

# 8-Bit Microprocessor (8085)

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Microprocessor Architecture, 2019

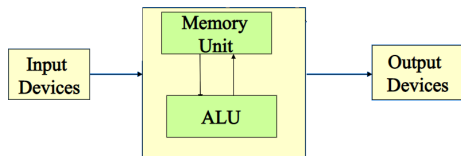
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# Introduction to Microprocessors

## Definition

**A computer:** is a programmable machine that receives input, stores and manipulates data//information, and provides output in a useful format.

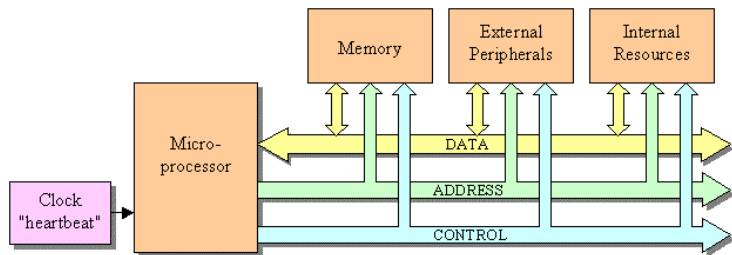


- CPU (ALU): Central Processing Unit<sup>1</sup>
- Memory.
- peripherals (Input/Output) .

<sup>1</sup>ALU represents the fundamental building block of the central processing unit (CPU) of a computer. Modern CPUs contain very powerful and complex ALUs.

## Organization of A Microprocessor-based System (Microcomputer)

- Microprocessor
- Memory
  - ROM : Read Only Memory
  - RAM : Random Access Memory
- I/O
  - Keyboard
  - Display Device
- Clock: Square Wave Oscillator (Timing)
- System Buses (Communication)
  - Data Bus.
  - Address Bus.
  - Control Bus.



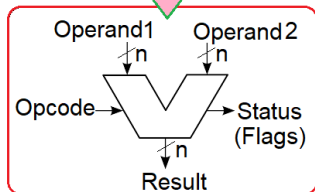
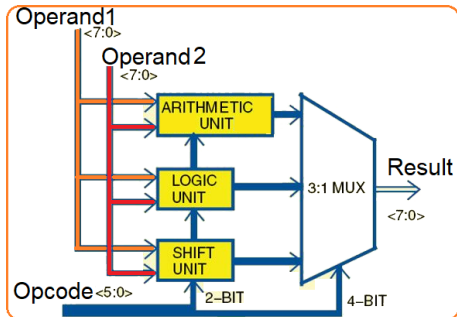
## Microprocessor (CPU) components

- Arithmetic and Logic Unit (ALU).
- General and Special purpose registers.
- Timing and Control Unit.



## Arithmetic and logic unit (ALU)

- Communicates & operates in binary numbers 0 & 1, called bits.
- Has a fixed set of instructions (machine language).
- operations: Addition, Subtraction, Increment, Decrement, Rotate, Logical AND, Logical OR, Logical XOR, Complement, Compare.



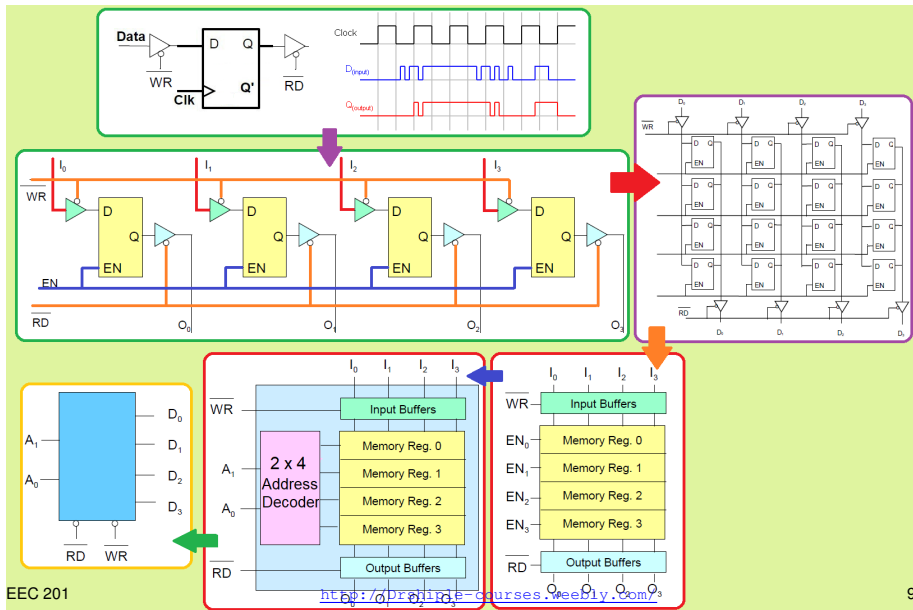
# Memory

physical devices used to store data or programs (sequences of instructions) on a temporary or permanent basis.


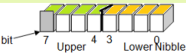

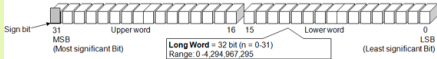
RAM	ROM
Random-Access Memory	Read-Only Memory
Erased when the power is turned off (volatile)	Non-volatile.

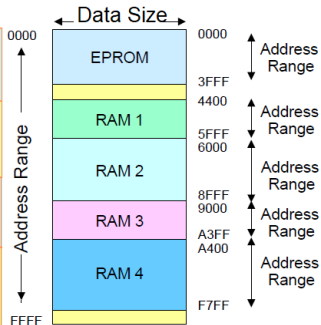


## Memory Elements



## Memory address range

<b>Nibble</b>	<b>4 bit</b>	<p><b>Nibble = 4 bit (n= 0-3)</b> Range: 0-15</p> 
<b>Byte</b>	<b>8 bit</b>	<p><b>Byte = 8 bit (n = 0-7)</b> Range: 0-255</p> 
<b>Word</b>	<b>16 bit</b>	<p><b>Word = 16 bit (n=0-15)</b> Range: 0-65,535</p> 
<b>Long word</b>	<b>32 bit</b>	<p><b>Long Word = 32 bit (n = 0-31)</b> Range: 0-4,294,967,295</p> 



Calculate address bus bites needed for each memory segment?

## System buses (communication)

### Address Bus:

- Unidirectional
- 16 bits

$$2^{16} = 2^6 \times 2^{10}$$

$$\approx 64 \times 1K$$

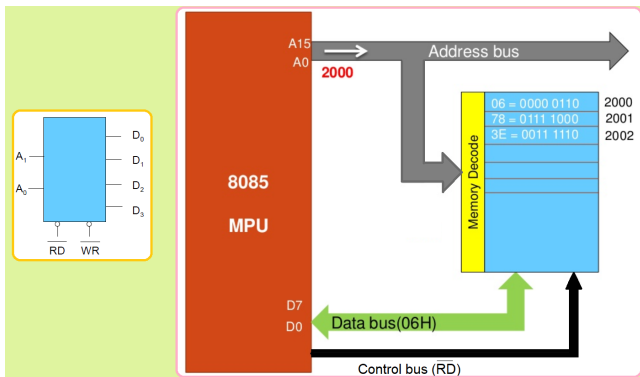
$$\approx 64K \text{ Byte}$$

exactly = 65,536  
 $\therefore 2^{10} = 1024 \neq 1000$

### Data Bus: why?

- Bidirectional
- 8 bits. (max numb?)

EEC 201



### Control Bus:

- Comprised of various single lines ( $\overline{RD}$ , etc).
- 16 bits

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## Excercise

Calculate the memory size of 24 address lines and 16 data lines?  
Memory size =  $2^{24} = 16M$  bytes of addressable memory.

# Software Flow

```
while(n>0)
{
sum = sum + n;
--n;
}
```

High Level



```
L28 movf  _n, f
    btfsc STATUS, Z
    goto  L41
    movf  _n, f
    addwf _sum, f
    btfsc STATUS, C
    incf  _sum+1, f
    decf  _n, f
    goto  L28
L41
```

Assembly



```
0000100010010011
0001100100000011
0010100000001111
0000100000010011
0000100000010011
0000011110010100
0001100000000011
0000101010010101
0111100000001111
```

machine Language