REGISTERS IN C.A

Computer architecture

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Table of contents

Introduction Registers

Registers or memory registers of a computer processor are used to store and transfer data and instructions at a very high speed. As you know, the computerCPU is definitely one of the most important and complex components of a computer, and it is not a single-purpose and one-dimensional piece of hardware, and it is responsible for many tasks. ,Thereforethe register in the processor has different types, each of which in turn is very important and inevitable in handling and processing instructions forthe CPU .

As you probably guessed, theregister memory of the processor is one of the fastest memories of a computer(even faster than the L1 cache memory of the processor) because ,the CPU stores the instructions in theregister memory to perform its processes on the instructions and then on They do the processing. The registers of the processor are generally responsible for 3 tasks, namelyDecode ,Fetch andExecute, in the matter of processing commands, each of which will .be explained below

Inside the CPU
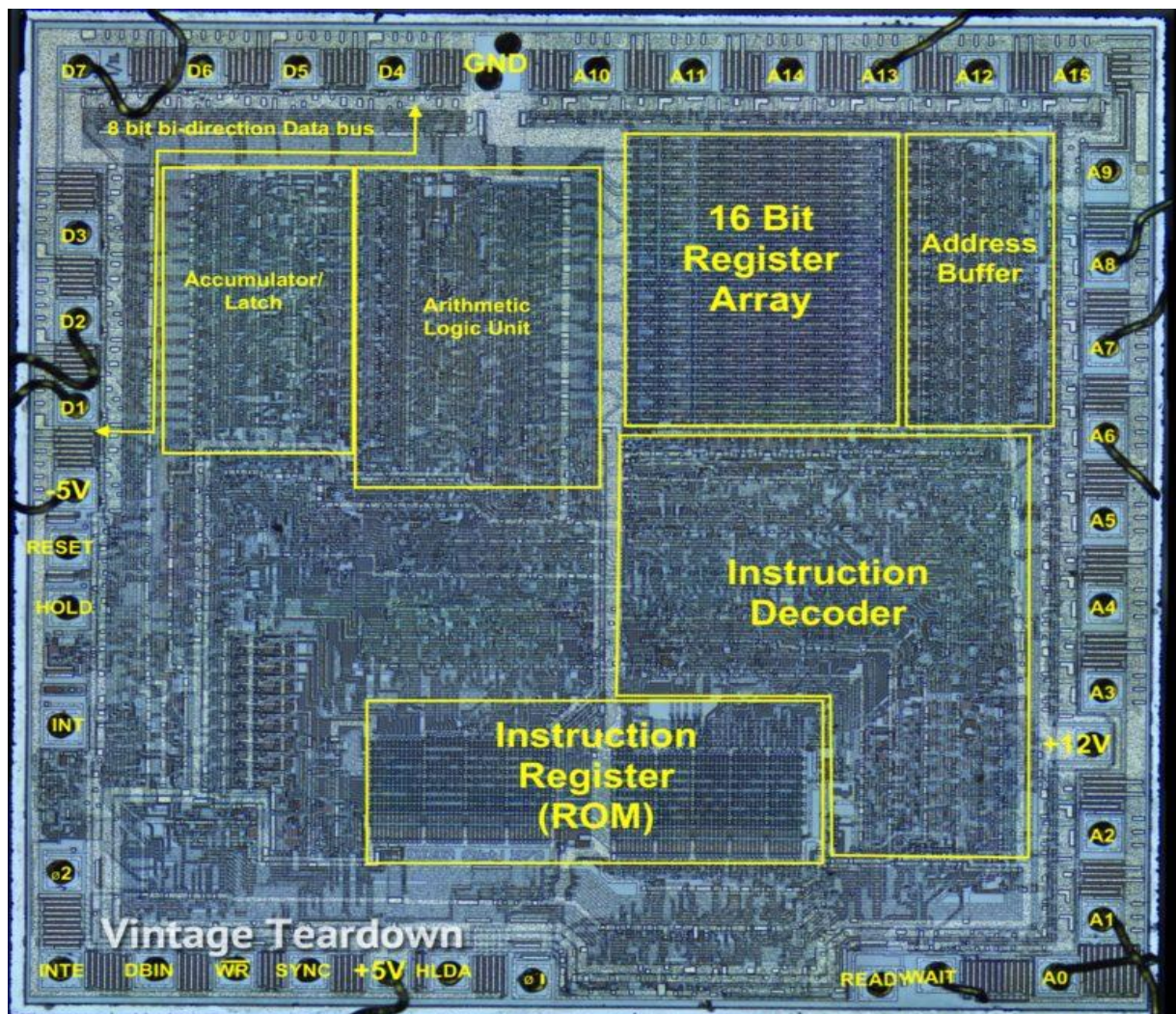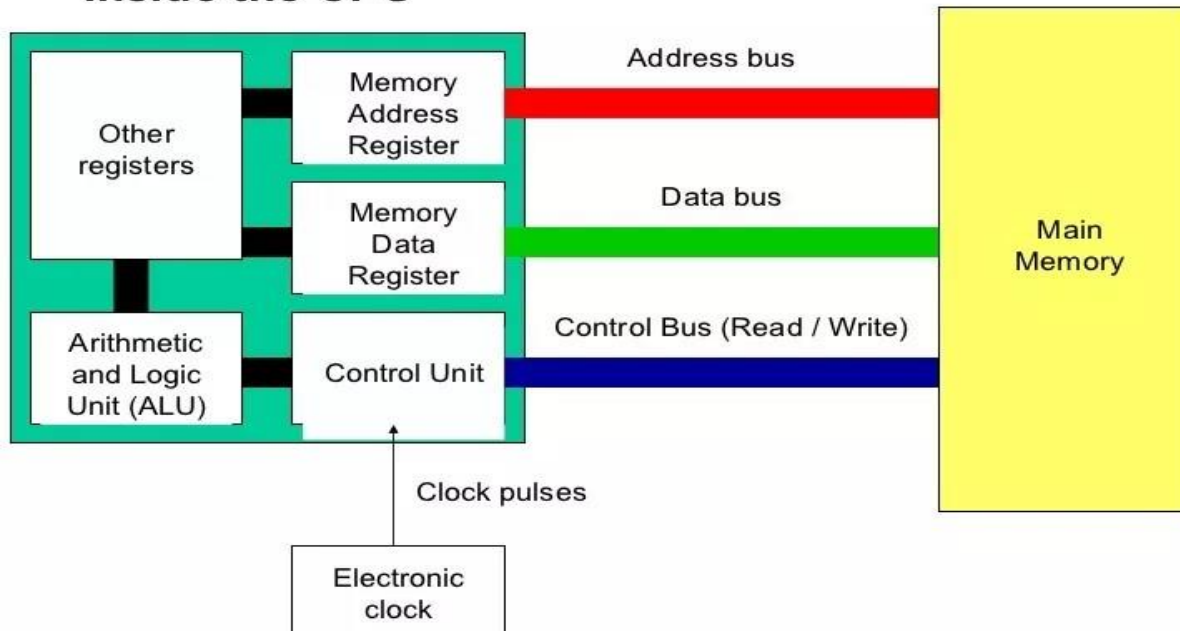
Type of Registers

Fetch or retrieve data: Fetch operation consists of getting the instructions given by the user to the computer, as well as retrieving or fetching the instructions byregisters from theRAM memory of the system in order to process the instructions.
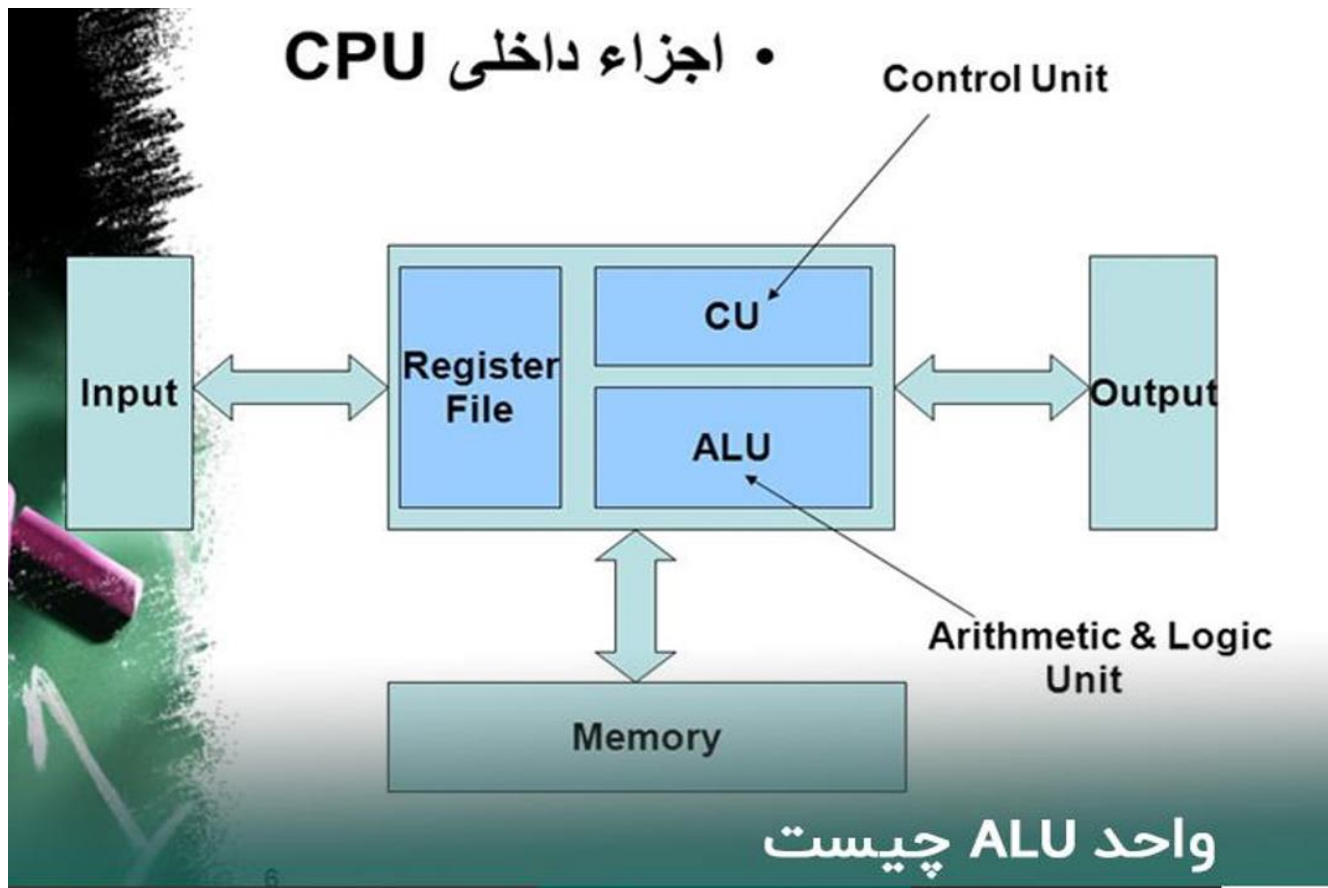
Decode or decoding of instructions: The operationof decoding instructions is for the purpose of translating instructions intocommands so that they can be executed by theALU unit, the unit that supervises the operation of decoding instructions, theCU unit Or it is the control unit in the CPU .

Execute commands: As we said the commands are executed by the ,ALU unit of the processor. After the execution of the commands by theALU logic unit the result is stored in the ,RAM memory of the system so that we can use the result of our commands.

What is theALU unit

The calculation and logic unit in processors is a separate and sensitive part that is located in all old and new processors. This unit, which is used to calculate logic and account operations, is one of the most sensitive and important parts of processors. It doesn't matter if the processor is used as a computerCPU or a simple microchip .

ALU unit is known as a basic and important unit in processors. Even the simplest processors and microchips have this unit and perform the simplest computing parts in this unit. One of the most important tasks in calculation and logic is calculating time and maintaining it

اجزاء داخلی CPU •

Control Unit

CU

Register File

ALU

Input

Output

Arithmetic & Logic Unit

Memory

واحد ALU چیست

CU

The Control Unitmanages all processor control signals, theCU unit The processor is actually the brain of the computer It is known because this unit manages and responds to orders and ensures the correct execution of .issued instructions
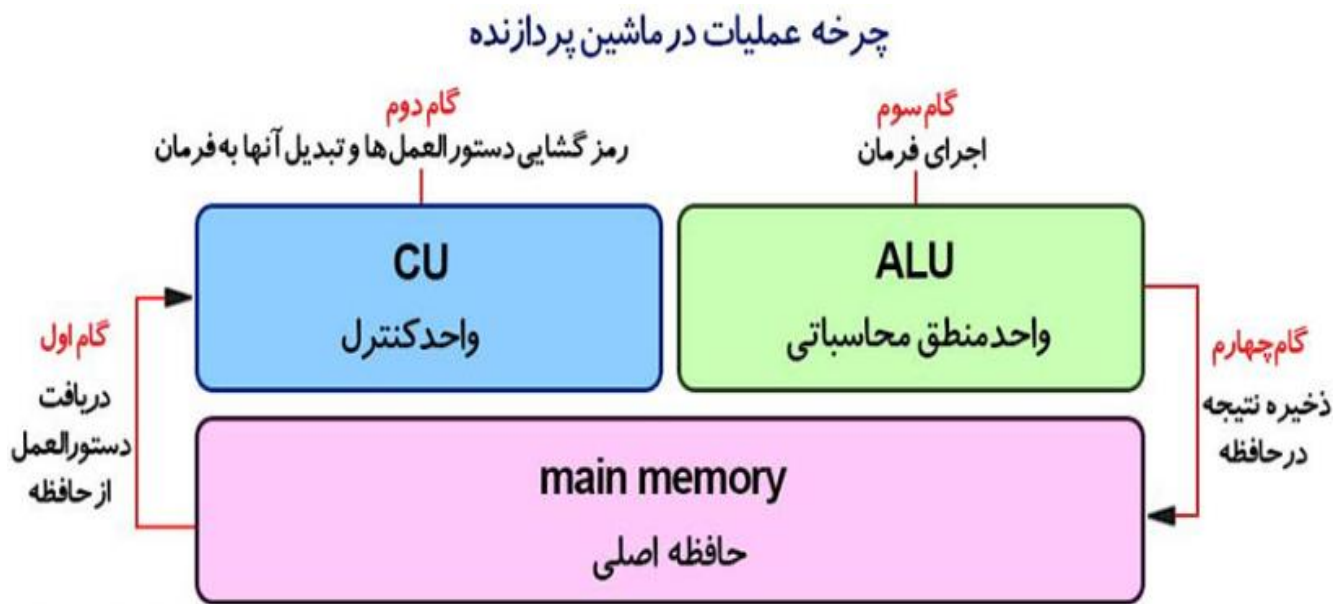
Control the execution of sequential instructions

Interpretation of instructions

 Directing data flowbetween different components of computers

Setting and controlling processor timing

Sending and receiving control signals from other computer hardware

tasks such asfetching ,datadecoding data and executive management of instructions and finally storing the results.

چرخه عملیات در ماشین پردازنده

گام دوم
رمزگشایی دستورالعمل‌ها و تبدیل آنها به فرمان

گام سوم
اجرای فرمان

CU
واحد کنترل

ALU
واحد منطق محاسباتی

گام اول
دریافت
دستورالعمل
از حافظه

گام چهارم
ذخیره نتیجه
در حافظه

main memory
حافظه اصلی

• Memory Address Register (MAR)

thisregister holds the memory addresses of data and instructions. This register is used to access data and instructions fromRAM memory during the execution of instructions. Supposethe CPU wants to store some data in theRAM memory or on the contrary, it wants tocall data from the RAM memory .MAR ,stores temporarily. Because if this was not the case the CPU would not know where the instructions should be stored in the RAM memory. So if we think about this matter logically, the existence of a registry calledMAR is mandatory.

• Program Counter (PC)

Program Counter register or**PC** for short is a register which is also called Instruction Pointer orIP This register is sometimes called .Instruction Address Register . This register stores the path of the memory address of the instruction that should be processed after the current instruction is finished. In other words, thisregister holds the memory address of the .next instruction until the processing of the current instruction is completed

• Accumulator Register (AC)

 Thisregister is used to store the results of the commands performed by the ALU unit of the system processor. Whenthe CPU processes the instructions and is finished, the result of the instructions is temporarily stored in theAC register. tothe Accumulator Register in **AX** technical terms They alsosay

Memory Data Register (MDR)

This register is one of the most importantCPU ,registersMDR register , <u>CU</u> unit register It is from the processor and contains information that must be stored in the system'sRAM memory or other memories. Also, this register can

contain data obtained byFetch operation or retrieving data from a storage device. TheMDR register is like <u>a buffer</u> It works and contains a copy of the information transferred from theRAM memory during theFetch operation to this register to be processed bythe CPU .

 Note thatthe MDR contains information that has not yet beendecoded by the processor's decoders The .MDR register contains information such as memory addresses that have been written to or read fromRAM . For example, to fetch data from cell 123 (in binary), we load the value 123 (in binary) in theMAR register and perform theFetch operation .

 When thefetch operation is finished, a copy of the data in cell 123 should be written to theMDR register. Or as another example, to store the value 98 (in binary) in cell 4 in the memory, we must load the address of the data stored in cell 4 of theRAM memory in theMAR register and the data of this cell in the MDR register 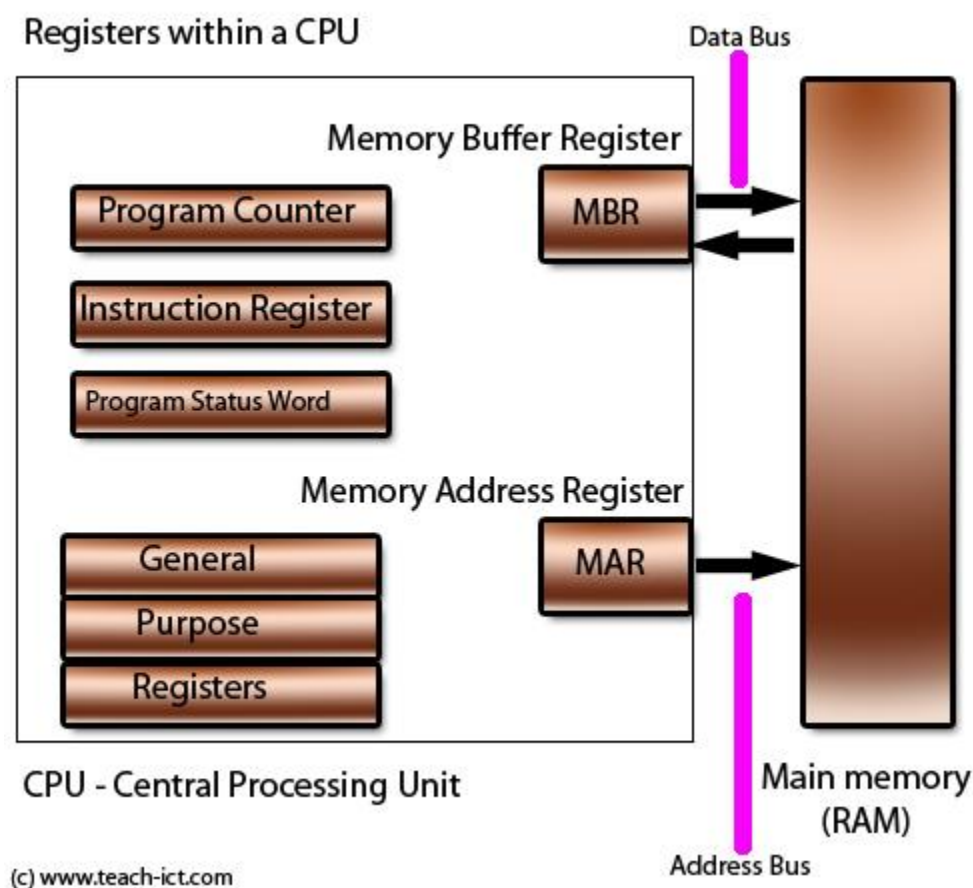and then the storage operation. Let's do the construction. , When theFetch operation is completed, the contents of cell 4 of theRAM memory will be filled with the value 98. TheMDR register is a bi-directional register, which means that data isfetched from the memory and stored in the MDR register which is actually written in one direction in this register. When , an instruction is written, the data must be written in theMDR register and then stored in theRAM memory

. Index Register

This register in the processor keeps numbers or values that can be added or subtracted from part of the address of an instruction to become an effective .and efficient addressIndex Register is often calledBase Register . Index Register in the computer processor is a register that is used to change operand addresses during the execution of a program. tothe Index Register in the technical correction**of BX** They alsosay

• Memory Buffer Register (MBR)

Thisregister stores the contents of data or instructions that are read from memory or written on it. In other words, this register is used to store data or instructions that are called from memory or loaded on it. TheMBR register is the same as theMDR register and they have no difference.

Registers within a CPU

Data Bus

Memory Buffer Register

Program Counter — MBR

Instruction Register

Program Status Word

Memory Address Register

General

Purpose — MAR

Registers

CPU - Central Processing Unit

(c) www.teach-ict.com

Main memory (RAM)

Address Bus

• Data Register

This register is used for temporary storage of data that is read or written from storage devices. toData Register in **DX** technical terms They alsosay
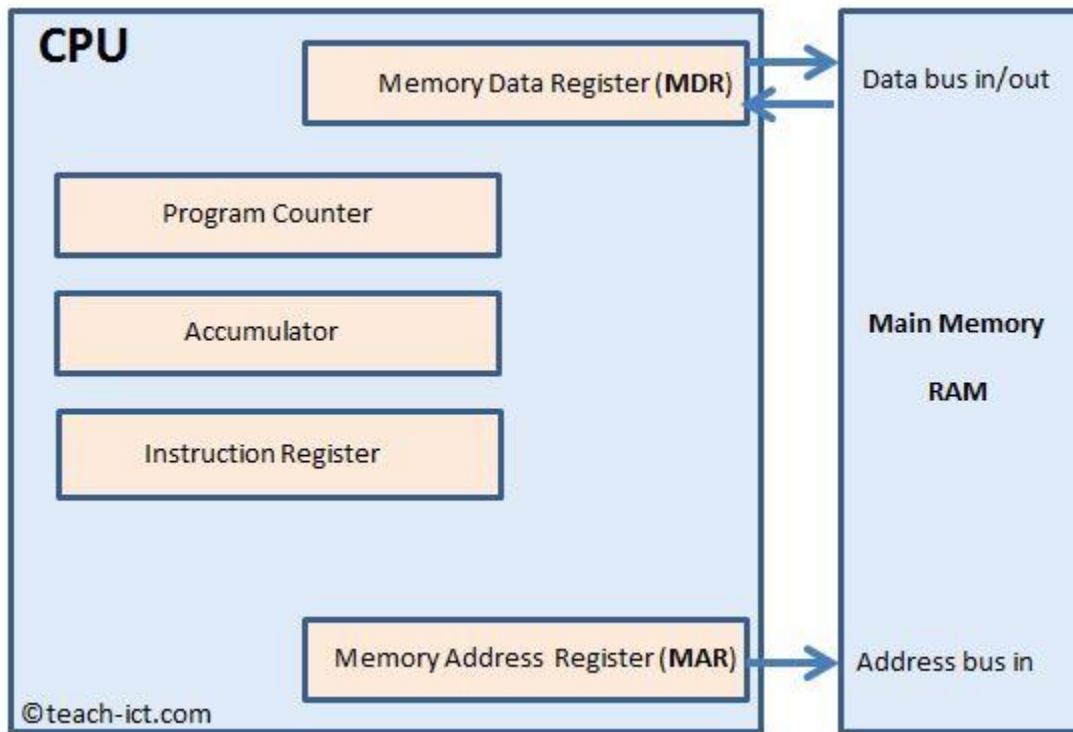
_ _ _ : Below is a list of the most common registers used in a basic computer

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Register	Symbol	Number of bits	Function
Data register	DR	16	Holds memory operand
Address register	AR	12	Holds address for the memory
Accumulator	AC	16	Processor register
Instruction register	IR	16	Holds instruction code
Program counter	PC	12	Holds address of the instruction
Temporary register	TR	16	Holds temporary data
Input register	INPR	8	Carries input character
Output register	OUTR	8	Carries output character

- Registers are part of the computer processor that are used to store and transfer data and instructions at a very high speed.

- Registers are one of the fastest memories of a computer, because the processor stores instructions in registers to perform its processing on instructions and then performs processing on them.

- Registers are generally responsible for 3 tasks, namelyDecode ,Fetch andExecute , in order to process commands :

  o Decode: instructions are translated intocommands to be executed by theALU unit .

  o Fetch: instructions are fetched from systemRAM memory into registers .

  o Execute: Instructions are executed by theALU unit of the processor .

- There are different types of constants, including:

  o Memory Address Register(MAR): Holds the memory addresses of data and instructions.

  o Program Counter (PC) Register: Holds the address of the current instruction.

  o Accumulator(AC): holds the result of the instructions performed by theALU unit of the processor .

  o Memory Data Register(MDR): Holds data that is read from or written to memory.

REGISTERS IN C.A

- o Index register: It holds numbers or values that can be added or subtracted from part of the address of an instruction to become an effective and efficient address.

- o Memory Buffer Register(MBR): Stores the contents of data or instructions that are read from or written to the memory.

- o Data register: holds data that is read or written from storage devices.

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