Microprocessor and Interfaces

8085 Microprocessor: Architecture, Instructions, Programming and Interfaces

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- Introduction
- Architecture of 8085
- Addressing Modes
- Instruction set of 8085
- Timing Diagrams
- Interrupts
- Interfacing

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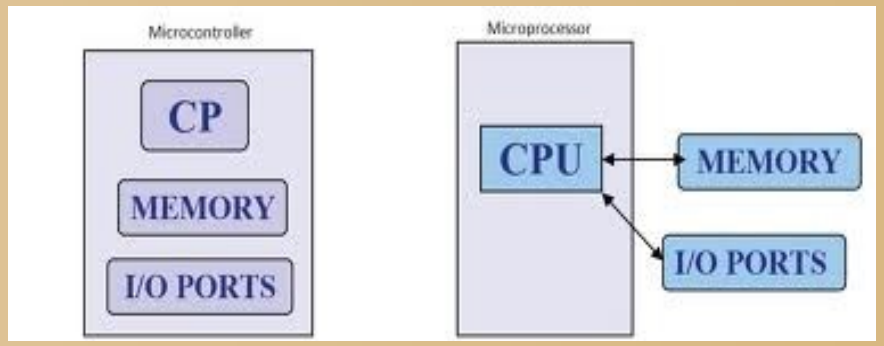
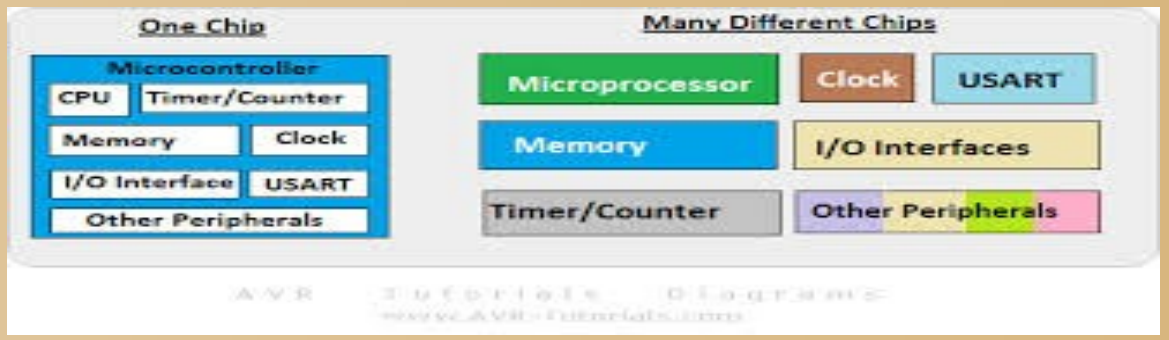
Introduction

- 1947- Invention of Transistor
- 1959 - Invention of Integrated Circuit
- 1965 - Birth of Moore's Law
- 1971 - Development of 1st ***Microprocessor*** (i.e Intel 4004 -4bit)
- 1979 - Introduction to 1st ***Micro-controller*** i.e. Intel 8048

Microprocessor and Micro-controller

- Micro-controller: Computer on chip
- Microprocessor : CPU on Chip





More .....

- Micro processor is programable, integrated device that has computing and decision making capabilities, similar to that of CPU of computer.
- Each processor has fixed set of instruction in form of binary patterns called a machine language.
- 0 and 1 are hard to understand for human. Therefore, the binary instructions are given abbreviated names called mnemonics, which forms the Assemble Language.
- Microprocessor is multipurpose, programable, clock driven register based electronic device that read binary instruction from a storage device called memory, accept binary data as input and process data according to those instructions and provide results as output.

Moore law

- Cramming More Components onto Integrated Circuits by Gordon Moore in 1965.

"With unit cost falling as the number of components per circuit rises, by 1975 economics may dictate squeezing as many as 65 000 components on a single silicon chip. "

http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=4785860&tag=1

- *In 1965 be said that by 1975 the number of component density per integrated circuit for minimum cost would be 65000. (i.e. double every year e.g. in 1965 in an IC, no. Of transistors was 32 in 1966 it was 64 and in 1975 count was of 65000)*
- *1975 -component density(i.e. no of transistors) per integrated circuit for minimum cost would be double after every 18 months.. also know as revised Moore's law.*
- *1995 – Moore evaluated his prediction and fount that technologies (RAM and Processors/Controllers) have followed closely the revised Moore's law.*

Evolution of IC technology

Year	Tech.	Transistor	Product
1947	transistor	1	
1950-60	Discrete component	1	Junction diodes and transistors
1961-65	SSI(small scale integration)	10-100	Flip flops, logic gates etc..
1966-70	MSI	100-1000	Counters, MUX adders etc
1971-79	LSI	1k - 20k	8 bit MP, RAM , ROM
1980-84	VLSI	20k - 50k	DSP, RISC 16/32 bit processors
1985 -----	ULSI(ultra large ...)	Above 50k	64 bit MPU and MCU's

Evolution of Microprocessor

- Has three branch
  - **Main branch** (having general processors processors). 4004,8008,8080,8085,8086.....80486,RISC, Pentium etc ..
  - **Embedded System** (having Controllers). 8048,8051,8096 Atmega, Atmel processors.
  - **Special purpose Processors** (contains processors like DSP, communication, switches, packet processing units etc..) DSP2920,TMS320, NEup2920

Features of Microprocessor

- Smaller in size
- Less costly
- Reliable
- Low power consumption
- High flexibility
- Powerful

Applications

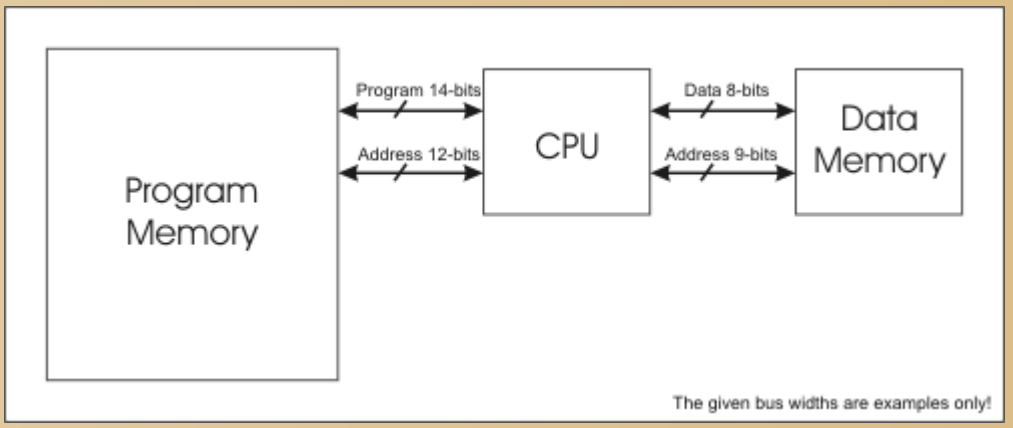
- General purpose microprocessor:
  - Desktop, laptops workstations servers etc..
- Micro-controller:
  - Consumer electronics, Instrumentation,multimedia
- Special purpose Microprocessor
  - DSP processors, switches, Intrusion detection etc ..

As an Engineer

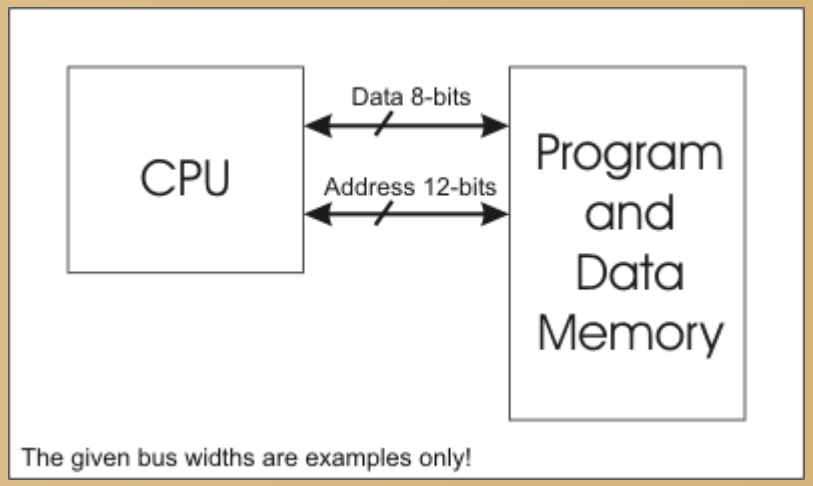
- Hardware Engineer
- Software Engineer
- System Integrator

Architecture

- Harvard



- Von Neumann



Processor contains...

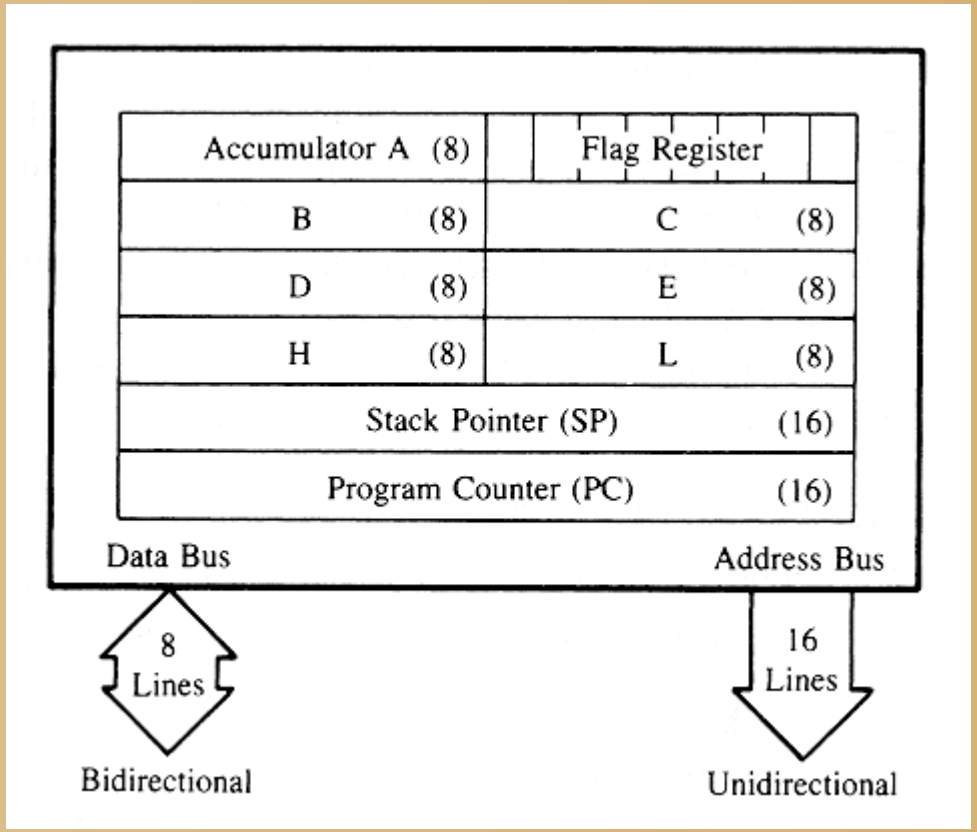
- **CPU**
  - Resisters
  - ALU(arithmetic-logic unit)
  - Timing and control unit

- **Input/Output Interface**
- **Memory**
- **Interconnections between these units**:

  Address Bus
  Data Bus
  Control Bus

Resisters

- General purpose
- Special purpose
- User accessible
- Non accessible



Resisters....

The internal architecture of the 8085 CPU is capable of performing the following operations:

> Store 8-bit data (Registers, Accumulator)

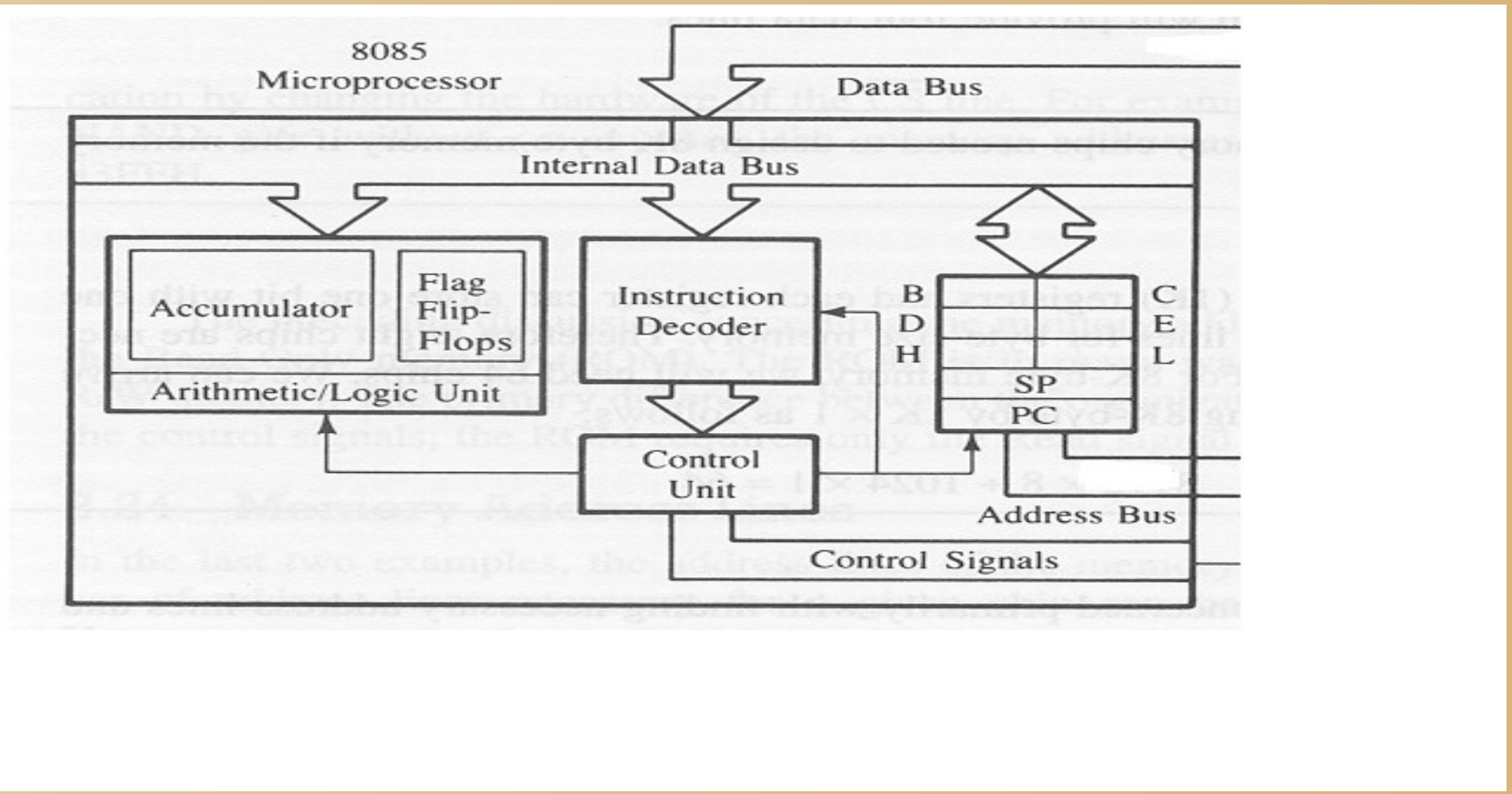
> Perform arithmetic and logic operations (ALU)

> Test for conditions (IF / THEN)

> Sequence the execution of instructions

> Store temporary data in RAM during execution

Resisters....


8085
Microprocessor
Data Bus
Internal Data Bus
Accumulator
Flag
Flip-
Flops
Arithmetic/Logic Unit
Instruction
Decoder
Control
Unit
B
D
H
C
E
L
SP
PC
Address Bus
Control Signals

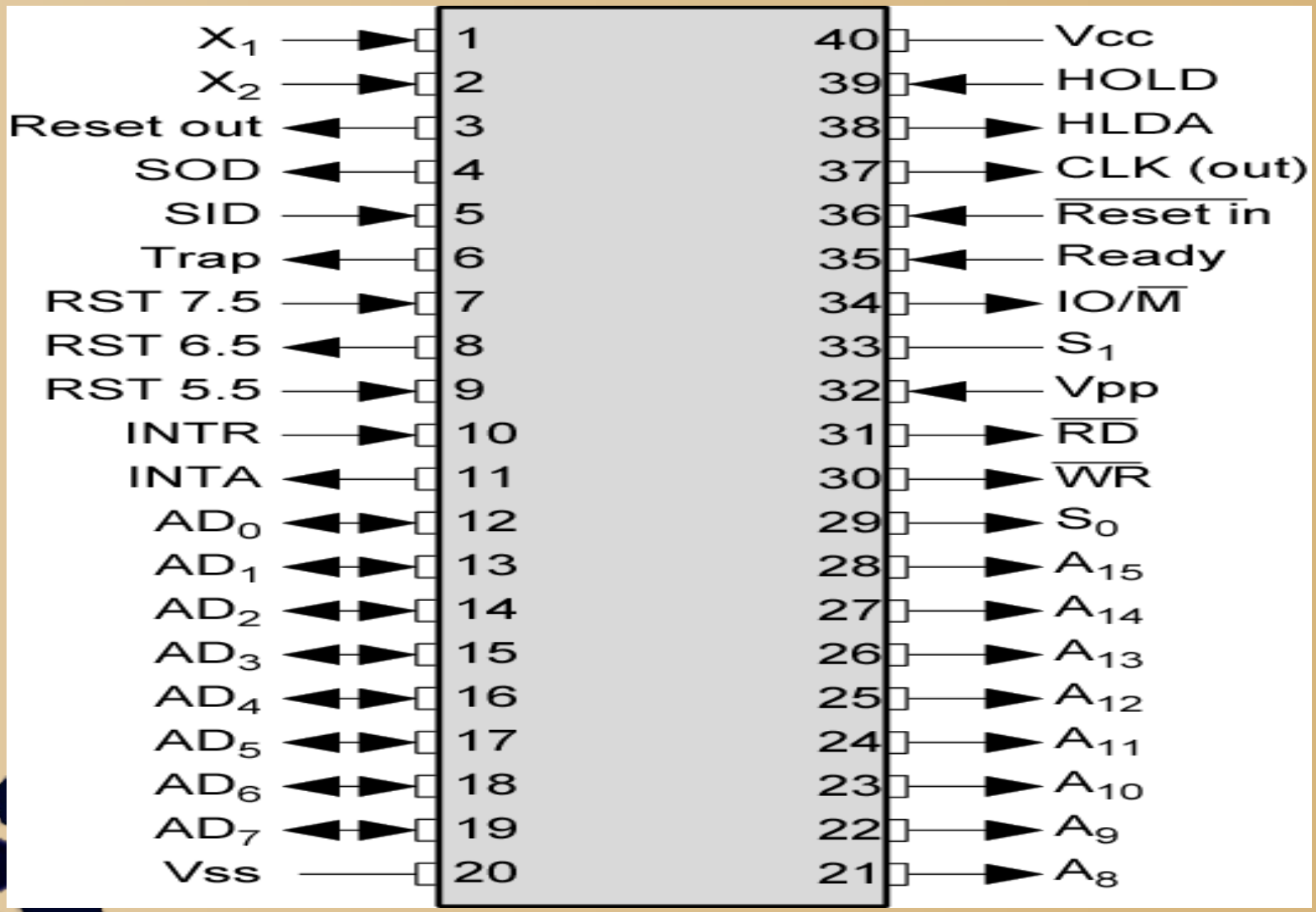
ALU

- Arithmetic operations
  - ,+, Increment, Decrements
- Logical operations
  - AND, OR, EXOR,NOT, SHIFT, ROTATE etc.

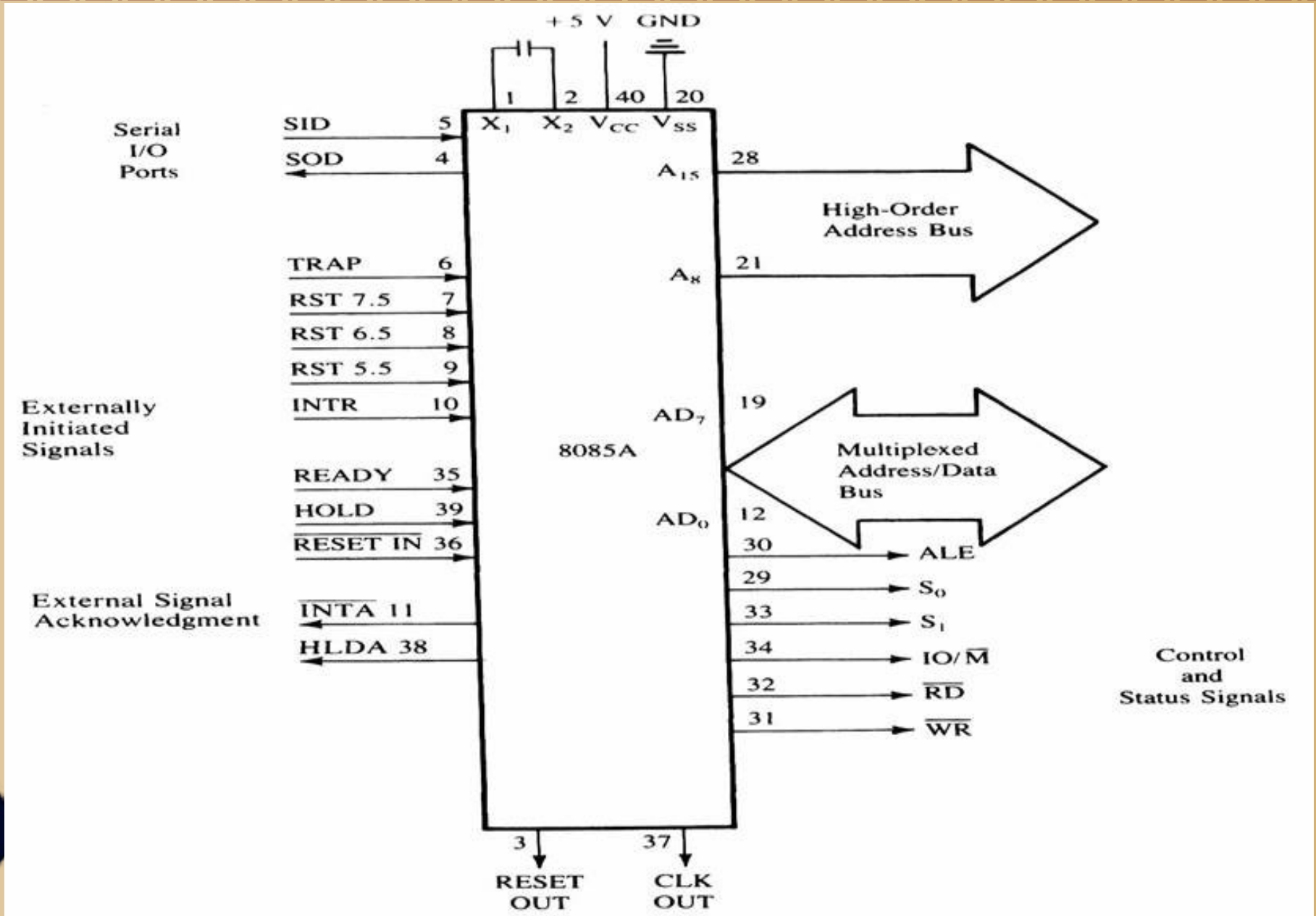
Interface

- Memory and control lines
  - R/W, IO/M, READY/WAIT, ALE
- CPU and Bus control lines.
  - Reset, Interrupts, Bus request/ bus control lines
- Utility Lines
  - Power supply, Gnd, Vcc, Clock

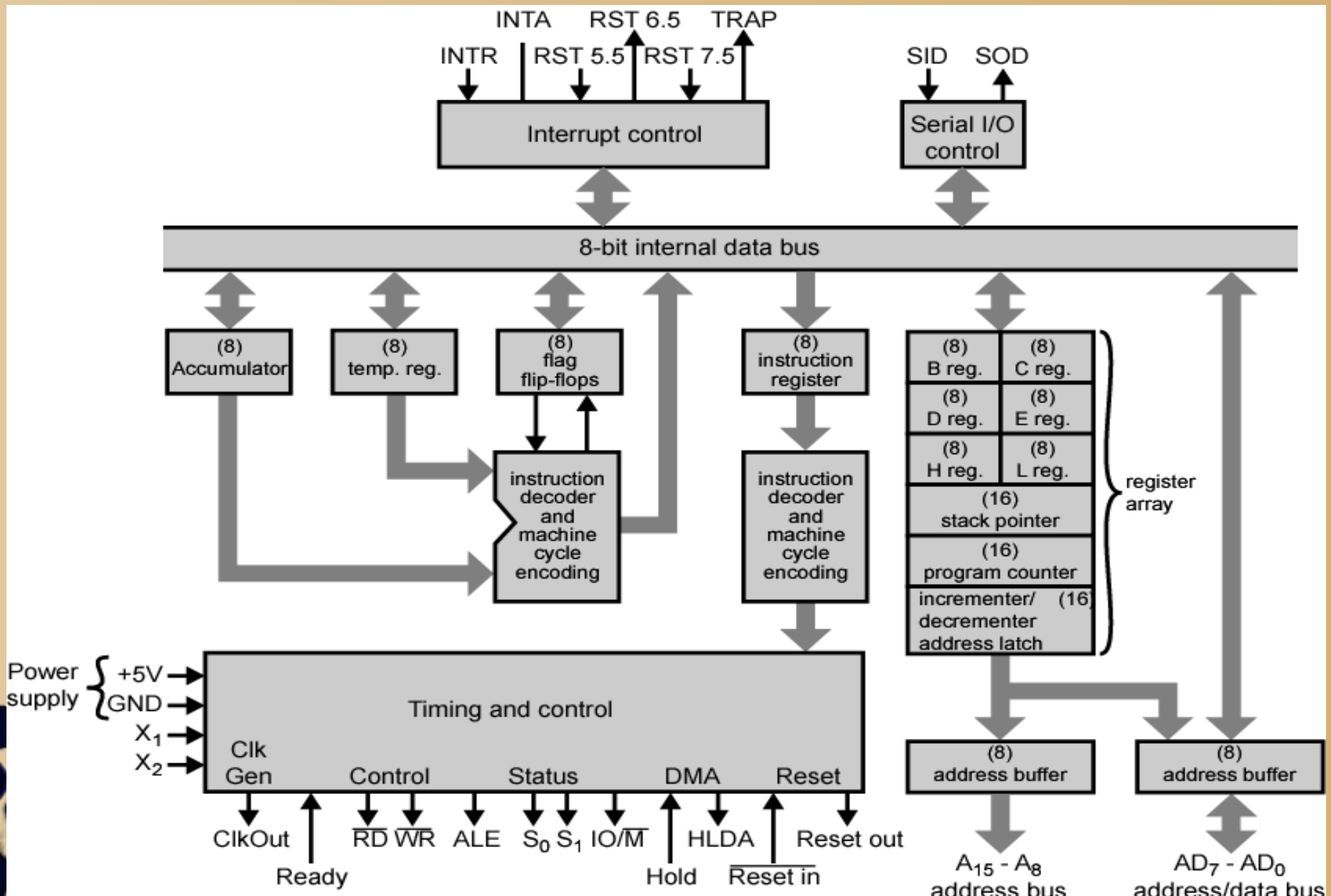
8085 pin diagram



Signals and I/O Pins



Functional block diagram



8085 and Its buses

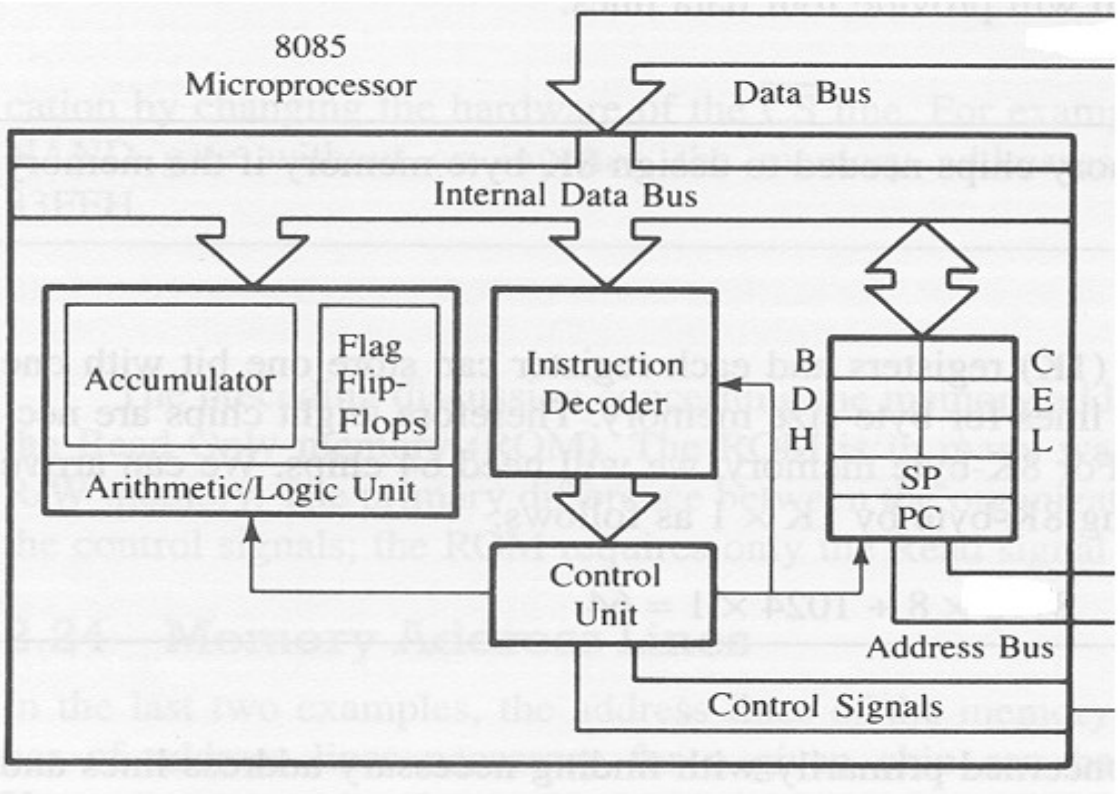
The 8085 is an 8-bit general purpose microprocessor that can address 64K Byte of memory.

It has 40 pins and uses +5V for power. It can run at a maximum frequency of 3 MHz.

The pins on the chip can be grouped into 6 groups:

- Address Bus.
- Data Bus.
- Control and Status Signals.
- Power supply and frequency.
- Externally Initiated Signals.
- Serial I/O ports

Internal structure of 8085



Cntd .....

Registers

- Six general purpose 8-bit registers: B, C, D, E, H, L
- They can also be combined as register pairs to perform 16-bit operations: BC, DE, HL
- Registers are programmable (data load, move, etc.)

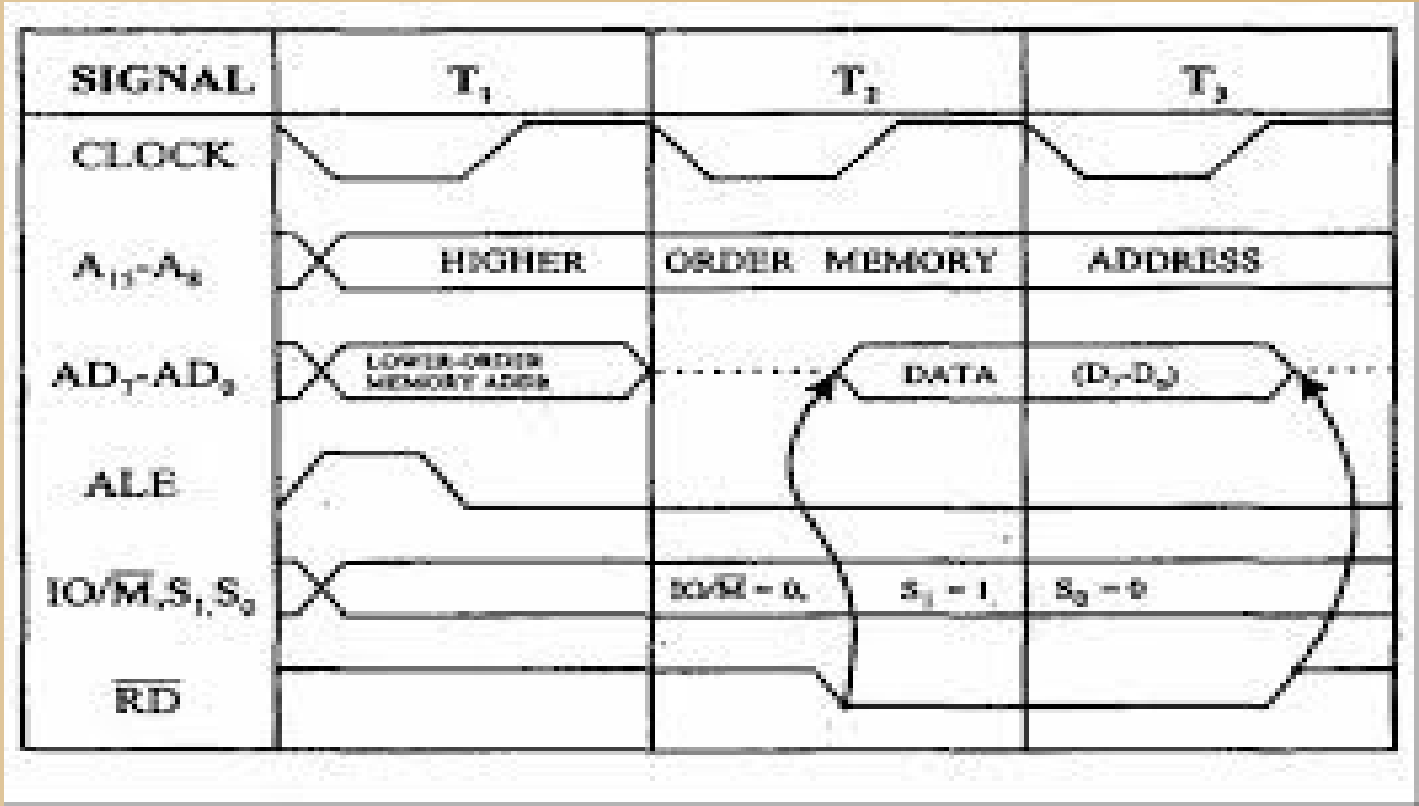
Accumulator

- Single 8-bit register that is part of the ALU !
- Used for arithmetic / logic operations – the result is always stored in the accumulator.

8085 Instruction Cycle

- IC = Fetch cycle + Execution cycle
  - Execution cycle = Read cycle + Write cycle
    - (one or more)

Fetch Cycle



S0	S1	*(Also depend on I0/M signal, only select lines are mentioned here)
0	0	Halt
0	1	Write
1	0	Read
1	1	Fetch