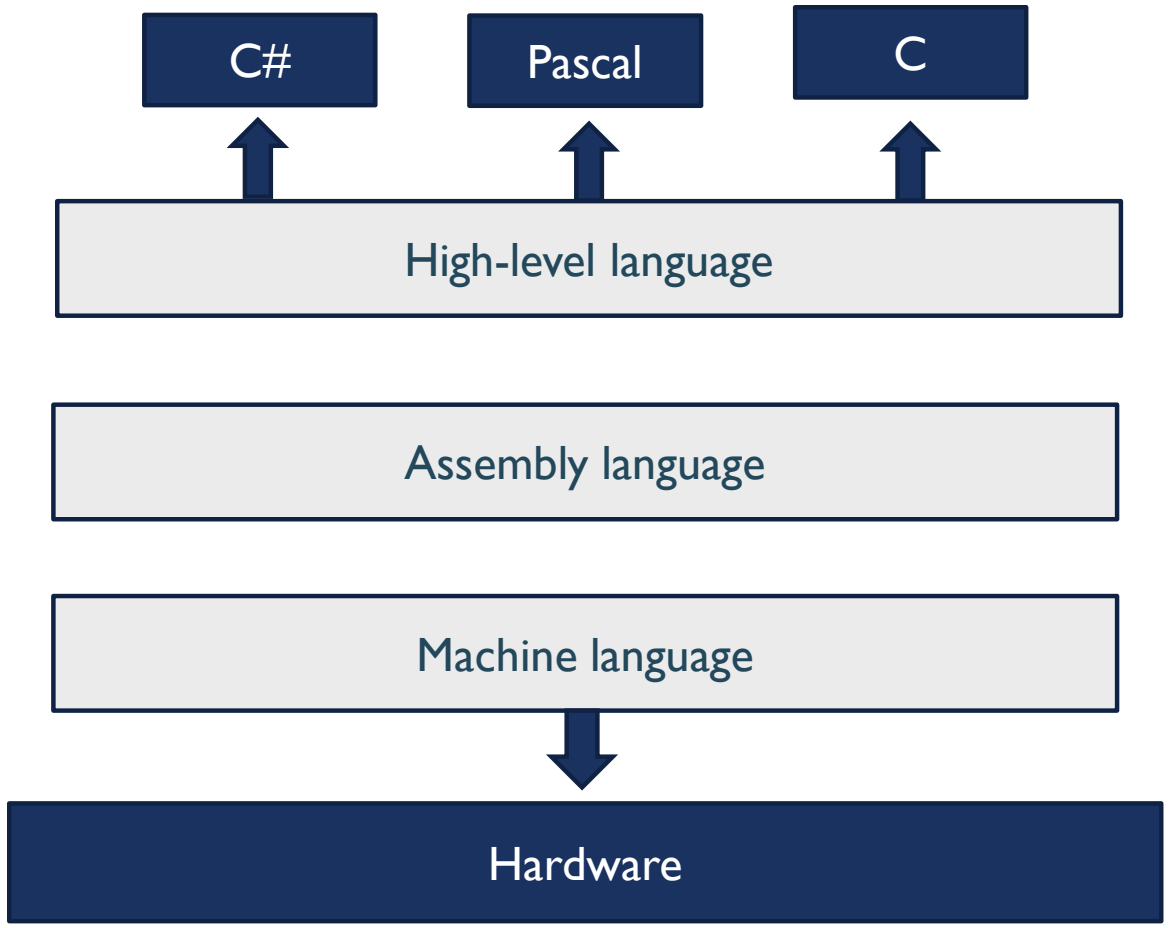
Mansoura University
Faculty of Computers and Information Sciences
Department of Computer Science
First Semester- 2020-2021

[CS212P/IT212] Computer Organization and Architecture

Grade : 2nd General / 3rd Programs

Eng. Esraa Salah

INTRODUCTION



WHAT IS THE DIFFERENCE BETWEEN COMPUTER ORGANIZATION AND COMPUTER ARCHITECTURE ?

- Computer architecture refers to those attributes of a system visible to a programmer or, put another way, those attributes that have a direct impact on the logical execution of a program.

  Ex: the instruction set, the number of bits used to represent various data types (e.g., numbers, characters), I/O mechanisms, and techniques for addressing memory.

- Computer organization refers to the operational units and their interconnections that realize the architectural specifications.

  Ex: control signals; interfaces between the computer and peripherals; and the memory technology used.

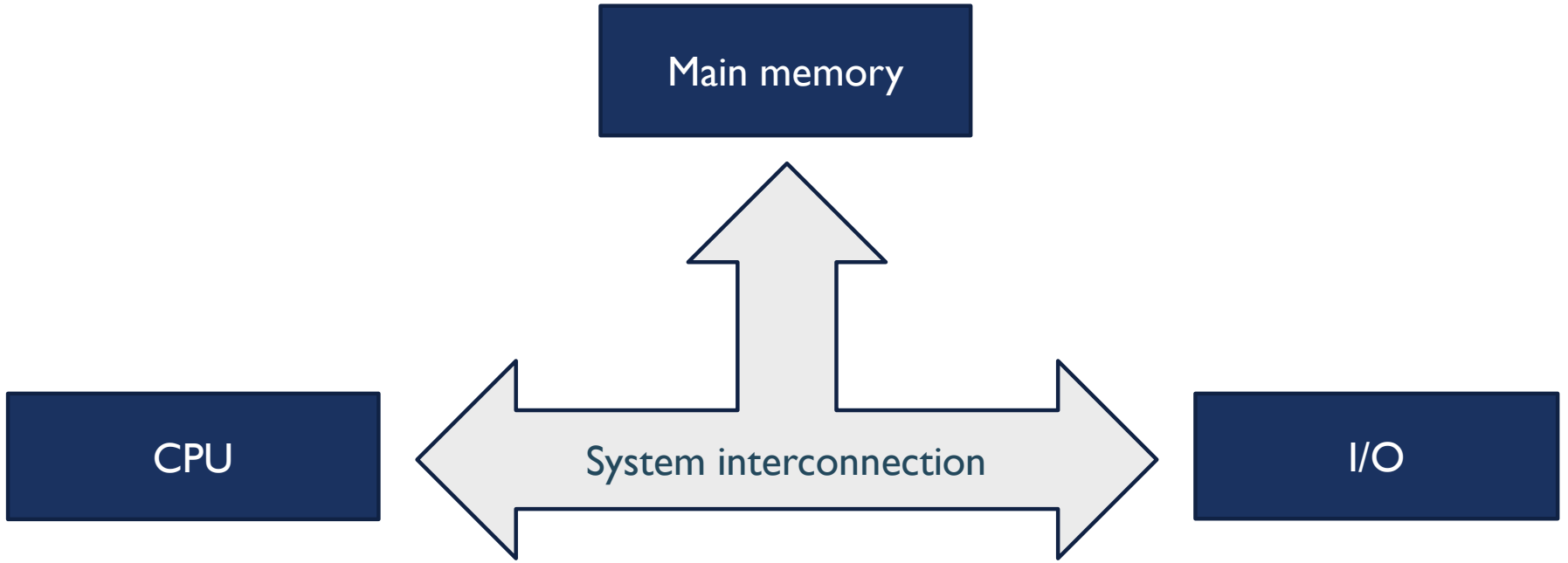
WHAT IS THE DIFFERENCE COMPUTER STRUCTURE AND COMPUTER FUNCTION ?

- Computer structure refers to the way in which the components of a computer are interrelated.
- Computer function refers to the operation of each individual component as part of the structure.

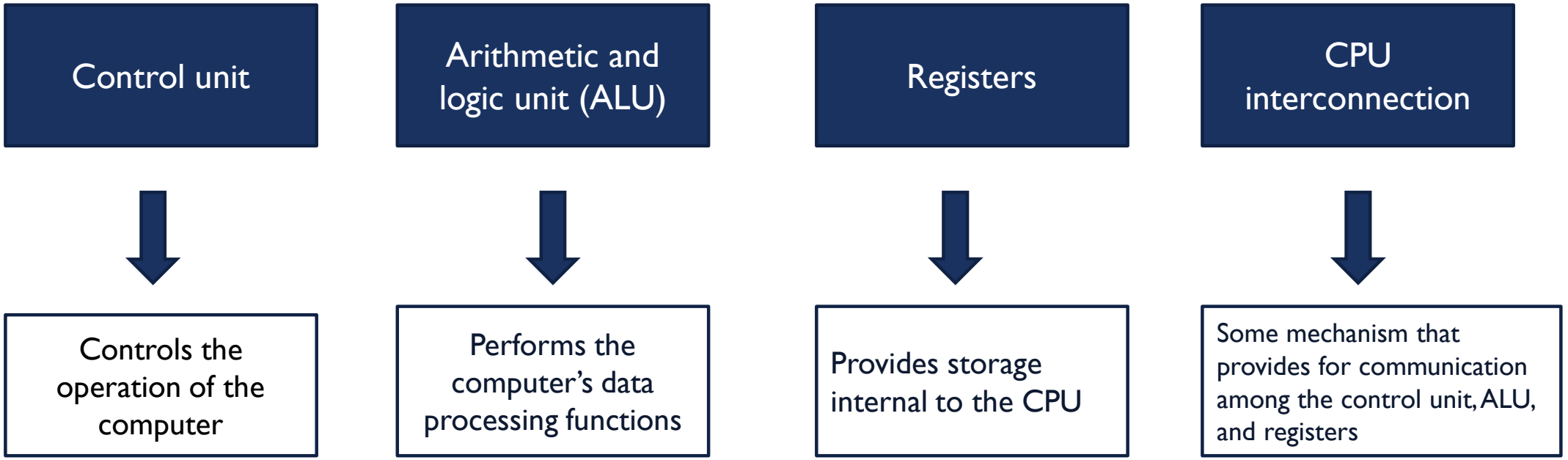
WHAT ARE THE FOUR MAIN FUNCTIONS OF A COMPUTER ?

- Data processing .
- data storage.
- data movement.
- Control

LIST AND BRIEFLY DEFINE THE MAIN STRUCTURAL COMPONENTS OF A COMPUTER



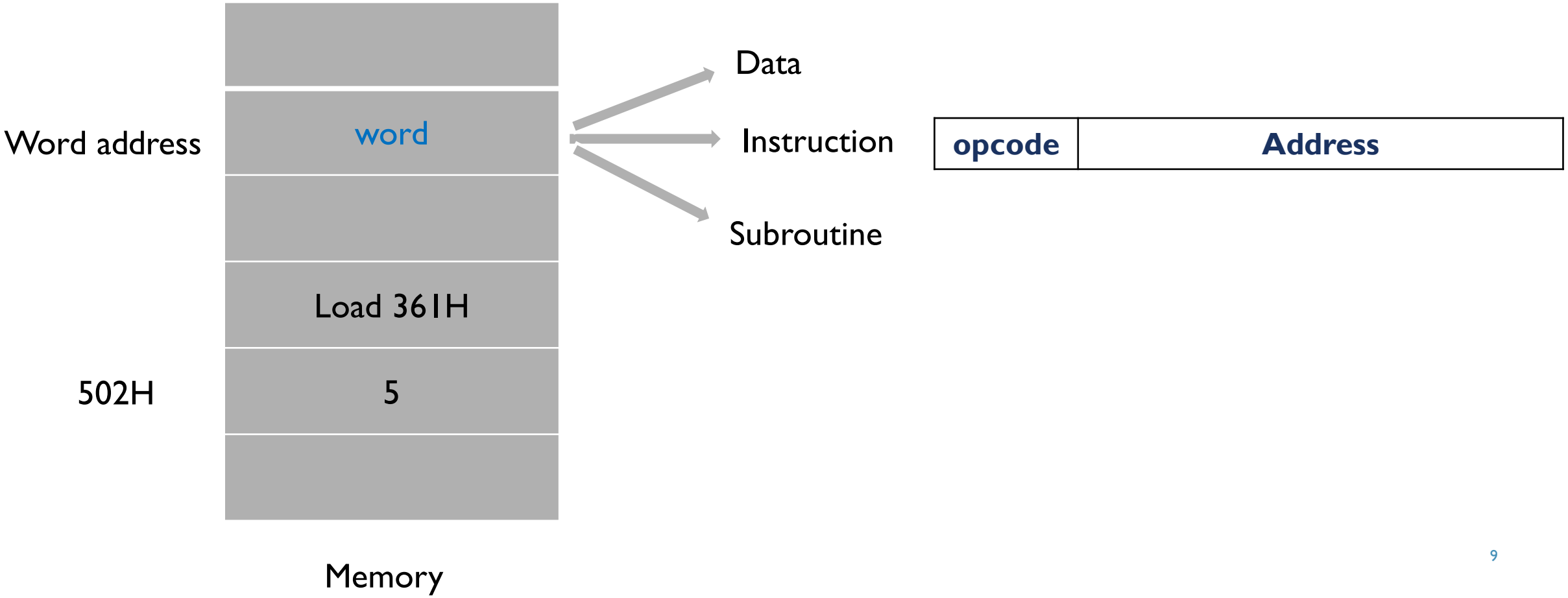
LIST AND BRIEFLY DEFINE THE MAIN STRUCTURAL COMPONENTS OF A PROCESSOR



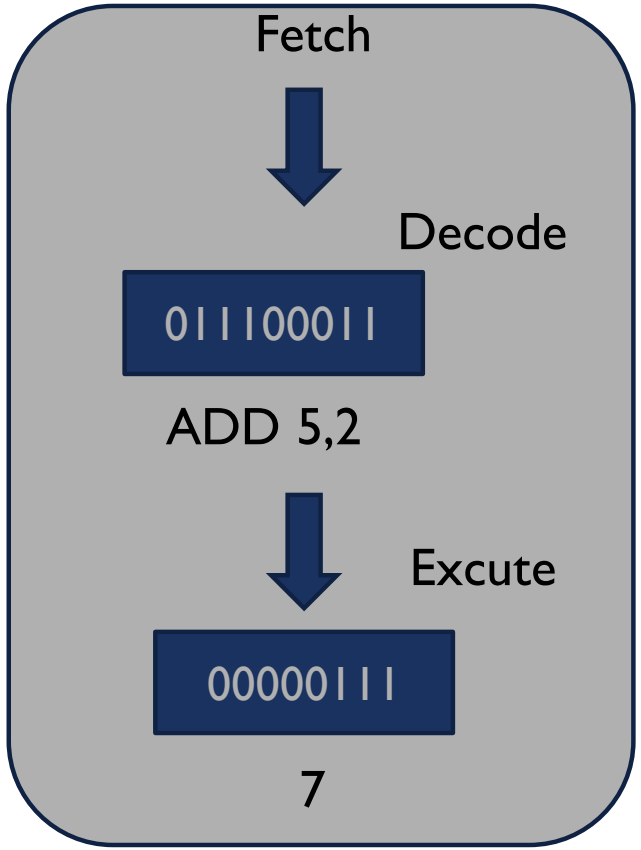
WHAT IS A STORED PROGRAM COMPUTER ?

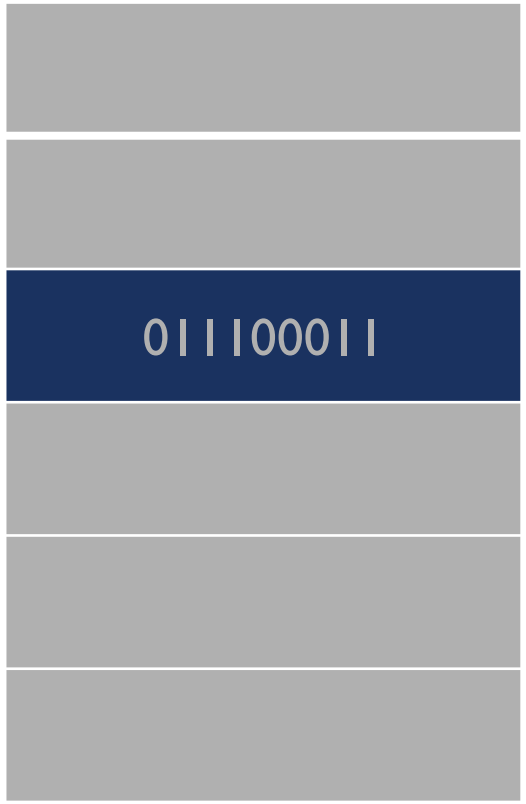
- In a stored program computer, programs are represented in a form suitable for storing in memory alongside the data.
- The computer gets its instructions by reading them from memory, and a program can be set or altered by setting the values of a portion of memory.

MEMORY


Word address
word
Load 361H
502H
5
Memory
Data
Instruction
Subroutine
opcode
Address

INSTRUCTION LIFECYCLE





CPU REGISTERS

- **IR:**

The instruction register (IR) is used to hold the instruction that is currently being executed.

- **AC:**

AC is one of the general purpose registers but it is specifically used to 'accumulate' the result of the currently running instructions.

- **PC:**

The Program Counter is one of the most important registers in the CPU. A program is a series of instructions stored in the memory. (PC) is used to hold the address of the next instruction to be read from memory after the current instruction is executed.

CPU REGISTERS

- **MAR:**

MAR are used to handle the data transfer between the main memory and the processor. The MAR holds the address of the main memory to or from which data is to be transferred.

- **MDR:**

MDR are used to handle the data transfer between the main memory and the processor. The MDR contains the data to be written into or read from the addressed word of the main memory.

QUESTION-1

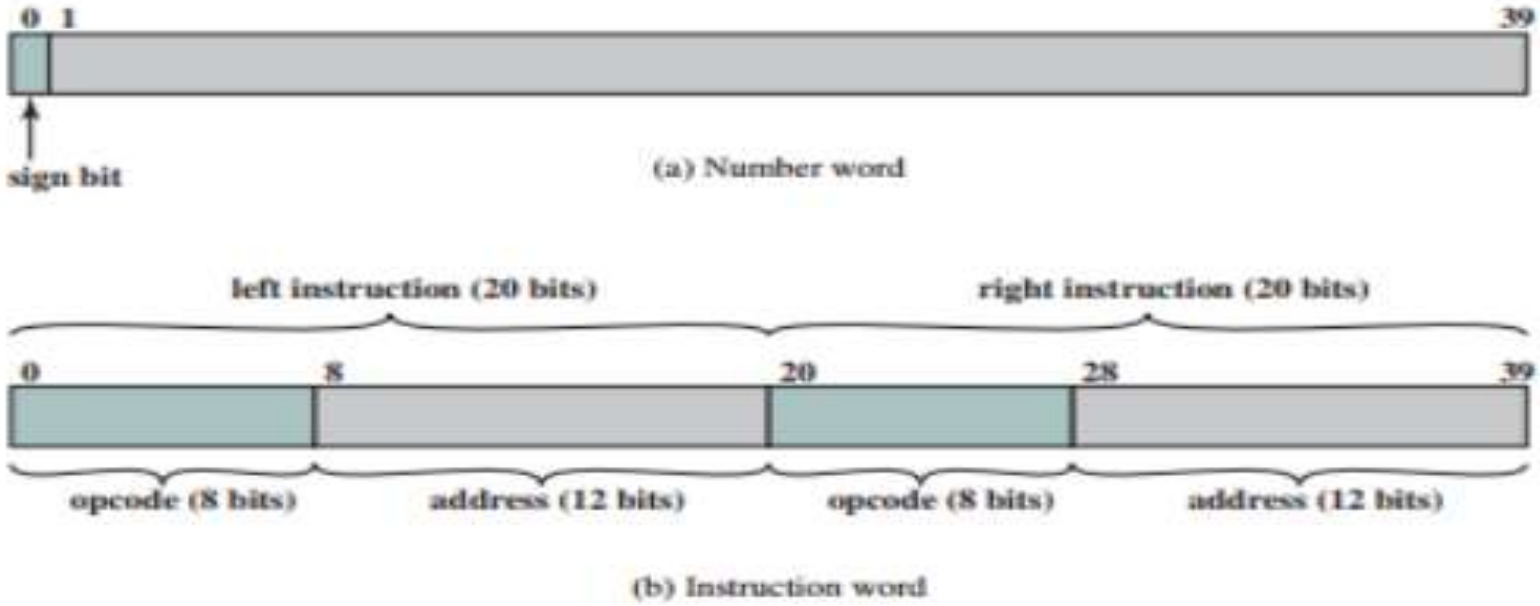
2) Given the memory contents of the IAS computer shown below

Address	Contents
08A	010FA210FB
08B	010FA0F08D
08C	020FA210FB

show the assembly language code for the program, starting at address 08A. Explain what this program does .

QUESTION-1

use the following figure / table as a reference :



use the following figure / table as a reference :

Instruction Type	Opcode	Symbolic Representation	Description
Data transfer	00001010	LOAD MQ	Transfer contents of register MQ to the accumulator AC
	00001001	LOAD MQ,M(X)	Transfer contents of memory location X to MQ
	00100001	STOR M(X)	Transfer contents of accumulator to memory location X
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Conditional branch	00001111	JUMP + M(X,0:19)	If number in the accumulator is nonnegative, take next instruction from left half of M(X)
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Arithmetic	00000101	ADD M(X)	Add M(X) to AC; put the result in AC
	00000111	ADD |M(X)|	Add |M(X)| to AC; put the result in AC
	00000110	SUB M(X)	Subtract M(X) from AC; put the result in AC
	00001000	SUB |M(X)|	Subtract |M(X)| from AC; put the remainder in AC
	00001011	MUL M(X)	Multiply M(X) by MQ; put most significant bits of result in AC, put least significant bits in MQ
	00001100	DIV M(X)	Divide AC by M(X); put the quotient in MQ and the remainder in AC
	00010100	LSH	Multiply accumulator by 2; that is, shift left one bit position
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Address modify	00010010	STOR M(X,8:19)	Replace left address field at M(X) by 12 rightmost bits of AC
	00010011	STOR M(X,28:39)	Replace right address field at M(X) by 12 rightmost bits of AC

QUESTION-1

	opcode	address	opcode	address
010FA210FB	00000001	000011111010	00100001	000011111011

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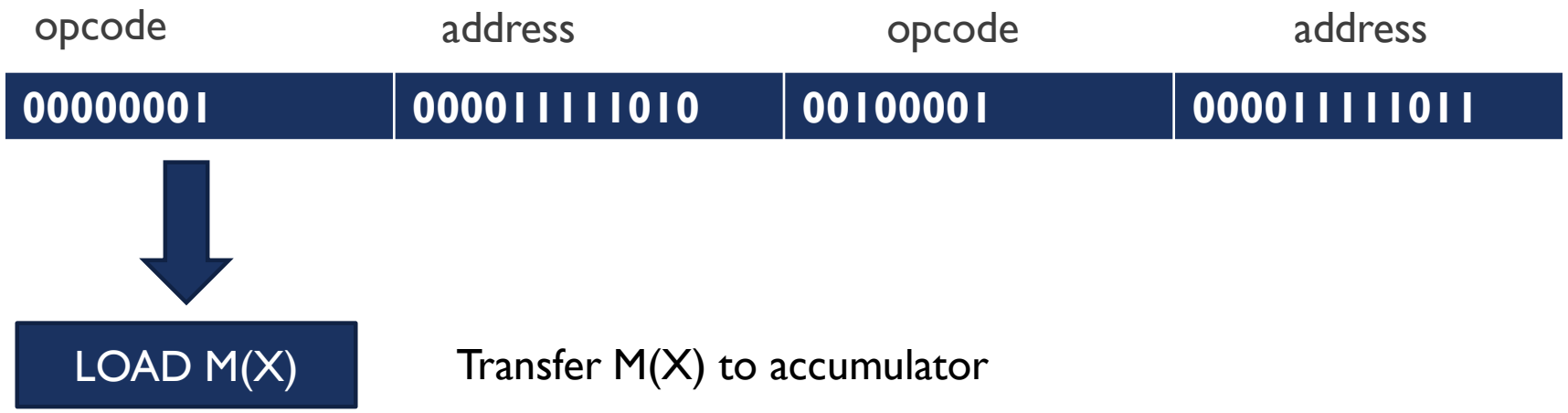
QUESTION-1

010FA210FB



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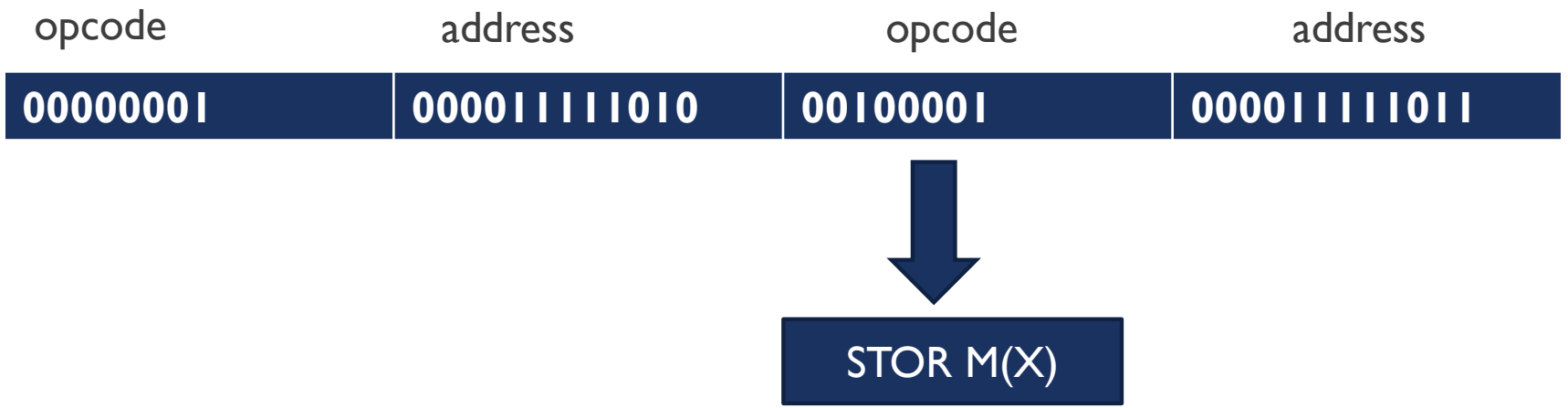
QUESTION-1

010FA210FB



Transfer contents of accumulator to memory location x

QUESTION-1


opcode
address
opcode
address
010FA210FB
00000001
000011111010
00100001
000011111011


010FA210FB
LOAD M(0FA)
STOR M(0FB)

QUESTION-1

	opcode	address	opcode	address
010FA0F08D	00000001	000011111010	00001111	000010001101

use the following figure / table as a reference :

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	00001000	SUB |M(X)|	Subtract |M(X)| from AC; put the remainder in AC
	00001011	MUL M(X)	Multiply M(X) by MQ; put most significant bits of result in AC, put least significant bits in MQ
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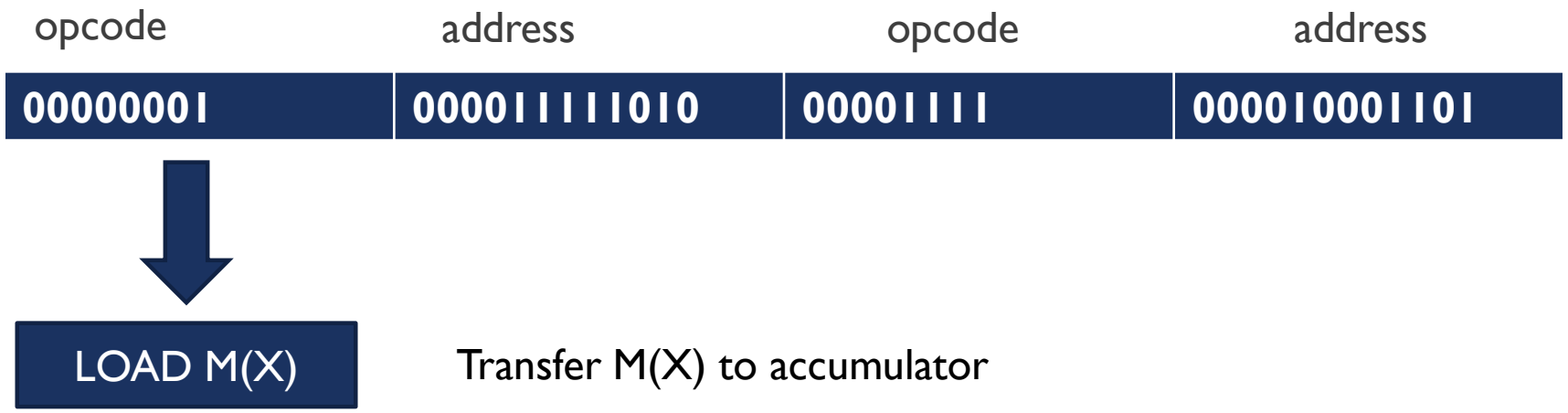
QUESTION-1

010FA0F08D



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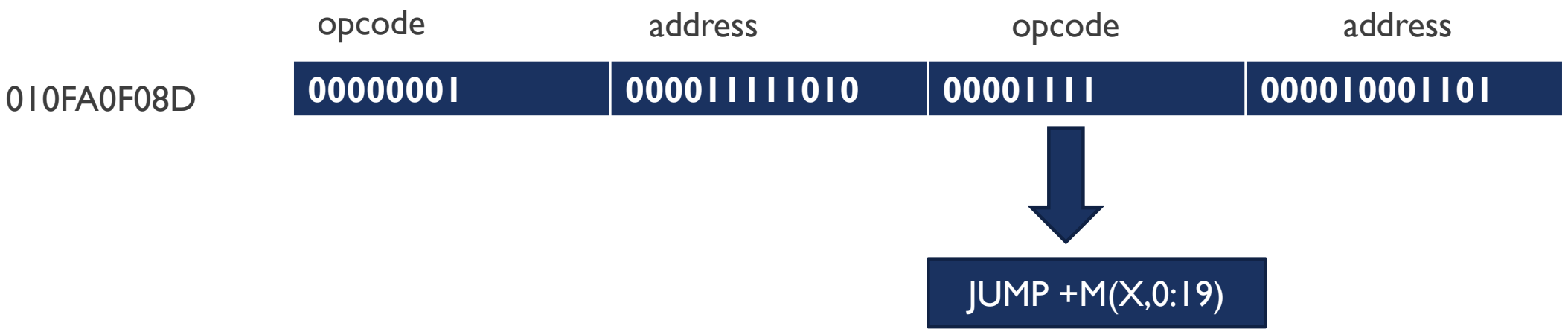
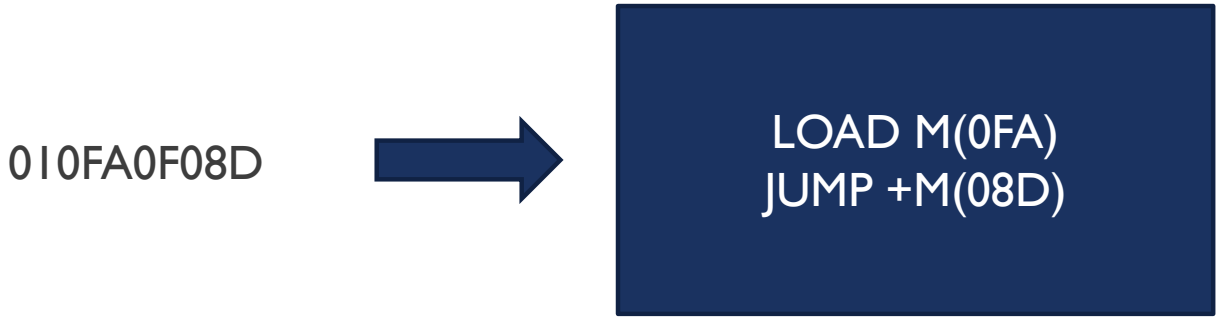
QUESTION-1



If number in the accumulator is nonnegative , take next instruction from left half of M(X)

QUESTION-1


opcode
address
opcode
address
010FA0F08D
00000001
000011111010
00001111
000010001101


010FA0F08D
LOAD M(0FA)
JUMP +M(08D)

QUESTION-1

	opcode	address	opcode	address
020FA210FB	00000010	000011111010	00100001	000011111011

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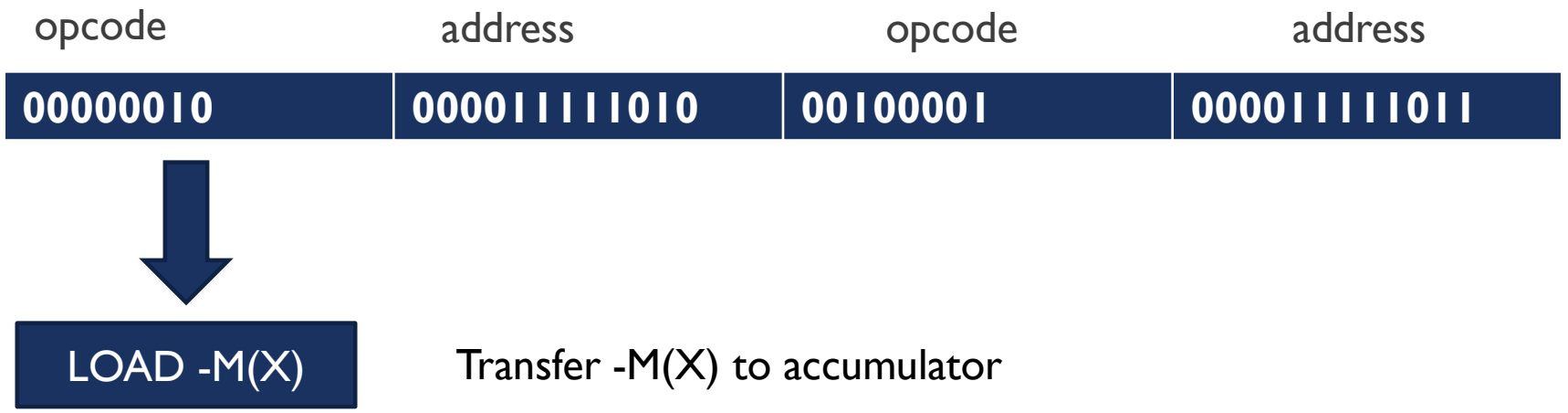
QUESTION-1

020FA210FB



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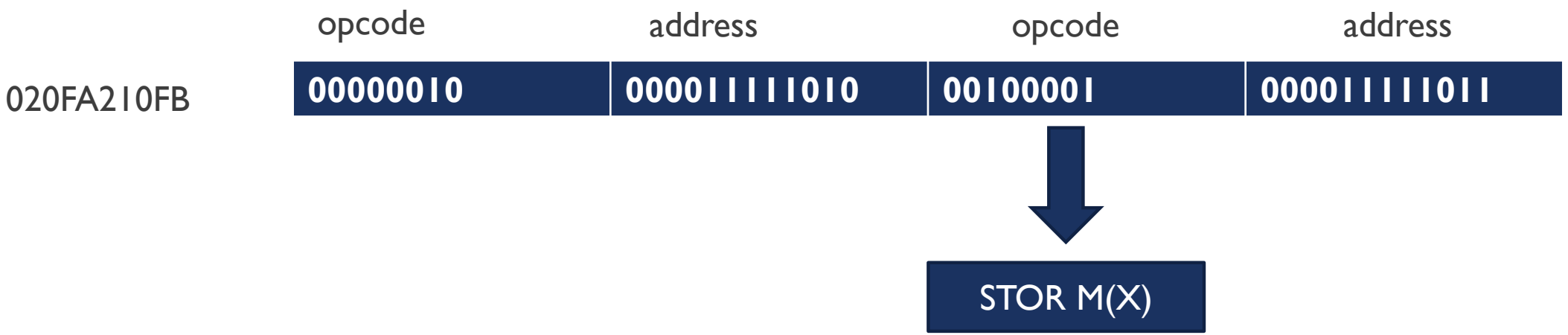
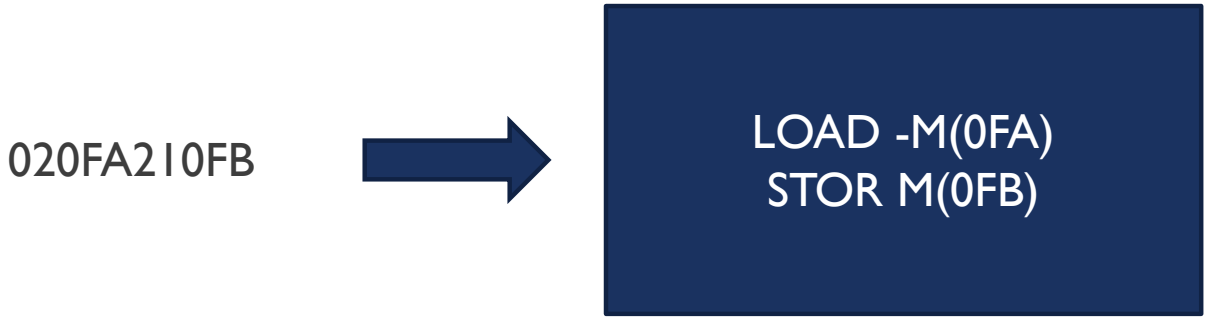
QUESTION-1



Transfer contents of accumulator to memory location x

QUESTION-1


opcode
address
opcode
address
020FA210FB
00000010
000011111010
00100001
000011111011


020FA210FB
LOAD -M(0FA)
STOR M(0FB)

QUESTION-1

Address	Contents
08A	010FA210FB
08B	010FA0F08D
08C	020FA210FB

Address	Contents
08A	LOAD M(0FA) STOR M(0FB)
08B	LOAD M(0FA) JUMP +M(08D)
08C	LOAD -M(0FA) STOR M(0FB)
08D	

This program will store the absolute value of content at memory location 0FA into memory location 0FB.

QUESTION-1

Address	Contents
08A	010FA210FB
08B	010FA0F08D
08C	020FA210FB

Address	Contents
08A	LOAD M(0FA) STOR M(0FB)
08B	LOAD M(0FA) JUMP +M(08D)
08C	LOAD -M(0FA) STOR M(0FB)
08D	

This program will store the absolute value of content at memory location 0FA into memory location 0FB.

QUESTION-1

1) Consider the following hypothetical machine that includes the characteristics listed below. The processor contains a single data register, called an accumulator (AC). Both instructions and data are 16 bits.

(a) Instruction format

(b) Integer format

QUESTION-1

Program counter (PC) = Address of instruction
Instruction register (IR) = Instruction being executed
Accumulator (AC) = Temporary storage

(c) Internal CPU registers

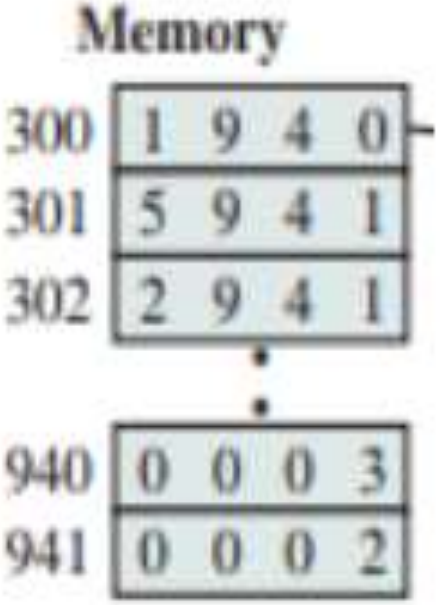
0001 = Load AC from memory
0010 = Store AC to memory
0101 = Add to AC from memory

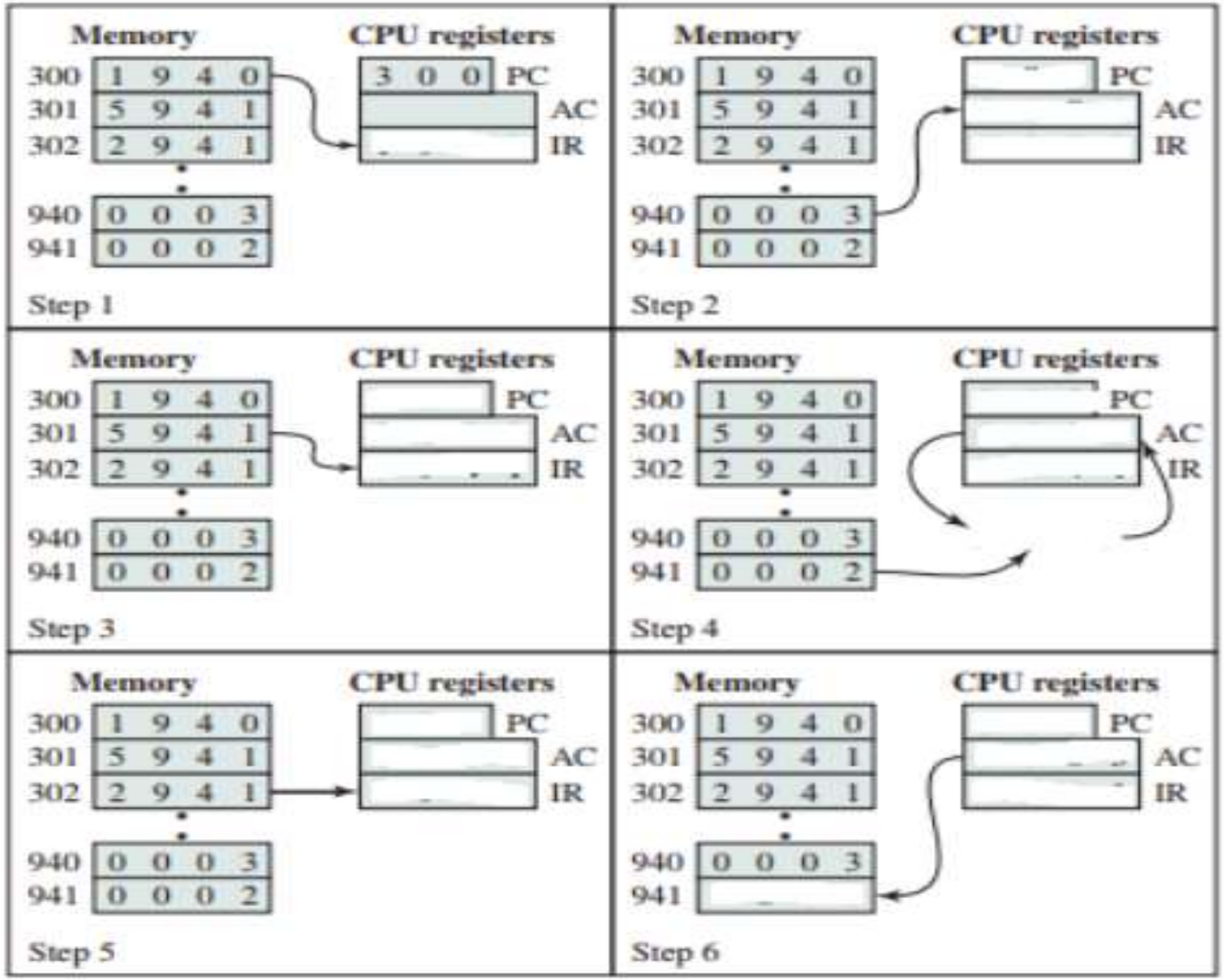
(d) Partial list of opcodes

QUESTION-1

The following is a program fragment at address 300. It is apparently that the first three memory locations are instructions (detected by their opcode) and the last two memory locations are data.

Task: Illustrate the partial program execution, showing the relevant portions of memory and processor registers.

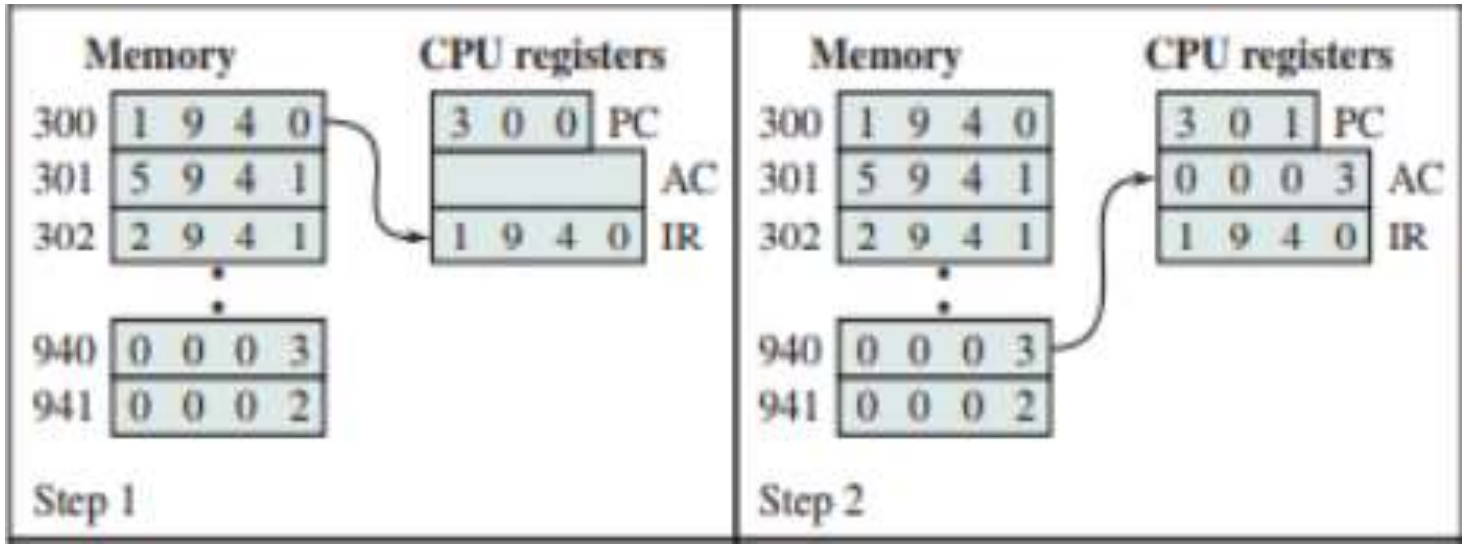



Memory
CPU registers
300 1 9 4 0
301 5 9 4 1
302 2 9 4 1
940 0 0 0 3
941 0 0 0 2
3 0 0 PC
AC
IR
Step 1
Step 2
Step 3
Step 4
Step 5
Step 6

QUESTION-1

- First instruction :

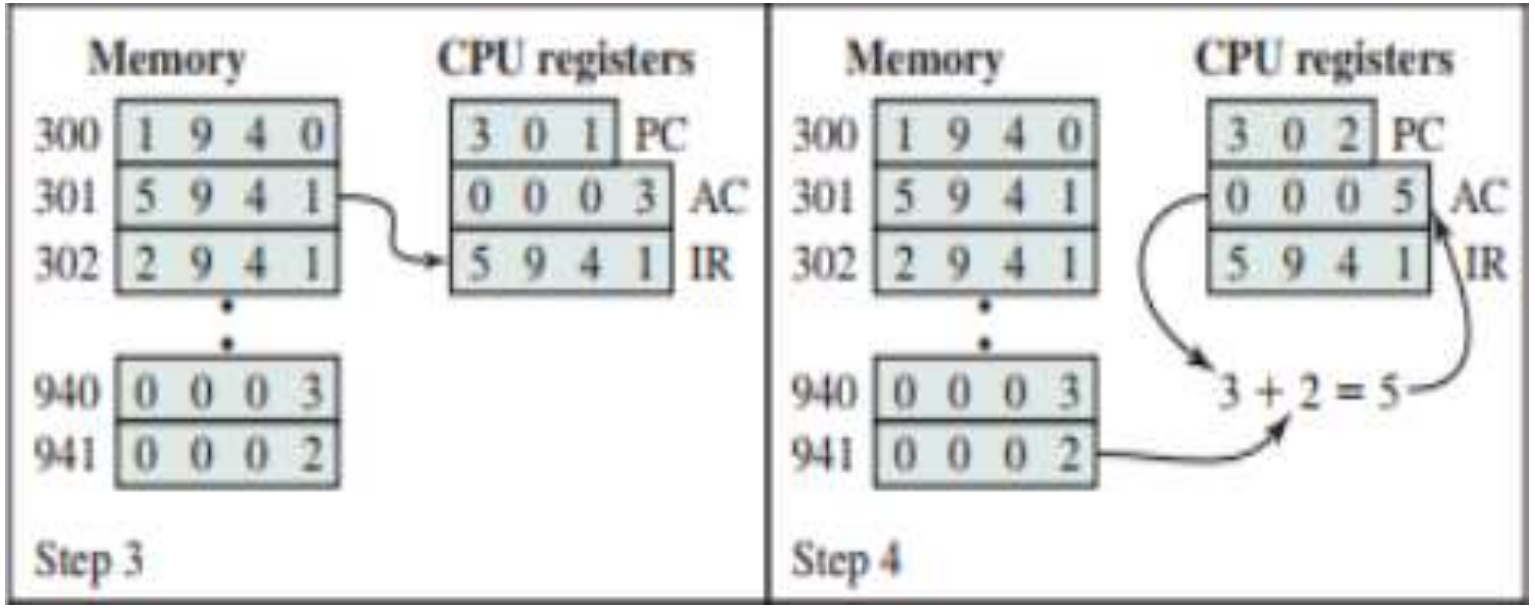
Fetch decode: 1=load Excute



QUESTION-1

- Second instruction :

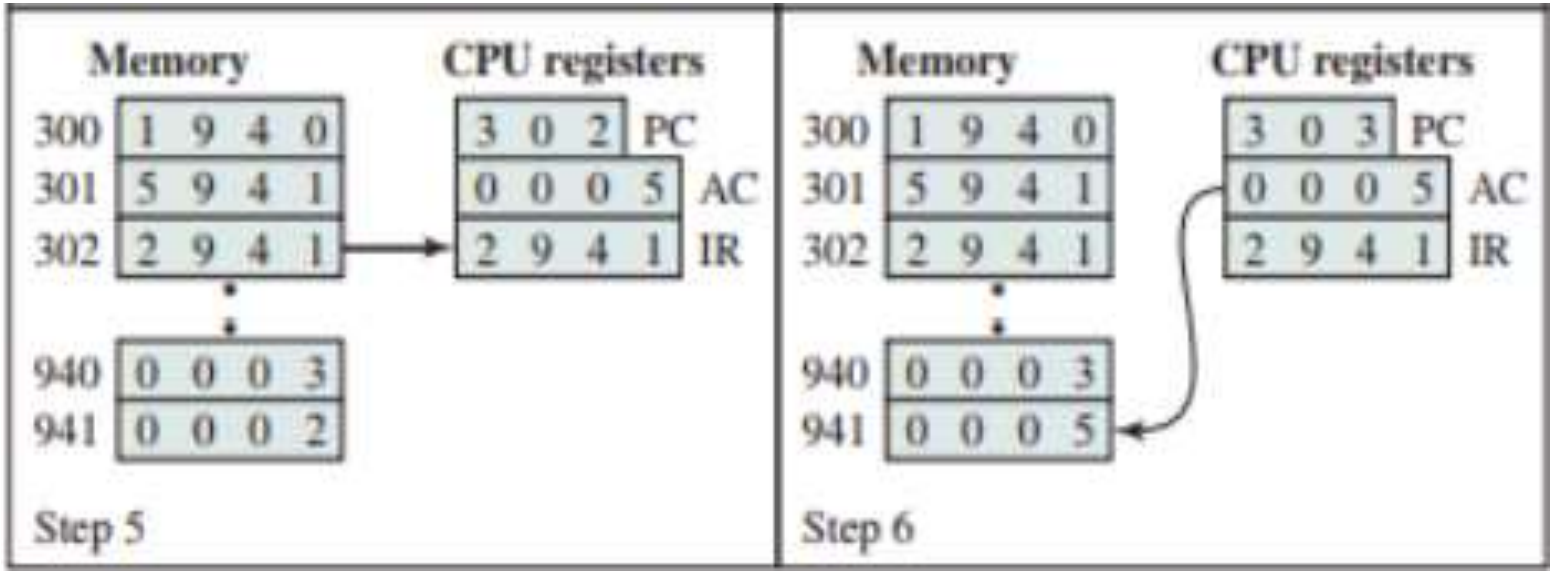
Fetch decode:5=Add Excute

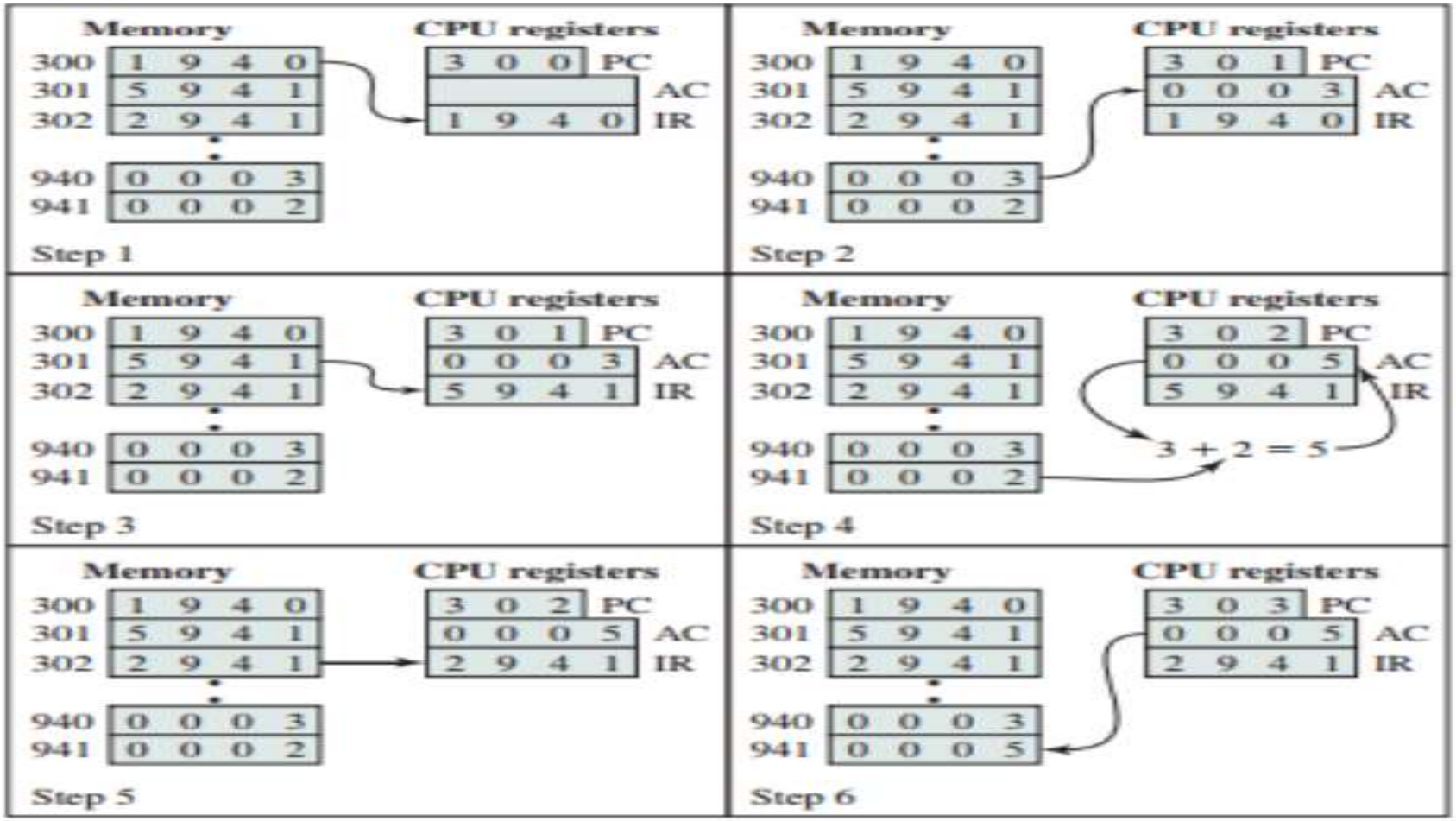


QUESTION-1

- Third instruction :

Fetch decode:2=Store Excute





The program fragment shown adds the contents of the memory word at address 940 to the contents of the memory word at address 941 and stores the result in the latter location.

THANKS ♥