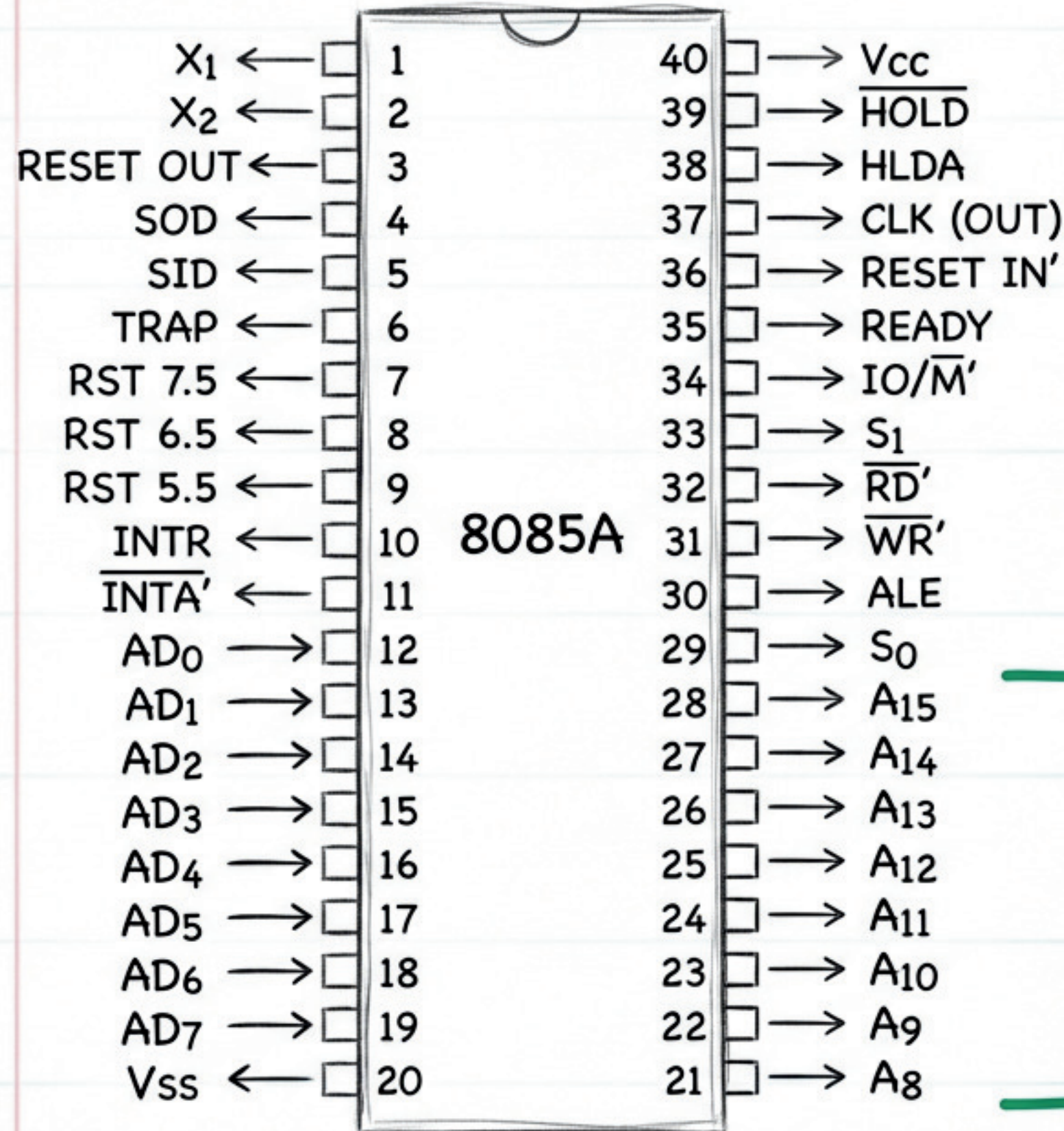
- Accumulator
- General Registers (B, C, D, E, H, L)
- Flag Register
- Program Counter
- Stack Pointer

9.4 Flags



1. Sign Flag (S)
2. Zero Flag (Z)
3. Auxiliary Carry (AC)
4. Parity Flag (P)
5. Carry Flag (CY)

9.5 Pins of 8085



Grouped into:

- Address Bus
- Data Bus
- Control Signals
 - $\overline{\text{RD}}$, $\overline{\text{WR}}$, ALE
- Interrupt Signals
 - TRAP, RST, INTR
- Power Supply
 - V_{CC}, V_{SS}

10. INSTRUCTION SET OF 8085

10.1 Data Transfer Group
→
MOV, MVI, LDA, STA

10.2 Arithmetic Group
→
ADD, SUB, INR, DCR

10.3 Logic Group
→
AND, OR, XOR, CMA

10.4 Branch Group
→
JMP, JZ, JC, CALL, RET

10.5 Stack & I/O Group
→
PUSH, POP
IN, OUT

10.6 Machine Control Group
→
NOP, HLT, EI, DI

11. ASSEMBLY LANGUAGE & ASSEMBLER

11.1 Assembly Language

- Low-level language
- Uses mnemonics

11.2 Assembler

- Converts assembly code into machine code

12. 8086 MICROPROCESSOR

12.1 Introduction to 8086

- 16-bit microprocessor
- 20-bit address bus
- Can address 1 MB memory

12.2 Architecture of 8086

1. Bus Interface Unit (BIU)

- Instruction fetch
- Address generation
- Instruction queue

2. Execution Unit (EU)

- Decodes and executes instructions
- ALU
- Registers

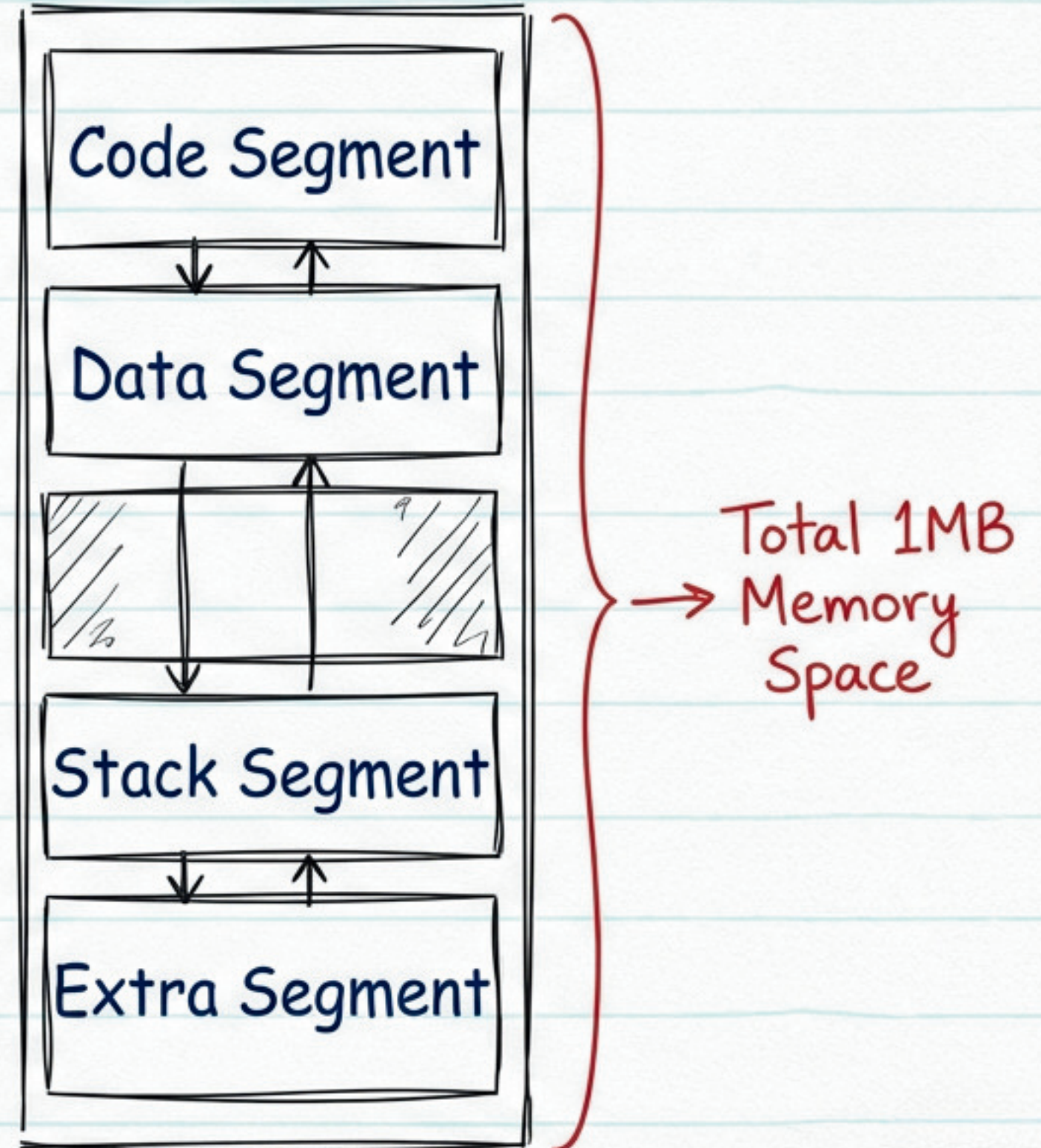
12. 8086 MICROPROCESSOR

12.3 Register Organization (8086)

- General Registers (AX, BX, CX, DX)
- Segment Registers
- Instruction Pointer
- Flag Register

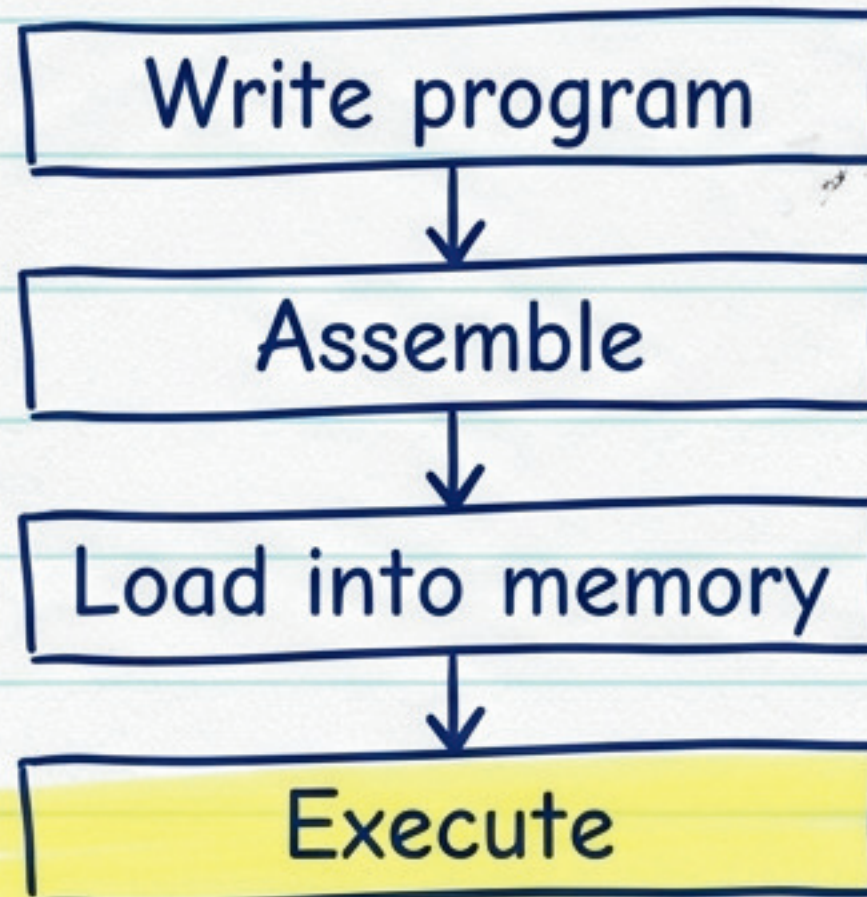
12.4 Memory Segmentation

Memory is divided into:



13. SIMPLE ASSEMBLY PROGRAMS

13.1 Steps to Execute a Program



13.2 Sample Program

Addition of two numbers using 8085.

End of Notes.