

# Chapter-1

## Microcomputer Systems

### 1.1.2 The CPU

The CPU is the brain of a computer system. Each instruction that the CPU executes is a bit string ( for 8086 processor instructions are 1 to 6 bytes long). The instructions performed by a CPU are called its **instruction set**.

#### Internal Organization

It has two main components : execution unit and bus interface units (Fig. 5.1) . It is a 16-bit microprocessor. The term 16-bit means that its ALU, internal register and most of its instructions are designed to work with 16-bit binary words.

The 8086 has 16-bits data bus. So it can read data or write data to memory (or ports) either 16-bits or 8-bits at a time. The 8086 has a 20-bits address bus, so it can address  $2^{20}$  memory locations. Each of the locations represents a byte-wide address.

### Execution Unit (EU)

This unit executes instructions. It contains the ALU. Which performs arithmetic (+, -, x, /) and logic (AND, OR, NOT) operations. The data for the operations are stored in registers. A register is like a memory location normally referred to by a name. **The execution unit has eight general registers:**

- 1.AX (Accumulator register)
- 2.BX (Base register)
- 3.CX (Count register)
- 4.DX (Data register)

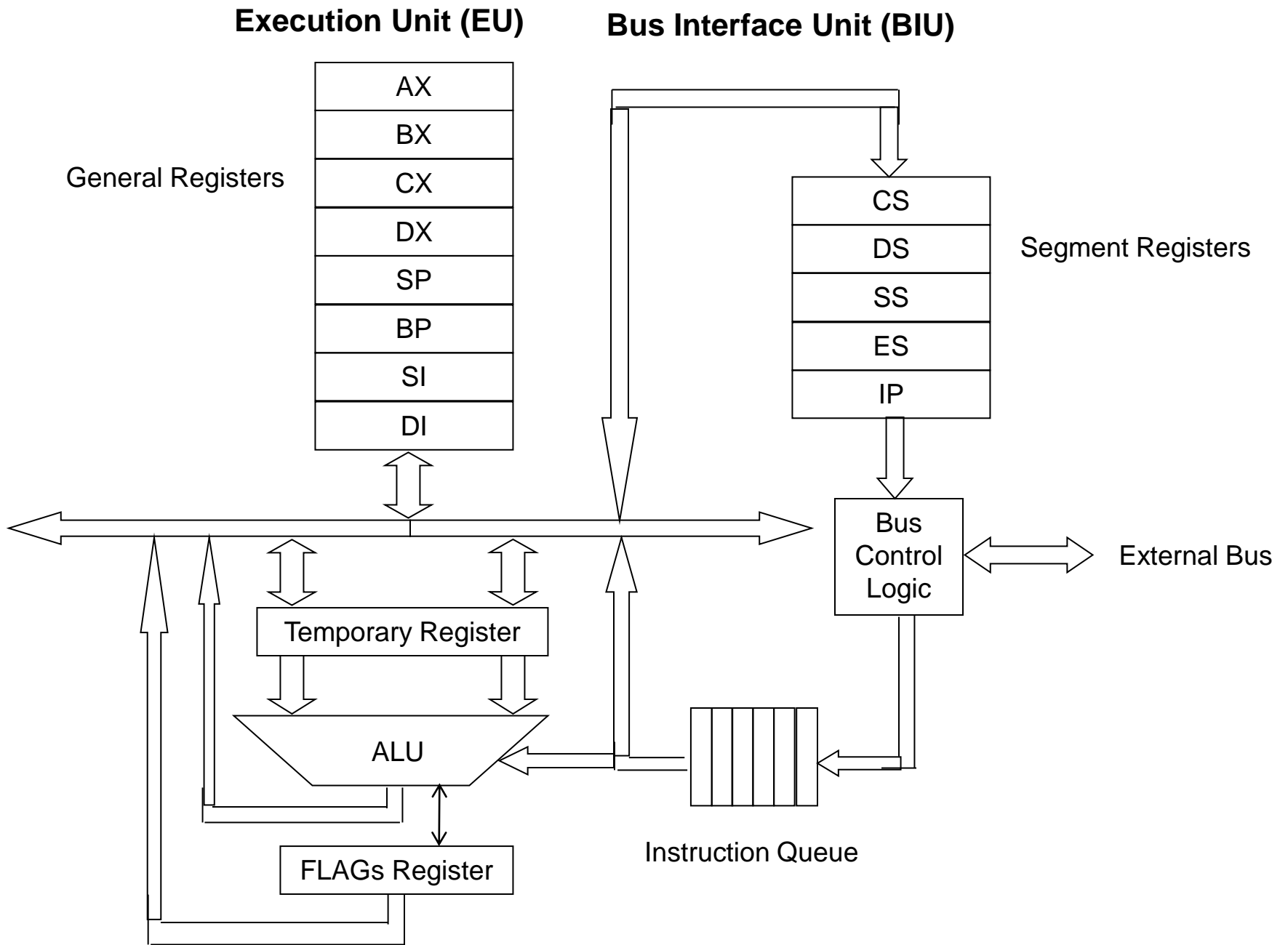


Figure 1.6 Intel 8086 Microprocessor Organization

5. SI (Source Index)
6. DI (Destination Index)
7. BP (Base Pointer)
8. SP (Stack Pointer)

Additionally the execution unit contains temporary registers for holding operands for the ALU and a FLAGS register whose individual bits (or FLAGS) indicate the nature of the result of computation.

### Bus Interface Unit (BIU)

The bus interface unit provides communication between the execution unit and the memory (or I/O port). It is responsible for transmitting address, data, and control signals on the buses. It has five registers:

1. CS (Code Segment)
2. DS (Data Segment)
3. SS (Stack Segment)
4. ES (Extra Segment)
5. IP (Instruction Pointer)

## 1.2 Instruction Execution

The instructions performed by a CPU are called its instruction set. A machine instruction has two parts: opcode and operand. The opcode specifies the type of operation, and the operands are often given as data, or register, or memory address (variable) to be operated on.

The CPU performs the following steps to execute an instruction forming fetch-execute cycle:

### Fetch:

1. Fetch an instruction from memory (Opcode Fetch or OF)
2. Decode the instruction to determine the operation (Opcode Decode or OD)
3. Fetch data from memory, if required (Operand Fetch or OF)

## Execute:

1. Perform the operation on the data
2. Store the result in memory, if necessary.

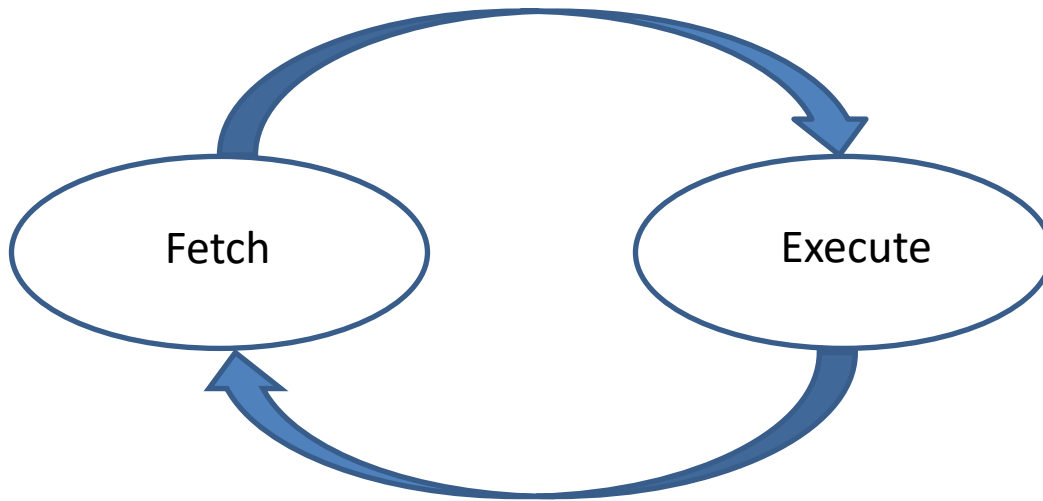


Figure : Fetch-execute cycle for instruction execution.

# 1.5 An Assembly Language Program

The following program adds the contents of two memory locations, symbolized by A and B. The sum is stored in location SUM.

```
TITLE PGM1_1:  SAMPLE PROGRAM
```

```
.MODEL SMALL
```

```
.STACK 100H
```

```
.DATA
```

```
A  DW  2
```

```
B  DW  5
```

```
SUM DW  ?
```



```
.CODE
MAIN PROC
;initialize DS
MOV AX, @DATA
MOV DS, AX
;add the numbers
MOV AX, A
ADD AX, B
MOV SUM, AX
;exit to DOS
MOV AX, 4C00H
INT 21H
MAIN ENDP
END MAIN
```