Microprocessor

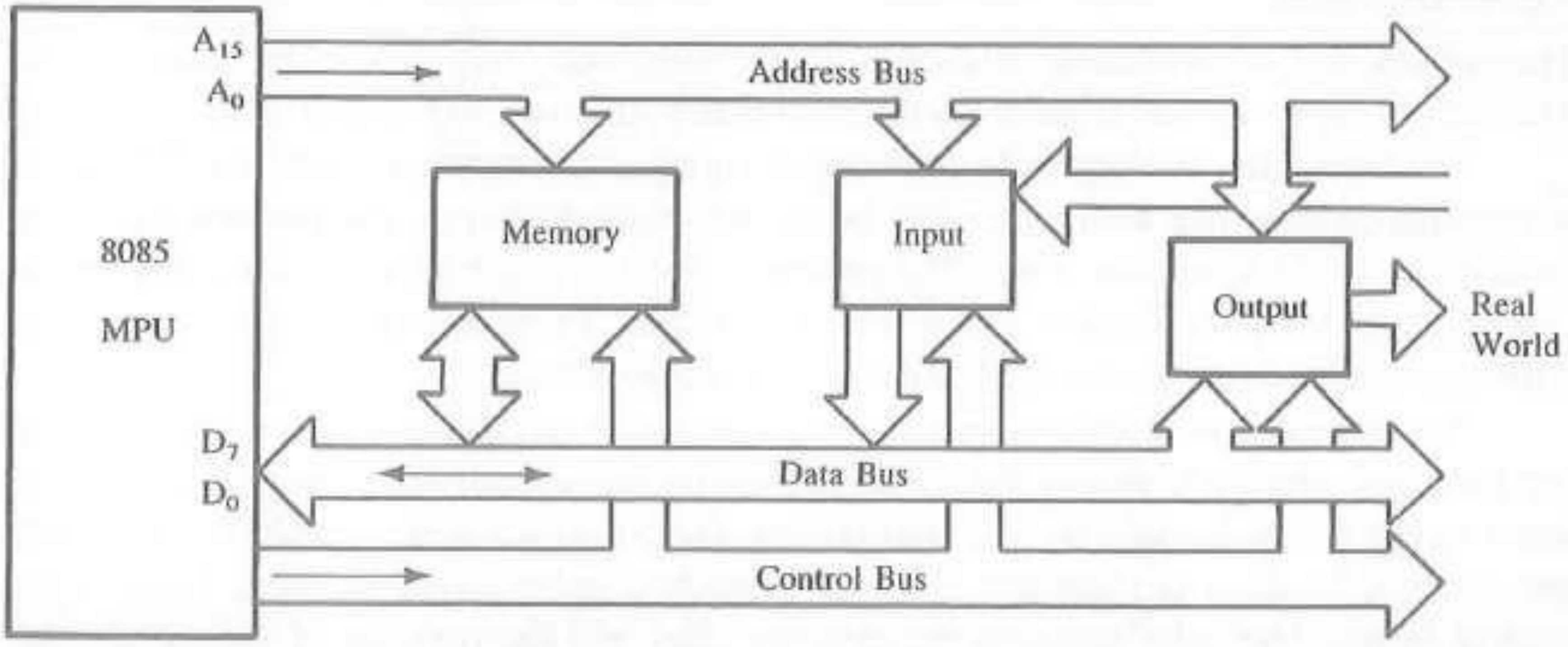
- ➢ It is brain of computer
- ➢ It is a single chip which is capable of processing data.
- ➢ It controls all the components in computer .eg monitor,keyboard,usb etc
- ➢ It fetch,decode and execute the instruction

Defination

- A microprocessor is a programmable electronic chips that has computing and decision making capacity similar to central processing unit of computer

Bus organization of 8085

- Bus is a group of conducting wires which carries information all the peripheral are connected to microprocessor through Bus.


A_{15}
A_0
Address Bus
8085
MPU
Memory
Input
Output
Real
World
D_7
D_0
Data Bus
Control Bus

Address Bus

- Is a group of conducting wires which carries address/particular location only.
- It is unidirectional only ie data flows from microprocessor to memory or from microprocessor to i/o device.
- Length of address bus is 16 bit(0000H to FFFFH)
- It can transfer maxmimum 16bit address which means it can address 65536 different memory location.

Data Bus

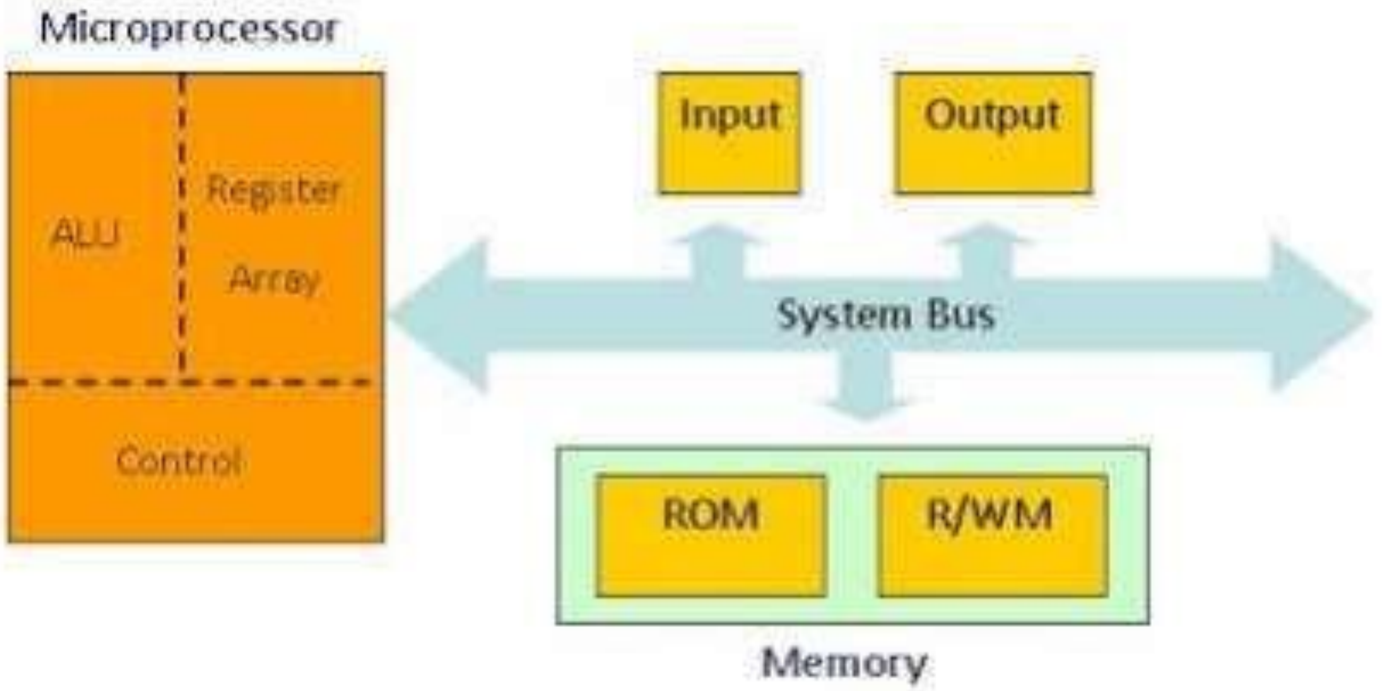
- Conducting wire carries data only.
- Bidirectional because data flow in both direction from microprocessor to memory or i/o device.
- Length of data bus of 8085 is 8bit (00H to FFH)
- The width of data bus is directly related to the largest number that bus can carry such as 8 bit bus can represent 2^8 (0-255)

Control bus

- Use to generate timing and control signal to control all associated peripherals.
- Uses control signal to process data that is what to do with selected memory location.   Some control signal are
- Memory read
- Memory write
- i/o read
- i/o write

- Opcode fetch

Microprocessor Architecture & Operation



ALU (Arithmetic/Logic Unit) – It performs such arithmetic operations as addition and subtraction, and such logic operations as AND, OR, and XOR. Results are stored either in registers or in memory.

Register Array – It consists of various registers identified by letter such as B, C, D, E, H, L, IX, and IY. These registers are used to store data and addresses temporarily during the execution of a program.

Control Unit – The control unit provides the necessary timing and control signals to all the operations in the microcomputer. It controls the flow of data between the microprocessor and memory and peripherals.

Input – The input section transfers data and instructions in binary from the outside world to the microprocessor. It includes such devices as a keyboard, switches, a scanner, and an analog-to-digital converter.

Output – The output section transfers data from the microprocessor to such output devices as LED, CRT, printer, magnetic tape, or another computer.

Memory – It stores such binary information as instructions and data, and provides that information to the microprocessor. To execute programs, the microprocessor reads instructions and data from memory and performs the computing operations in its ALU section. Results are either transferred to the output section for display or stored in memory for later use.

System bus – It is a communication path between the microprocessor and peripherals. The microprocessor communicates with only one peripheral at a time. The timing is provided by the control unit of the microprocessor.

Microprocessor Vs Microcontroller

Microprocessor	Microcontroller
CPU is stand alone, RAM,ROM, I/O & timer are separate.	CPU, RAM,ROM, I/O & timer all are on single chip.
Designer can decide amount of RAM,ROM, & I/O ports.	Fixed amount of on-chip RAM,ROM, & I/O ports.
High processing power	Low processing power
High power consumption	Low power consumption
Typically 32/64 bit	8/16 bit
General purpose	Single purpose(control oriented)
Less reliable	Highly reliable
Eg.- 8086,8085	8051

Processor overview

Intel Microprocessors: Historical Perspective

Processor	Year of Introduction	Number of Transistors	Initial Clock Speed	Address Bus	Data Bus	Addressable Memory
4004	1971	2,300	108 kHz	10-bit	4-bit	640 bytes
8008	1972	3,500	200 kHz	14-bit	8-bit	16 K
8080	1974	6,000	2 MHz	16-bit	8-bit	64 K
8085	1976	6,500	5 MHz	16-bit	8-bit	64 K
8086	1978	29,000	5 MHz	20-bit	16-bit	1 M
8088	1979	29,000	5 MHz	20-bit	8-bit*	1 M
80286	1982	134,000	8 MHz	24-bit	16-bit	16 M
80386	1985	275,000	16 MHz	32-bit	32-bit	4 G
80486	1989	1.2 M	25 MHz	32-bit	32-bit	4 G
Pentium	1993	3.1 M	60 MHz	32-bit	32/64-bit	4 G
Pentium Pro	1995	5.5 M	150 MHz	36-bit	32/64-bit	64 G
Pentium II	1997	8.8 M	233 MHz	36-bit	64-bit	64 G
Pentium III	1999	9.5 M	650 MHz	36-bit	64-bit	64 G
Pentium 4	2000	42 M	1.4 GHz	36-bit	64-bit	64 G

8085 instruction set

<u>Classified into five functional categories:</u>

- Data transfer(Copy) operation
- Arithmetic operation
- Logical operation
- Branching operation
- Machine control operation

Data transfer(copy) operation

- Copies data from a location called source to another location called Destination without modifying the content of source.
- The various types of data transfer are:
- Between register
- Specific data byte to register
- Between memory location and a register
- Between i/o device and accumulator

Arithmetic Operation

These instructions perform arithmetic operations such as addition, subtraction, increment, and decrement.

- ☐ **Addition**—Any 8-bit number, or the contents of a register, or the contents of a memory location can be added to the contents of the accumulator and the sum is stored in the accumulator. No two other 8-bit registers can be added directly (e.g., the contents of register B cannot be added directly to the contents of register C). The instruction DAD is an exception; it adds 16-bit data directly in register pairs.
- ☐ **Subtraction**—Any 8-bit number, or the contents of a register, or the contents of a memory location can be subtracted from the contents of the accumulator and the results stored in the accumulator. The subtraction is performed in 2's complement, and the results, if negative, are expressed in 2's complement. No two other registers can be subtracted directly.
- ☐ **Increment/Decrement**—The 8-bit contents of a register or a memory location can be incremented or decremented by 1. Similarly, the 16-bit contents of a register pair (such as BC) can be incremented or decremented by 1. These increment and decrement operations differ from addition and subtraction in an important way; i.e., they can be performed in any one of the registers or in a memory location.

Logical Operation

These instructions perform various logical operations with the contents of the accumulator.

- ☐ **AND, OR, Exclusive-OR**—Any 8-bit number, or the contents of a register, or of a memory location can be logically ANDed, ORed, or Exclusive-ORed with the contents of the accumulator. The results are stored in the accumulator.
- ☐ **Rotate**—Each bit in the accumulator can be shifted either left or right to the next position.
- ☐ **Compare**—Any 8-bit number, or the contents of a register, or a memory location can be compared for equality, greater than, or less than, with the contents of the accumulator.
- ☐ **Complement**—The contents of the accumulator can be complemented; all 0s are replaced by 1s and all 1s are replaced by 0s.

Branching operation

This group of instructions alters the sequence of program execution either conditionally or unconditionally.

- ☐ **Jump**—Conditional jumps are an important aspect of the decision-making process in programming. These instructions test for a certain condition (e.g., Zero or Carry flag) and alter the program sequence when the condition is met. In addition, the instruction set includes an instruction called *unconditional jump.*
- ☐ **Call, Return, and Restart**—These instructions change the sequence of a program either by calling a subroutine or returning from a subroutine. The conditional Call and Return instructions also can test condition flags.

Machine control operation

- Control machine function such as Halt,Interrupt.

Instruction

- Is a command to the microprocessor to perform a given task on specified data.
- Each instruction has two parts

One is the task to be performed called operational code(op-code)

Data to be operated on called operand

May include 8 or 16 bite data ,an internal register ,a memory location.

Instruction Word Size

- 1-Byte instruction
- 2-Byte instruction
- 3-Byte instruction

1 byte instruction

A 1-byte instruction includes the opcode and the operand in the same byte. For example:

Task	Opcode	Operand*	Binary Code	Hex Code
Copy the contents of the accumulator in register C.	MOV	C,A	0100 1111	4FH
Add the contents of register B to the contents of the accumulator.	ADD	B	1000 0000	80H
Invert (complement) each bit in the accumulator.	CMA		0010 1111	2FH

These instructions are 1-byte instructions performing three different tasks. In the first instruction, both operand registers are specified. In the second instruction, the operand B is specified and the accumulator is assumed. Similarly, in the third instruction, the accumulator is assumed to be the implicit operand. These instructions are stored in 8-bit binary format in memory; each requires one memory location.

2-byte instruction

In a 2-byte instruction, the first byte specifies the operation code and the second byte specifies the operand. For example:

Task	Opcode	Operand	Binary Code	Hex Code	
Load an 8-bit data byte in the accumulator.	MVI	A,32H	0011 1110	3E	First Byte
			0011 0010	32	Second Byte
Load an 8-bit data byte in register B.	MVI	B,F2H	0000 0110	06	First Byte
			1111 0010	F2	Second Byte

These instructions would require two memory locations each to store the binary codes. The data bytes 32H and F2H are selected arbitrarily as examples.

3-byte instruction

In a 3-byte instruction, the first byte specifies the opcode, and the following two bytes specify the 16-bit address. Note that the second byte is the low-order address and the third byte is the high-order address. For example:

Task	Opcode	Operand	Binary Code	Hex Code*	
Load contents of memory 2050H into A.	LDA	2050H	0011 1010	3A	First Byte
			0101 0000	50	Second Byte
			0010 0000	20	Third Byte
Transfer the program sequence to memory location 2085H.	JMP	2085H	1100 0011	C3	First Byte
			1000 0101	85	Second Byte
			0010 0000	20	Third Byte