# MICROPROCESSOR INTEL 8085

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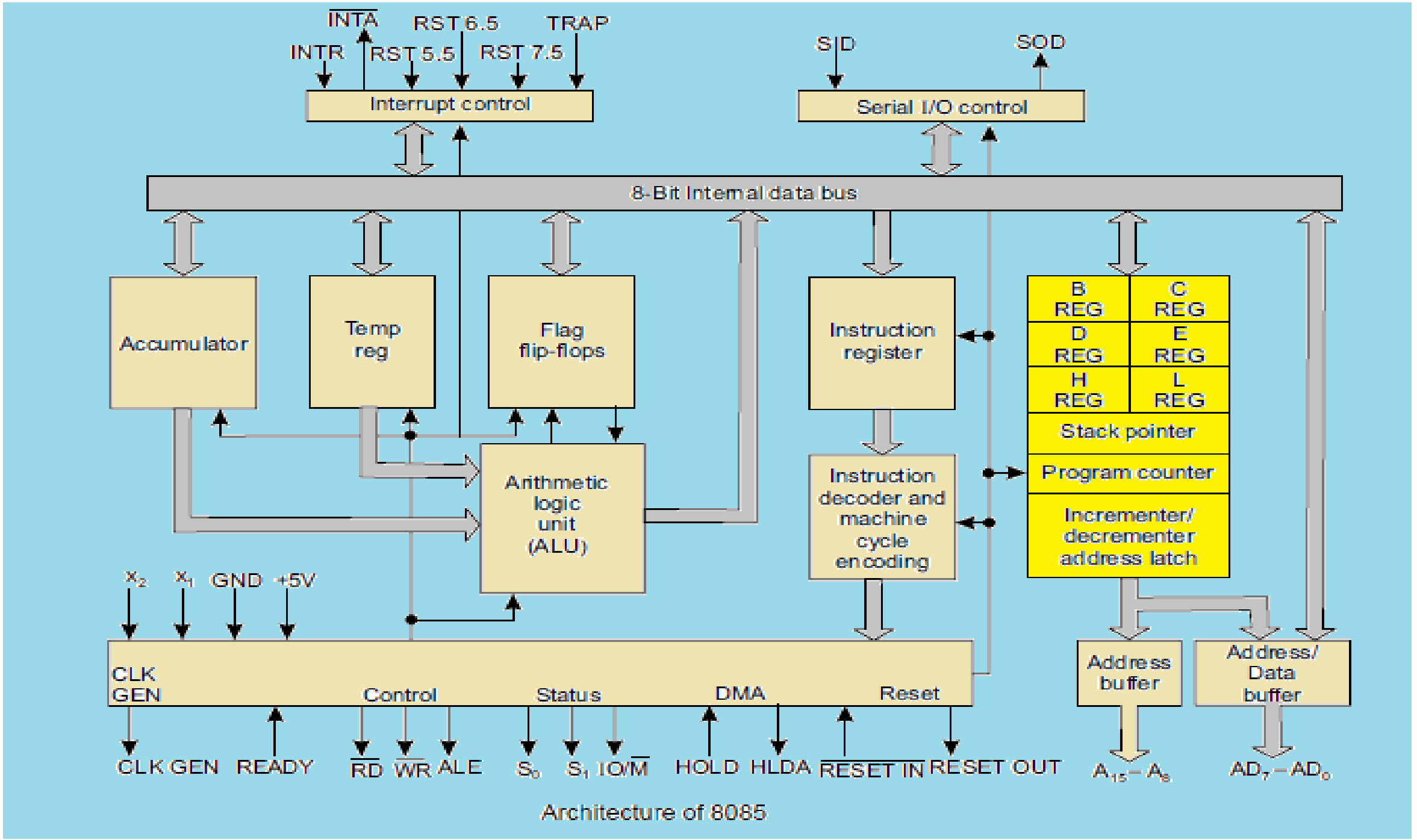
# Introduction :

8085 is pronounced as “eighty-eighty-five” microprocessor. It is an 8-bit microprocessor designed by Intel in 1977 using NMOS technology

It has the following configuration

- It is a 40 pin dual in line package single chip integrated circuit
- 8-bit data bus
- 16-bit address bus, which can address upto 64KB
- A 16-bit program counter
- A 16-bit stack pointer
- Six 8-bit registers arranged in pairs: BC, DE, HL
- Requires +5V supply to operate at 3.2 MHZ single phase clock
- It is used in washing machines, microwave ovens, mobile phones, etc

# ARCHITECTURE OF INTEL 8085 MICROPROCESSOR




Architecture of 8085

# 8085 Microprocessor – Functional Units

**8085 consists of the following functional units –**

1. Accumulator
2. General Purpose Registers
3. Arithmetic and Logic Unit (ALU)
4. Program Counter (PC)
5. Stack Pointer (SP)
6. Temporary Register
7. Flags
8. Instruction Register and Decoder
9. Timing and control unit
10. Interrupt control
11. Serial I/O control
12. Address buffer and Address-Data buffer
13. Address Bus and Data Bus

## Accumulator (A):

- The accumulator is an 8-bit register that is part of the arithmetic/logic unit (ALU)
- This register is used to store 8-bit data and to perform arithmetic and logical operations. The result of an operation is stored in the accumulator

## General Purpose Registers :

- The 8085 have six general-purpose registers to store 8-bit data during program execution
- These registers are identified as **B, C, D, E, H, and L**
- They can be combined as register pairs- **BC, DE, and HL**-to perform some 16-bit operations

## Arithmetic and Logic Unit (ALU):

- It is used to perform the arithmetic operations like addition, subtraction, multiplication, division, increment and decrement and logical operations like AND, OR and EX-OR
- It receives the data from accumulator and registers

## Program Counter (PC):

- This 16-bit register sequencing the execution of instructions
- It is a memory pointer. Memory locations have 16-bit addresses
- The function of the program counter is to point to the memory address of the **next instruction to be executed**
- When an opcode is being fetched, the program counter is incremented by one to point to the next memory location

## Stack Pointer (SP):

- The stack pointer is also a 16-bit register used as a memory pointer
- It points to a memory location in R/W memory, called the stack
- The beginning of the stack is defined by loading a 16-bit address in the stack pointer (register)
- Frequently used logic was stored in SP. It will processed by LIFO principle

## Temporary register :

- It is an 8-bit register, which holds the temporary data of arithmetic and logical operations

## Instruction register and decoder :

- It is an 8-bit register. When an instruction is fetched from memory then it is stored in the Instruction register. Instruction decoder decodes the information present in the Instruction register

**Flags**:

- The ALU includes five flip-flops that are set or reset according to the result of an operation

- The microprocessor uses the flags for testing the data conditions

- They are Zero (Z), Carry (CY), Sign (S), Parity (P), and Auxiliary Carry (AC) flags. The most commonly used flags are Sign, Zero, and Carry

- The bit position for the flags in flag register is,

| $D_7$ | $D_6$ | $D_5$ | $D_4$ | $D_3$ | $D_2$ | $D_1$ | $D_0$ |
|---|---|---|---|---|---|---|---|
| S | Z | | AC | | P | | CY |

## 1.Sign Flag (S):

After execution of an arithmetic and logical operation, if D7 of the result is 1, the sign flag is set. Otherwise it is reset. D7 is reserved for indicating the sign; the remaining is the magnitude of the number. If D7 is 1, the number will be viewed as a negative number. If D7 is 0, the number will be viewed as a positive number

## 2.Zero Flag (z):

If the result of arithmetic and logical operation is zero, then zero flags is set otherwise it is reset.

## 3.Auxiliary Carry Flag (AC):

If D3 generates any carry when doing any arithmetic and logical operation, this flag is set. Otherwise it is reset

## 4.Parity Flag (P):

If the result of arithmetic and logical operation contains **even number of 1's** then this flag will be set and if it is an **odd number of 1's** it will be reset

## 5.Carry Flag (CY):

If any arithmetic and logical operation result any carry then carry flag is set otherwise it is reset

## Timing and control unit :

It provides timing and control signal to the microprocessor to perform operations. Following are the timing and control signals, which control external and internal circuits

- Control Signals: READY, RD', WR', ALE
- Status Signals: S0, S1, IO/M'
- DMA Signals: HOLD, HLDA
- RESET Signals: RESET IN, RESET OUT

## Serial Input/output control :

- It controls the serial data communication by using these two instructions: SID (Serial input data) and SOD (Serial output data)

## Interrupt control:

- As the name suggests it controls the interrupts during a process. When a microprocessor is executing a main program and whenever an interrupt occurs, the microprocessor shifts the control from the main program to process the incoming request. After the request is completed, the control goes back to the main program
- There are 5 interrupt signals in 8085 microprocessor: INTR, RST 7.5, RST 6.5, RST 5.5, TRAP

## Address buffer and address-data buffer :

- The content stored in the stack pointer and program counter is loaded into the address buffer and address-data buffer to communicate with the CPU. The memory and I/O chips are connected to these buses; the CPU can exchange the desired data with the memory and I/O chips

## Address bus and data bus :

- Data bus carries the data to be stored. It is bidirectional, whereas address bus carries the location to where it should be stored and it is unidirectional. It is used to transfer the data & Address I/O devices
- The 8 MSBs of the address are transmitted by the address bus (pin $A_8$ to $A_{15}$)
- The 8 LSBs of the address are transmitted by address/data bus (pin $AD_0$ to $AD_7$)