Computer Architecture

Lecture 5
8085 Architecture and Programming

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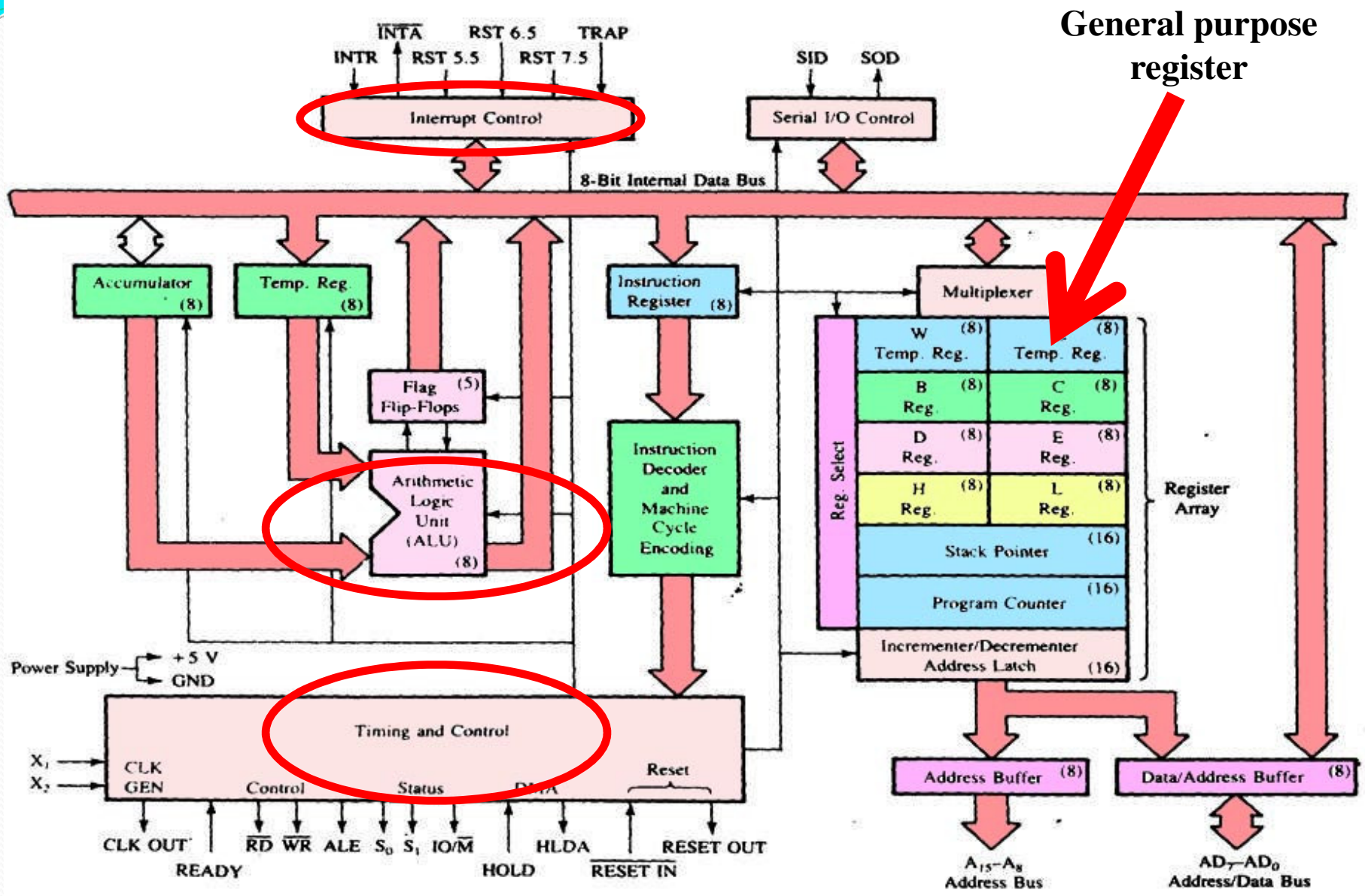
Internal Architecture of 8085 Microprocessor



Internal Architecture of 8085 Microprocessor

1- Control Unit:

- Generates signals within microprocessor to carry out the instruction, which has been decoded. In reality causes certain connections between blocks of the microprocessor to be opened or closed, so that data goes where it is required, and so that ALU operations occur.

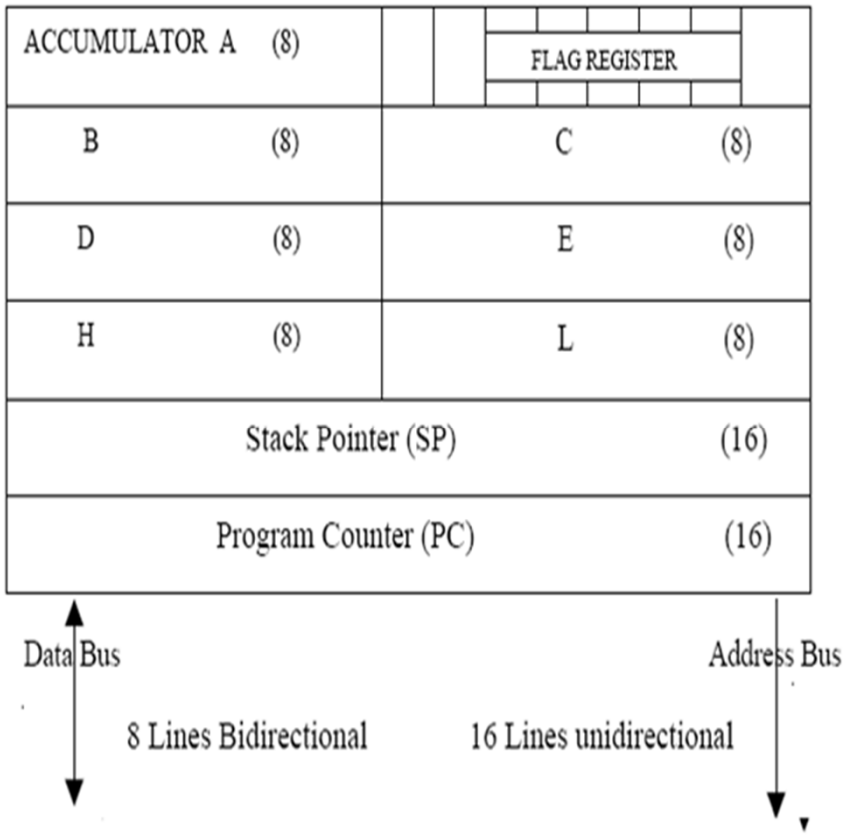
2- Arithmetic Logic Unit:

- The ALU performs the actual numerical and logic operation such as ‘add’, ‘subtract’, ‘AND’, ‘OR’, etc. Uses data from memory and from Accumulator to perform arithmetic. Always stores result of operation in Accumulator.

Internal Architecture of 8085 Microprocessor

3- Registers:

- The8085/8080A-programming model includes six registers, one accumulator, and one flag register, as shown in previous figure. In addition, it has two 16-bit registers: the stack pointer and the program counter. They are described briefly as follows.



Internal Architecture of 8085 Microprocessor

- The 8085/8080A has six general-purpose registers to store 8-bit data; these are identified as B,C,D,E,H, and L as shown in the figure. They can be combined as register pairs - BC, DE, and HL - to perform some 16-bit operations. The programmer can use these registers to store or copy data into the registers by using data copy instructions.

Accumulator:

- The accumulator is an 8-bit register that is a part of 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. The accumulator is also identified as register A.

Internal Architecture of 8085 Microprocessor

FLAG REGISTER:

- The Status Flags of the 8080 and 8085 are single bits which indicate the logical conditions that existed as a result of the execution of the instruction just completed. This allows instructions following to act accordingly, such as a branch as a result of two values comparing equal.

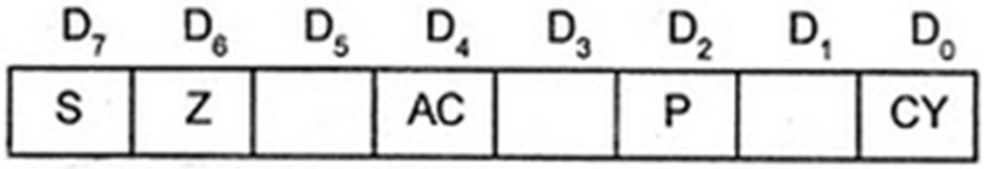


Fig 1.7 : Bit positions of various flags in the flag register of 8085

The flags are:

Internal Architecture of 8085 Microprocessor

The flags are:

- **(CY) Carry Flag**: If an arithmetic result in a carry, the flag is set otherwise the flag is reset.
- **(P) Parity Flag**: After the arithmetic and logic operation, if the result have even number of (1's) the flag is set. If it has odd number of (1's) the flag is reset.
- **(AC) Auxiliary Carry Flag**: In arithmetic operation, when a carry is generated by digit B3 and passed on the digit B4, the AC is set else it is reset.

Internal Architecture of 8085 Microprocessor

- **(Z) Zero Flag**: This flag is set if the result is zero, and reset if the result is not zero.
- **(S) Sign Flag**: After the execution the operation arithmetic or logical, if B7 of the result is 1 then the sign flag is set.

EXAMPLE:

- Write the contents of flags after executing the operation A5H + 77H

Convert from HEX to Binary system:

0111 0111

1010 0101

0001 1100 ⟶ the carry is (1)

ZF¬= 0, SF= 0, CF= 1, PF=0, AC= 0

Internal Architecture of 8085 Microprocessor

Program Counter (PC):

- This 16-bit register deals with sequencing the execution of instructions. This register is a memory pointer. Memory locations have 16-bit addresses, and that is why this is a 16-bit register.
- The microprocessor uses this register to sequence the execution of the instructions. The function of the program counter is to point to the memory address from which the next byte is to be fetched. When a byte (machine code) is being fetched, the program counter is incremented by one to point to the next memory location

Internal Architecture of 8085 Microprocessor

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 16-bit address in the stack pointer. The stack concept is explained in the chapter "Stack and Subroutines."

Instruction Register/Decoder:

- Temporary store for the current instruction of a program. Latest instruction sent here from memory prior to execution. Decoder then takes instruction and ‘decodes’ or interprets the instruction. Decoded instruction then passed to next stage.

Internal Architecture of 8085 Microprocessor

Memory Address Register

- Holds address, received from PC, of next program instruction. Feeds the address bus with addresses of location of the program under execution.

Control Generator

- Generates signals within microprocessor to carry out the instruction which has been decoded. In reality causes certain connections between blocks of the microprocessor to be opened or closed, so that data goes where it is required, and so that ALU operations occur.

Internal Architecture of 8085 Microprocessor

Register Selector:

- This block controls the use of the register stack in the example. Just a logic circuit which switches between different registers in the set will receive instructions from Control Unit.

General Purpose Registers:

- Microprocessor requires extra registers for versatility. Can be used to store additional data during a program. More complex processors may have a variety of differently named registers.

8085 System Bus:

- The microprocessor performs four operations primarily.

- Memory Read
- Memory Write
- I/O Read
- I/O Write

- All these operations are part of the communication processes between microprocessor and peripheral devices. The 8085 performs these operations using three sets of communication lines called buses - the address bus, the data bus and the control bus.

8085 System Bus:

1- Address Bus:

- The address bus is a group of 16 lines represent by (A0 A1…A15). The address bus is unidirectional bits flow only in one direction from the 8085 processor to the peripheral devices. The microprocessor uses the address bus to perform the first function: identifying a peripheral or memory location. Each peripheral or memory location is identified by a 16 bit address. The 8085 with its 16 lines is capable of addressing 64 K memory locations.

8085 System Bus:

2- Data Bus

- The data bus is a group of eight lines represent (D0 D1…D7) used for data flow. They are bidirectional: data flows in both direction between the 8085 microprocessor, and memory or peripheral devices. The 8 lines enable the microprocessor to manipulate 8-bit data at-a-time only ranging from 00 to FF.

8085 System Bus:

3- Control Bus

- The control bus consists of ten single lines that carry synchronization signals. These are not groups of lines like address of data bus but individual lines that provide a pulse to indicate an operation. The 8085 generates specific control signal for each operation it performs. These signals are used to identify a device type which the processor intends to communicate.


The End