Faculty Of Computers and Information
Mansoura University

Hardware of Real-time Systems

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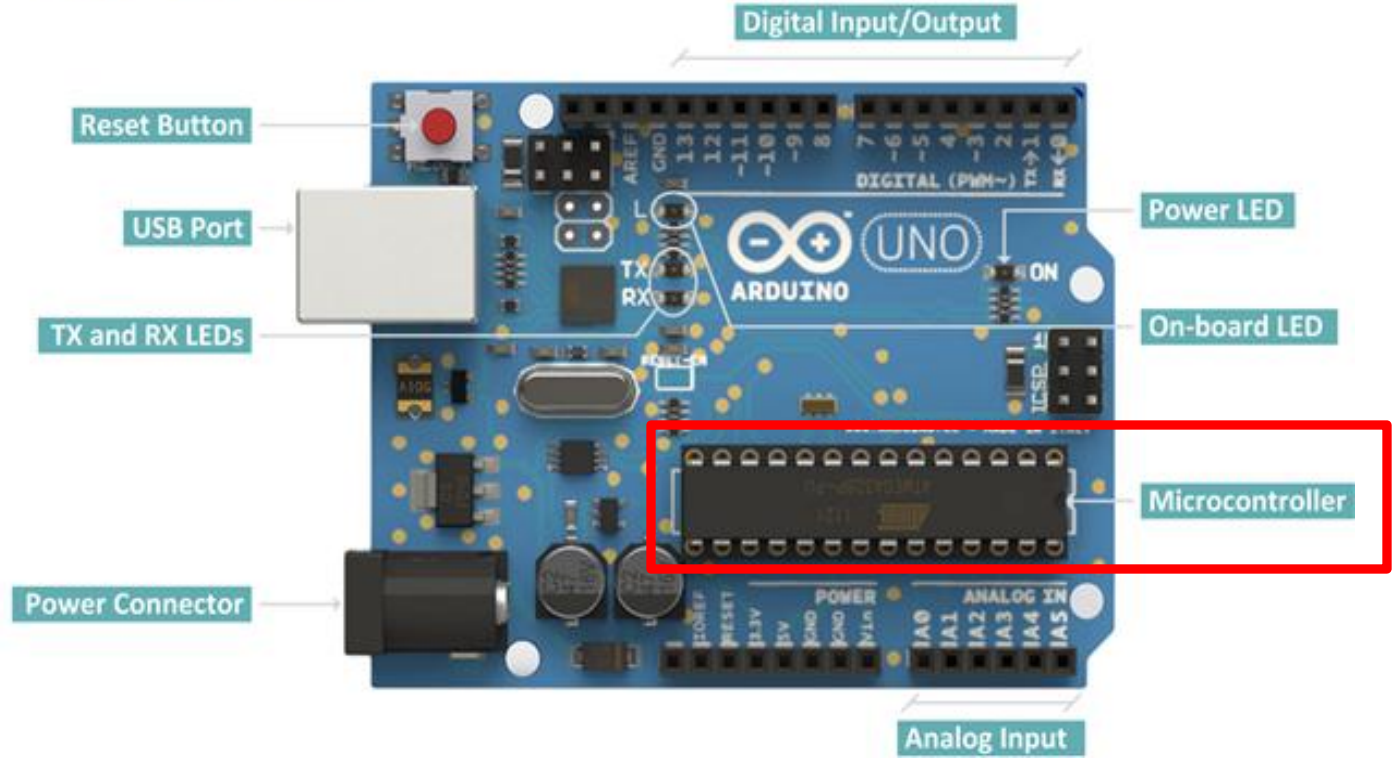
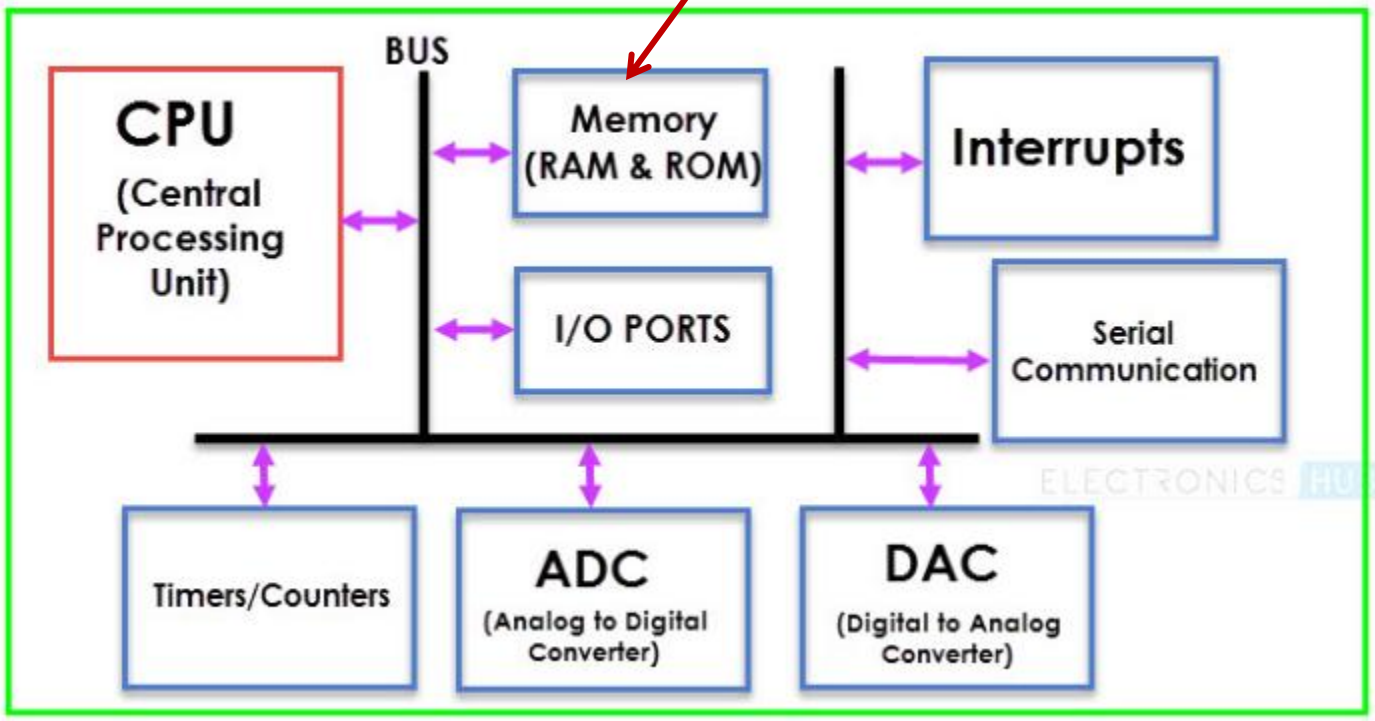
“ ARDUNO UNO “


Digital Input/Output
Reset Button
USB Port
TX and RX LEDs
Power Connector
Power LED
On-board LED
Microcontroller
Analog Input
ARDUINO
UNO
DIGITAL (PWM~)
POWER
ANALOG IN

Microcontroller

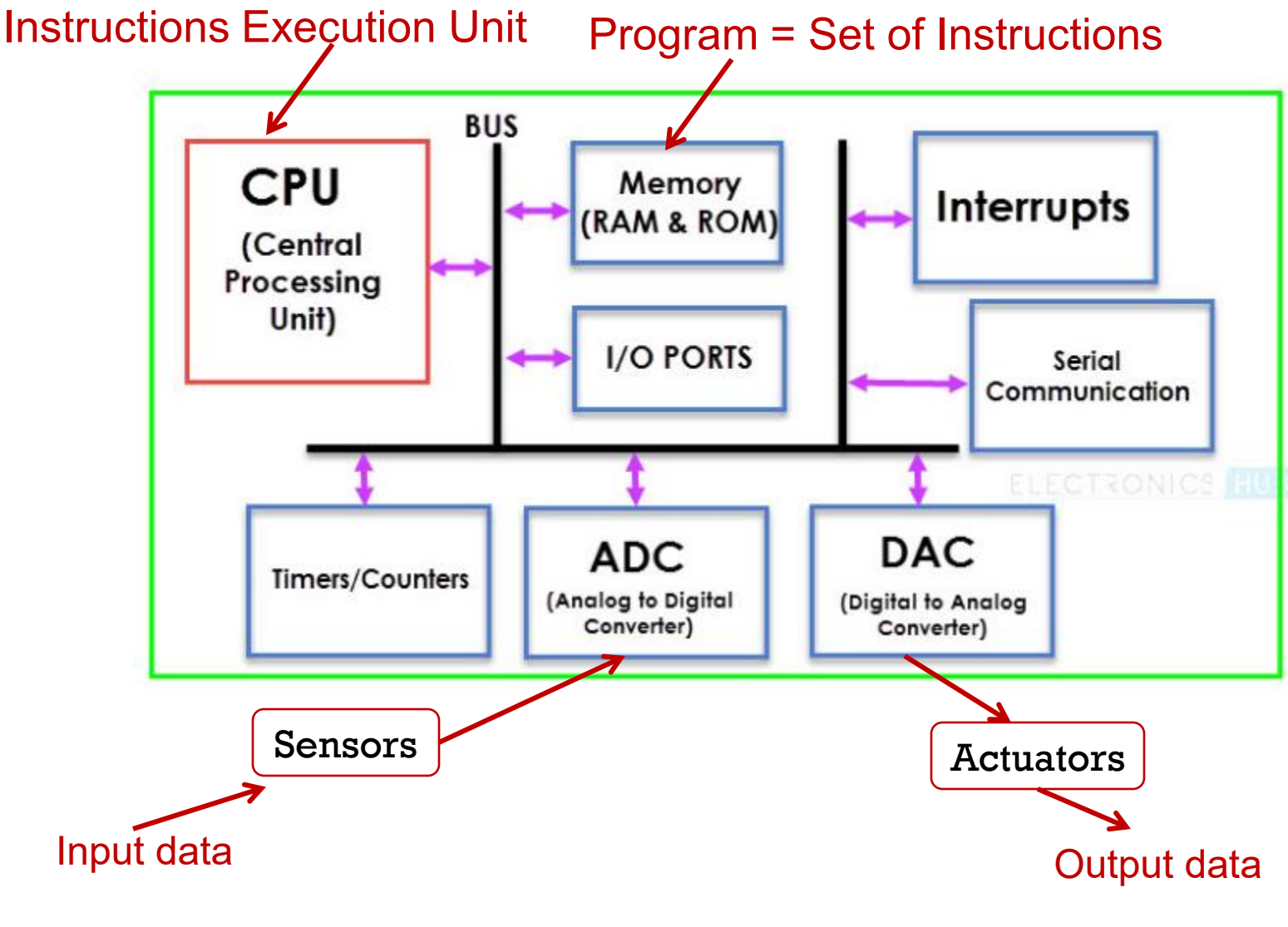
A Microcontroller is a VLSI Integrated Circuit (IC) that contains electronic computing unit and logic unit (CPU), Memory (Program Memory and Data Memory), I/O Ports (Input / Output Ports) and few other components integrated on a single chip.

Program = Set of Instructions

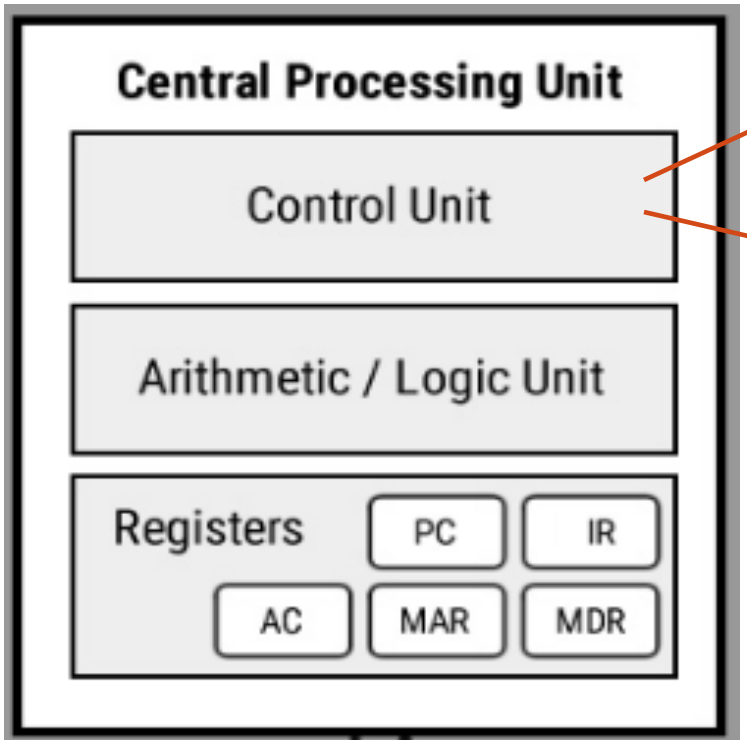


Instructions need some data

Microcontroller



You need to know some basic concepts !



Microprogramming CU = microcode = micro-instructions

hard - wired logic

Note: each register has a size in bits, and the number and size of registers are varying among different processors architectures.

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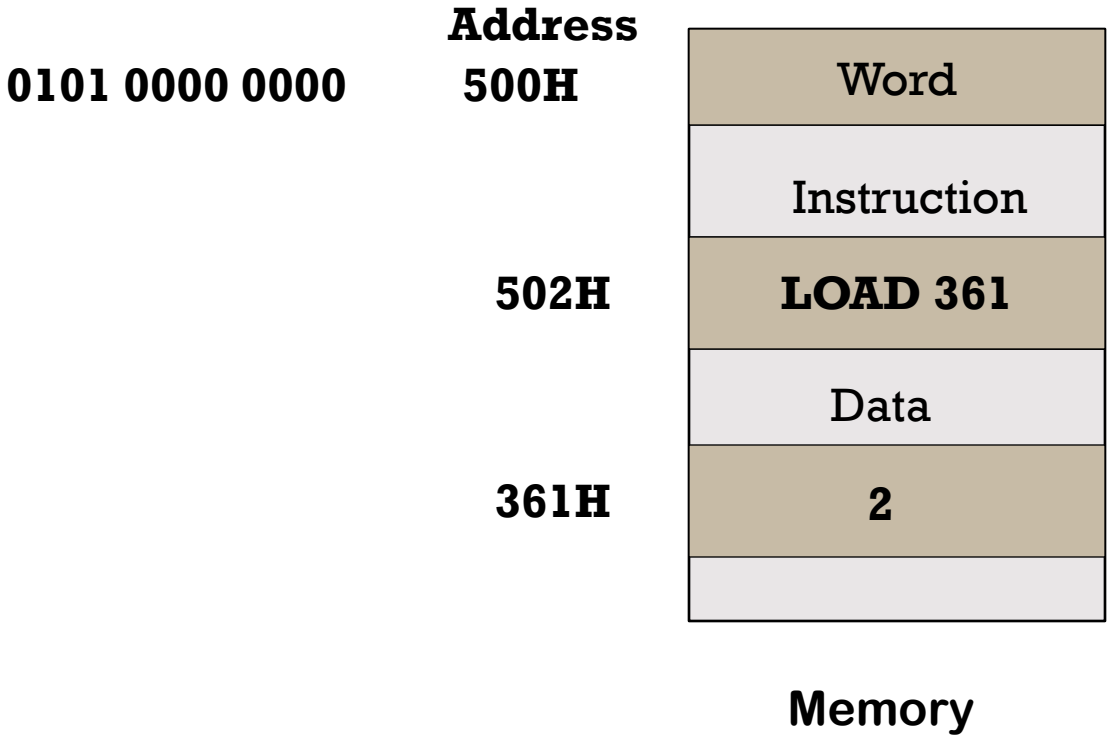

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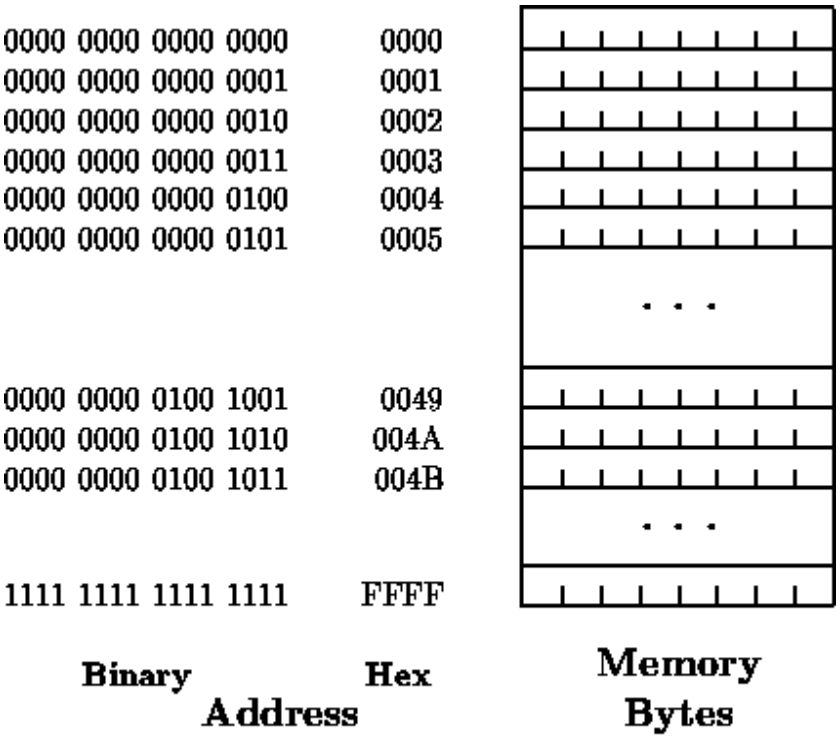
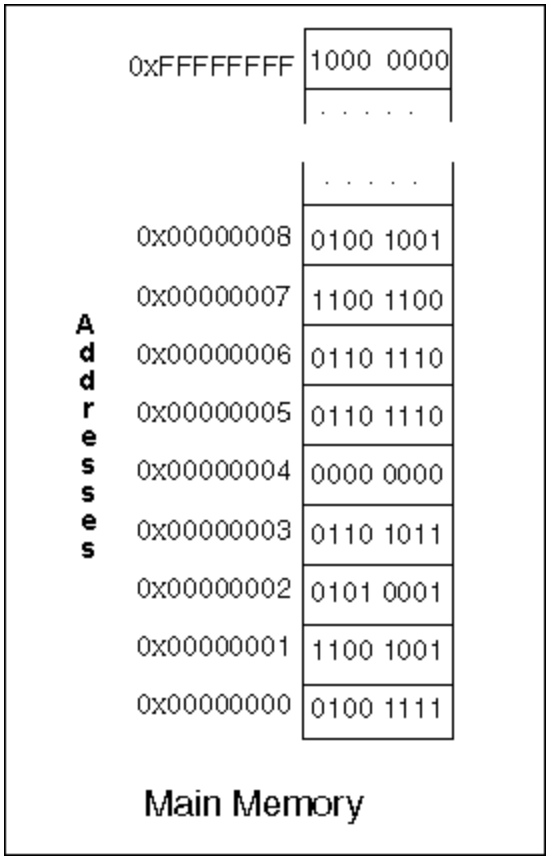


Figure 1.2: Memory and Addresses



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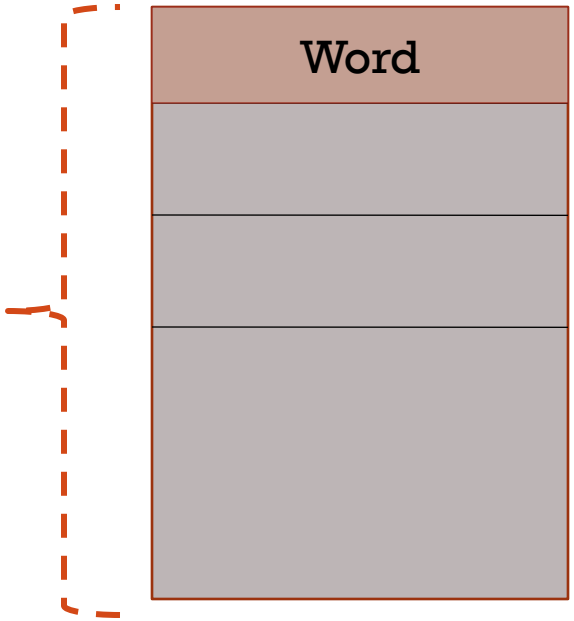

Memory
(1MB)

Size in bits

$$memory\ size\ in\ words = \frac{memory\ size\ in\ bits}{word\ size}$$

$$memory\ size\ in\ words = \frac{2^{10} \times 2^{10} \times 2^{3}}{2^{3}} = 2^{20}\ words$$

$$\#\ bits\ for\ address = 2^{20}\ words = 20\ bits$$

Memory size in words

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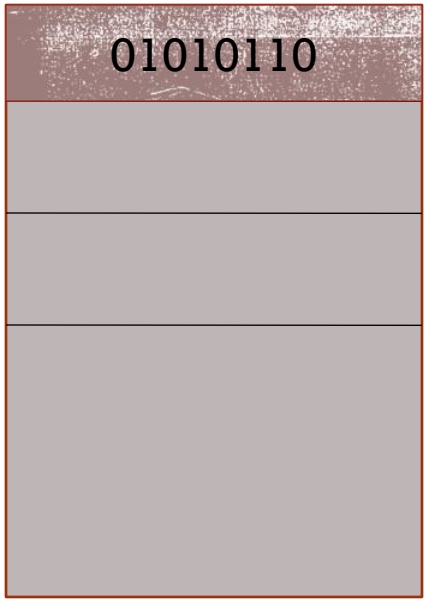

Memory
(1MB)

0001 0001 0010 0010 1111

0x1122F

$$memory\ size\ in\ words = \frac{memory\ size\ in\ bits}{word\ size}$$

$$memory\ size\ in\ words = \frac{2^{10} \times 2^{10} \times 2^{3}}{2^{3}} = 2^{20}\ words$$

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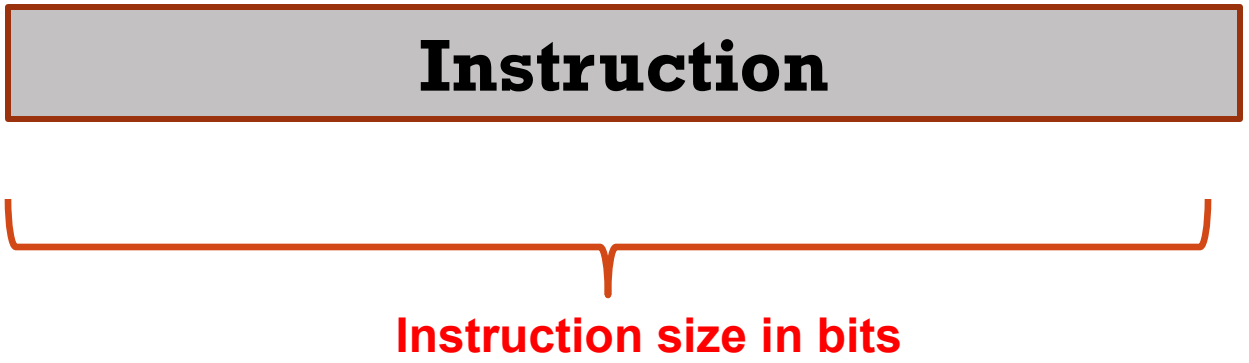

Example:

LOAD 361H = 1010 0011 0110 0001

Note: each family of processors has its own set of instructions for handling various operations.

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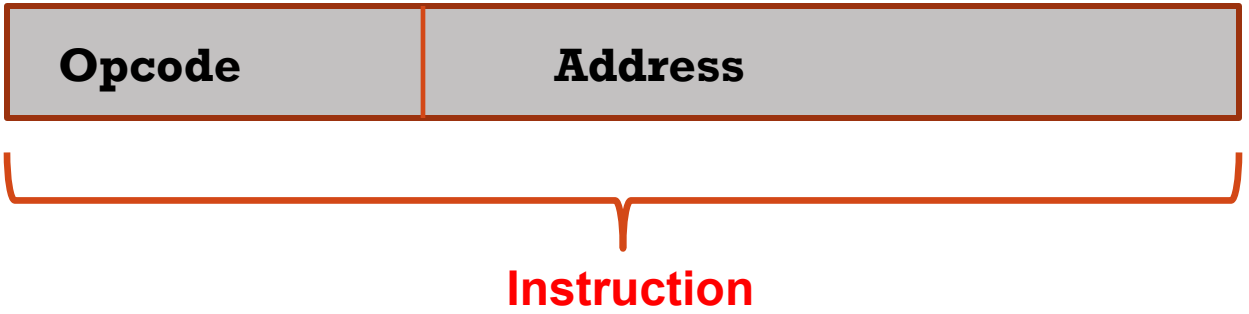

Example:

LOAD 361H = 1010 0011 0110 0001

How many operations supported by this microprocessor?

What is the maximum memory size can be addressed by this microprocessor?

Q

A. Consider a hypothetical 8-bit microprocessor (word size =8bits) having 16-bit instructions composed of two fields: the first byte contains the operation code and the remainder is the operand address. [4 Marks]

1. What is the instruction size in bits?
2. What is the operand address size in bits?
3. What is the maximum directly addressable memory capacity (in words)?
4. How many numbers of instructions that word contains?

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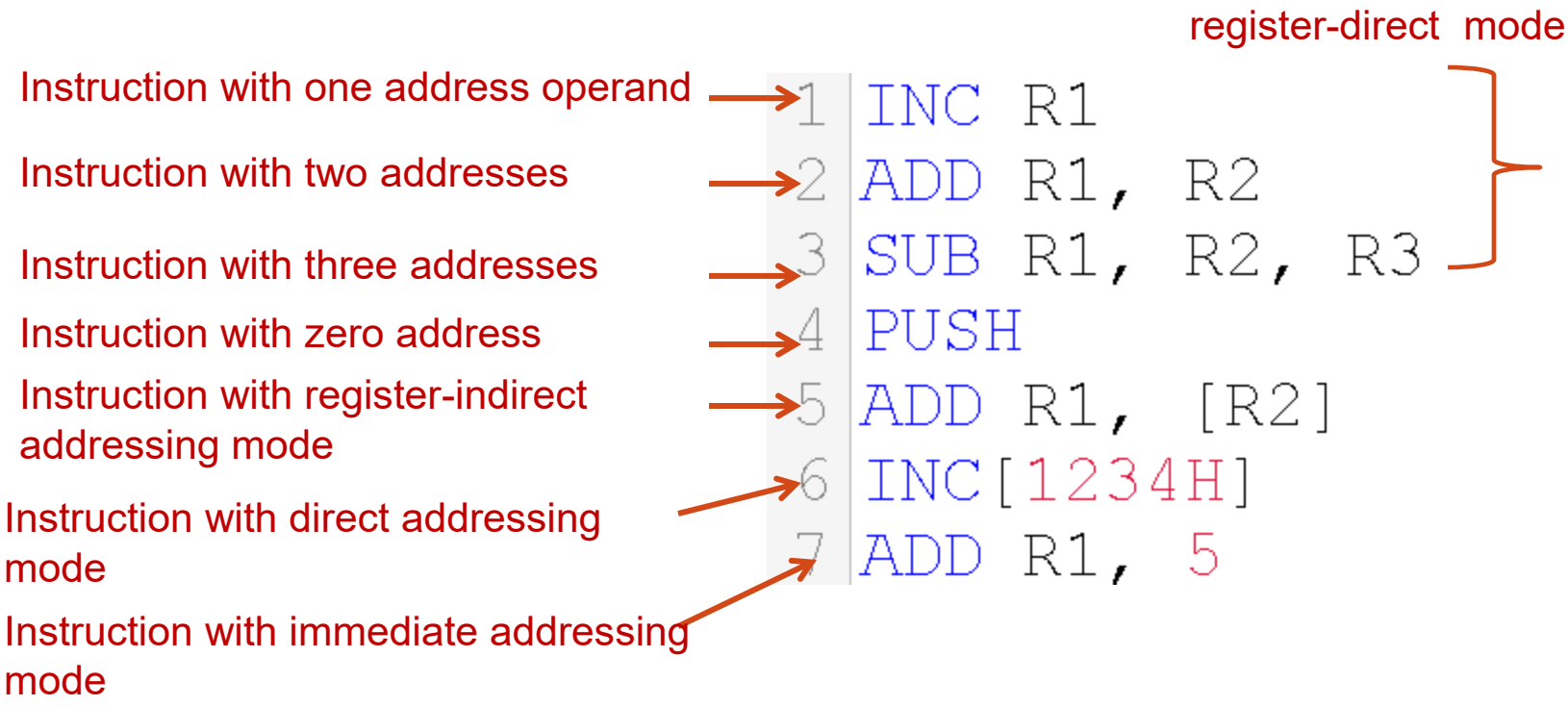

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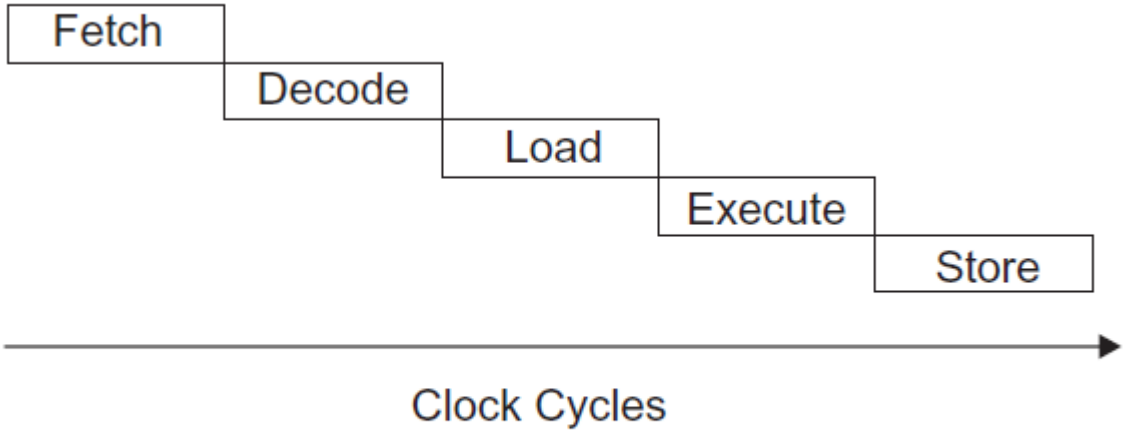
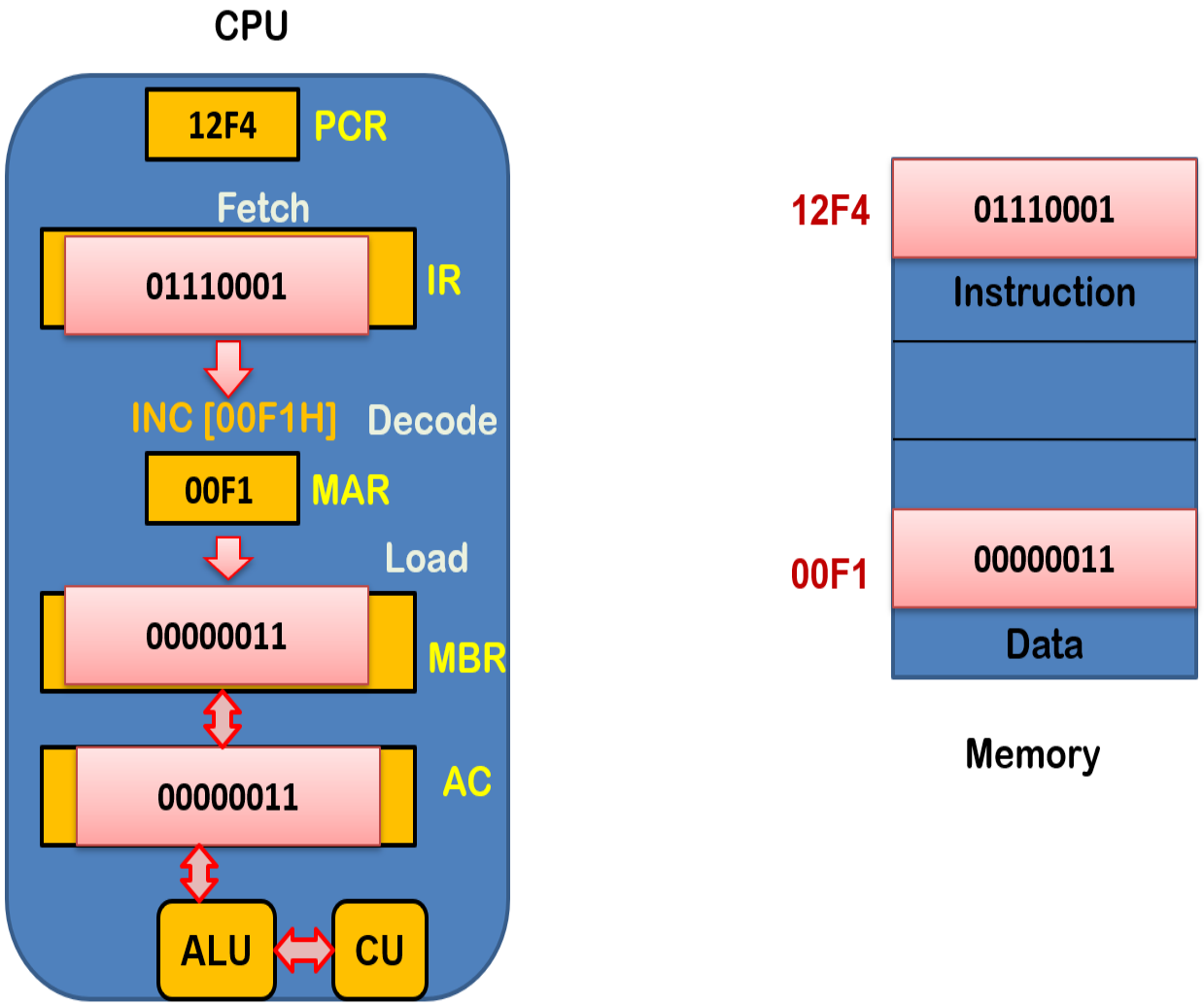


Figure 2.3. Sequential instruction cycle with five phases.

You need to know some basic concepts!



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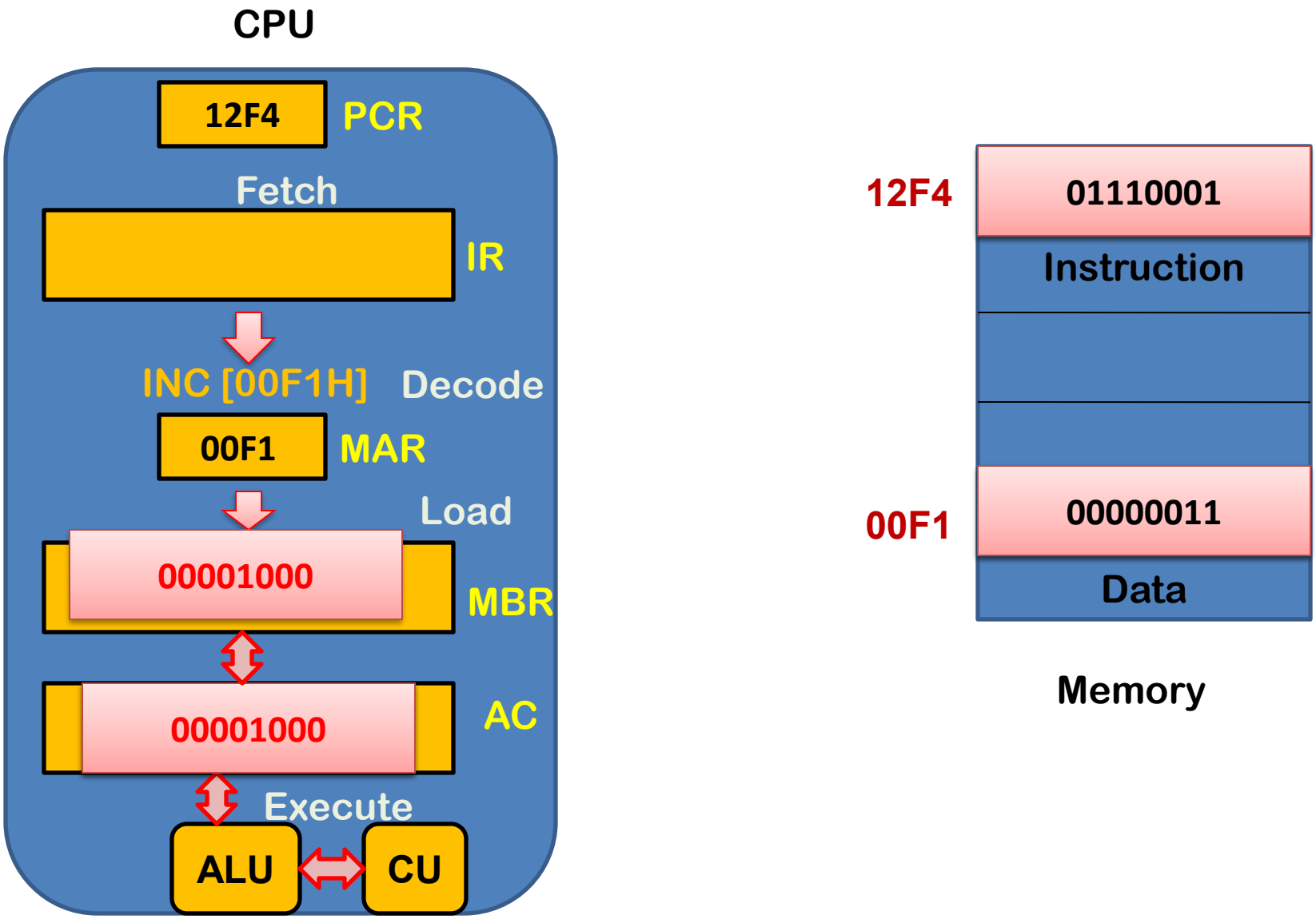

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