Von Neumann architecture

Learning objectives:

- describe the interaction of CPU with peripheral devices
- describe the purpose of CPU components, system bus and main memory
- analyze a simple program in assembler

Glossary

Control unit (CU)

Arithmetic Logic Unit (ALU)

Peripheral devices

CPU(central processing unit)

System bus

Registers

Control bus

Data bus

Address bus

Temporary storage

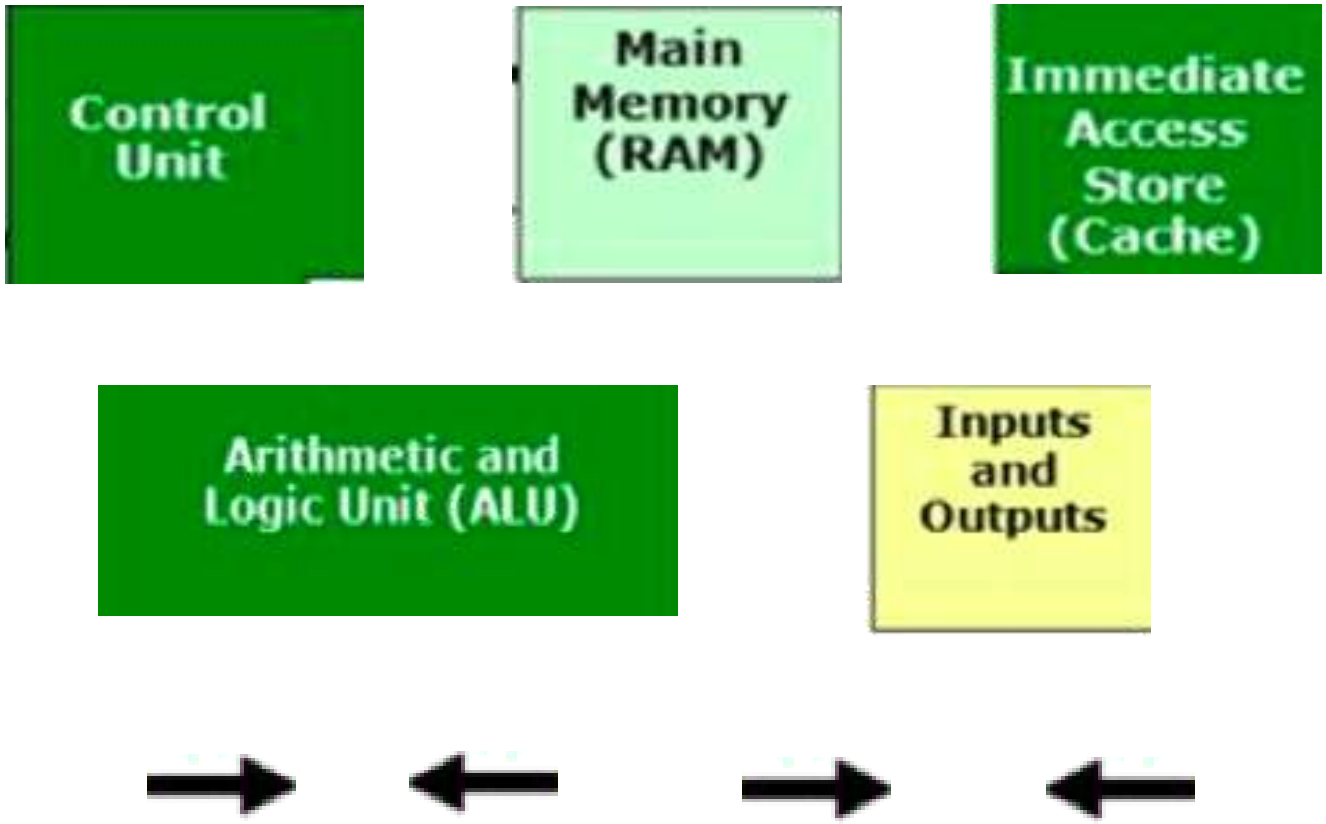
Formative Assessment 1: Watch the video and answer the test questions

http://www.youtube.com/watch?v=5BpgAHBZgec

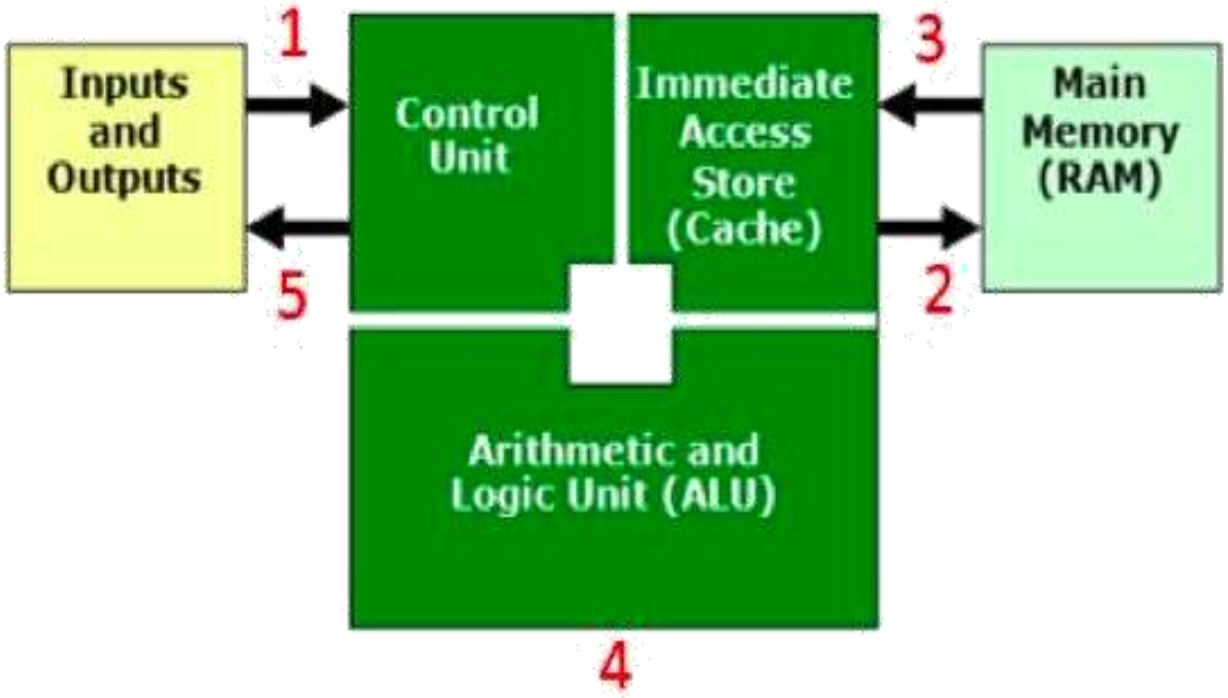
Assessment criteria:

- defines parts of von Neumann architecture
- knows the types of buses

Find the correct order of von Neumann architecture



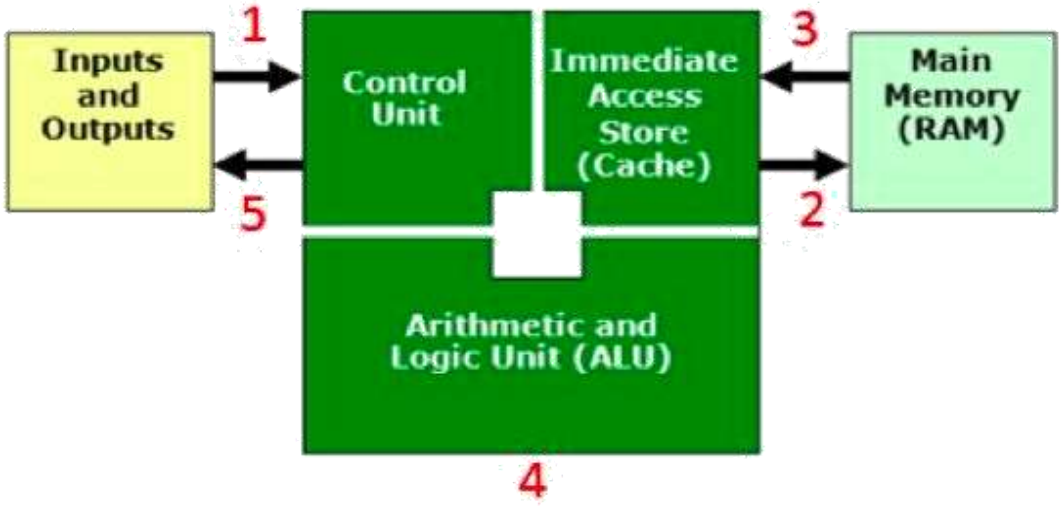
Answer


Inputs and Outputs
1
Control Unit
Immediate Access Store (Cache)
3
Main Memory (RAM)
5
2
Arithmetic and Logic Unit (ALU)
4

Parts of Von Neumann architecture

1. Input Devices
2. Output Devices
3. Memory
4. ALU
5. CU

Find the correct order of work von Neumann architecture



1. _____?
2. _____?
3. _____?
4. _____?
5. _____?

The control device sends the processed data back (for example, to an output device, such as a monitor

The control unit sends this data to the main memory to be executed later.

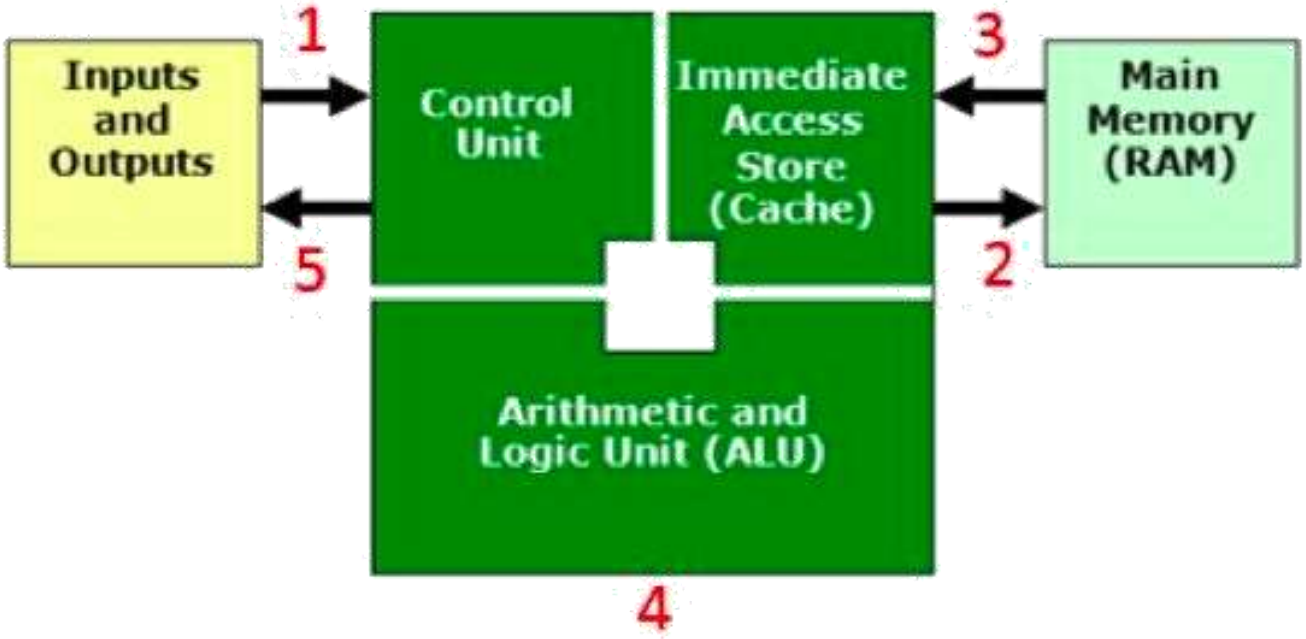
When the time comes, the data will be transported from the main memory to the cache (memory registers)

The input device (eg, the keyboard) sends data to the CPU. The control device receives this data.

Data will be sent to the ALU for processing

Von Neumann architecture

1. The input device (for example keyboard) sends data to the CPU. The control device receives this data.
2. The control unit sends this data to the main memory to be executed later.
3. When the time comes, the data will be transported from the main memory to the cache (memory registers)
4.Data will be sent to the ALU for processing
5. The control device sends the processed data back (for example, to an output device, such as a monitor.



- The black arrows show the flow of data.
- They're called BUSES

Formative Assessment 2: Filling gap

Assessment criteria:

- knows the types of buses
- knows the purpose of the data bus, control bus and address bus
- knows the basic components of a computer
- defines parts of von Neumann architecture
- knows the difference between Ram and ROM

Von Neumann Architecture

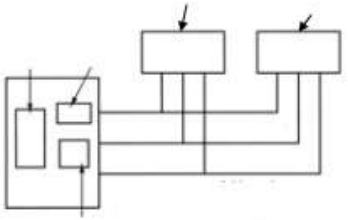
Filling gap **Name**_____

ROM ,executed and controls, a central processing unit (ALU/CU), von Neumann, memory, and input/output (I/O) interfaces, CPU, RAM (random-access memory) ,control unit (CU), registers, program instructions and data, arithmetic logic units (ALU), temporary storage , RAM , RAM control signals , data ,control unit, ALUs, different components, control bus, data bus, address bus, microprocessor , main memory, ROM (read-only memory), I/O interfaces, signals, bus

Computer architecture has undergone incredible changes in the past 20 years, from the number of circuits that can be integrated onto silicon wafers to the degree of sophistication with which different algorithms can be mapped directly to a computer's hardware. One element has remained constant throughout the years, however, and that is the _____concept of computer design. Von Neumann architecture is composed of 5 distinct components (or sub-systems): _____

Figure 2.1 Basic Computer Components

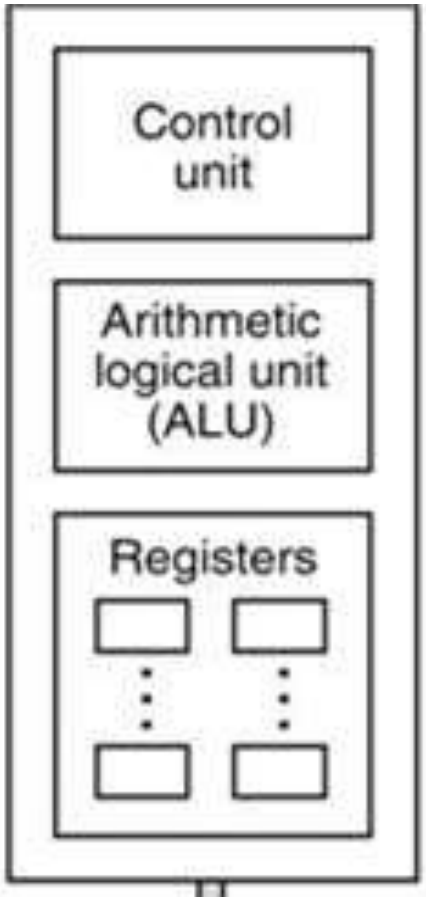
1. The_____, which can be considered the heart of the computing system, includes three main components: the _____one or more_____, and various _____.The _____determines the order in which instructions should be _____the retrieval of the proper operands. It interprets the instructions of the machine. The execution of each instruction is determined by a sequence of _____produced by the control unit. In other words, the control unit governs the flow of information through the system by issuing control signals to_____. Each operation caused by a control signal is called a microoperation (MO). _____perform all mathematical and Boolean operations. The registers are _____locations to quickly store and transfer the data and instructions being used. Because the registers are often on the same chip and directly connected to the CU, the registers have faster access time than _____. Therefore, using registers both as the source of operands and as the destination of results will improve the performance. A CPU that is implemented on a single chip is called a_____.
2. The computer's *memory* is used to store_____. Two of the commonly used type of memories are _____and_____. _____stores the data and general-purpose programs that the machine executes. _____is temporary; that is, its contents can be changed at any time and it is erased when power to the computer is turned off. _____is permanent and is used to store the initial boot up instructions of the machine.



Memory
Control bus
CPU
Data Bus
ALU
Control unit
Registers
I/O interfaces
ALU

CPU

CPU – Central Processing Unit is a brain of computer



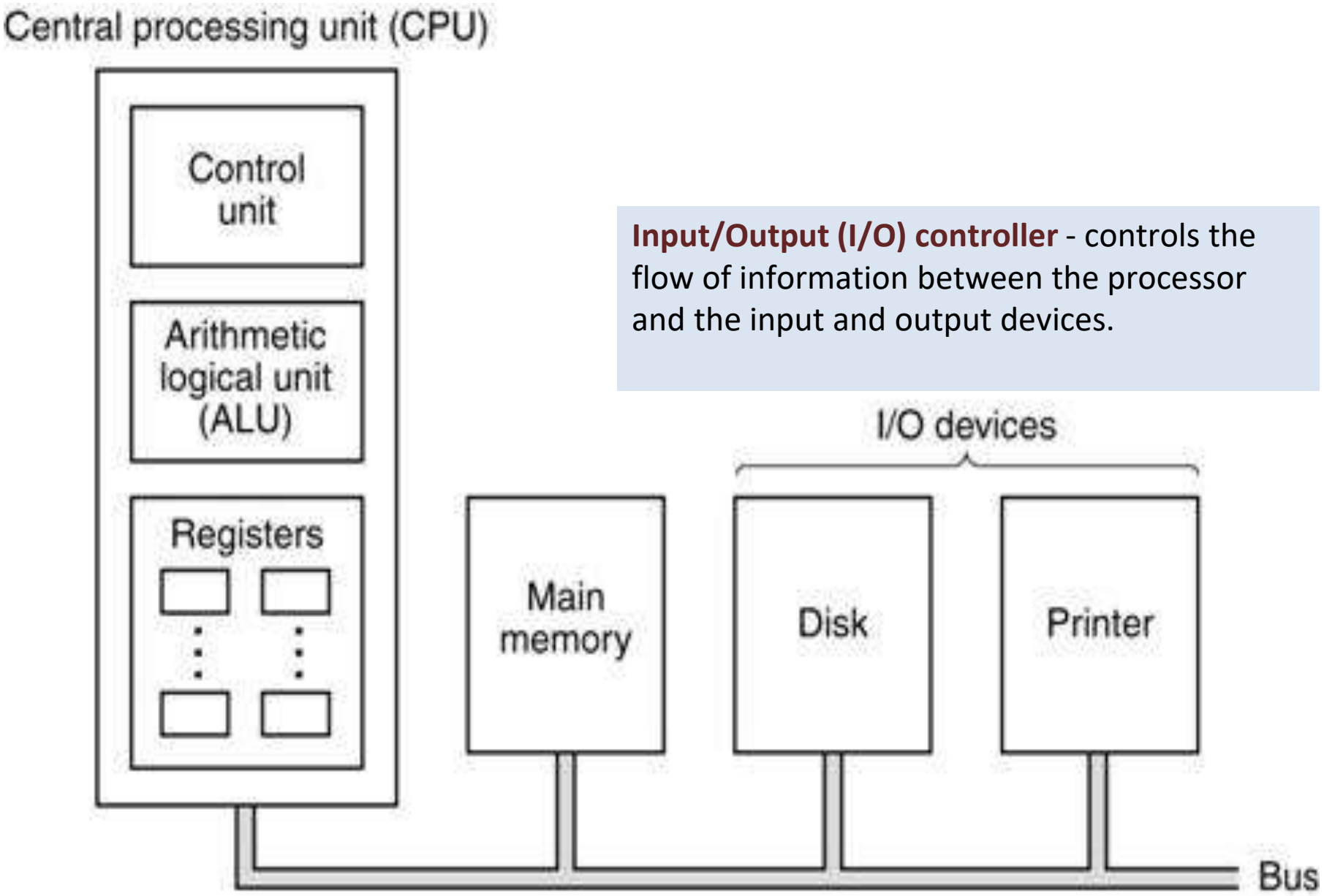
Keywords

CU- part of the processor that manages the execution of instructions.

ALU – part of the processor that processes and manipulates data**.**

Registers- the section of high speed memory within the CPU that stores data to be processed..

ALU – carries out two types operation – arithmetic (+,-,*,/) and logic (AND, OR, NOT, etc).



Input/Output (I/O) controller - controls the flow of information between the processor and the input and output devices.

System bus

- The main bus is the SYSTEM BUS
- The System bus connects the memory, input, output and the motherboard.
- It's actually made up of 3 separate buses, but when we join them together we can just call it the System Bus

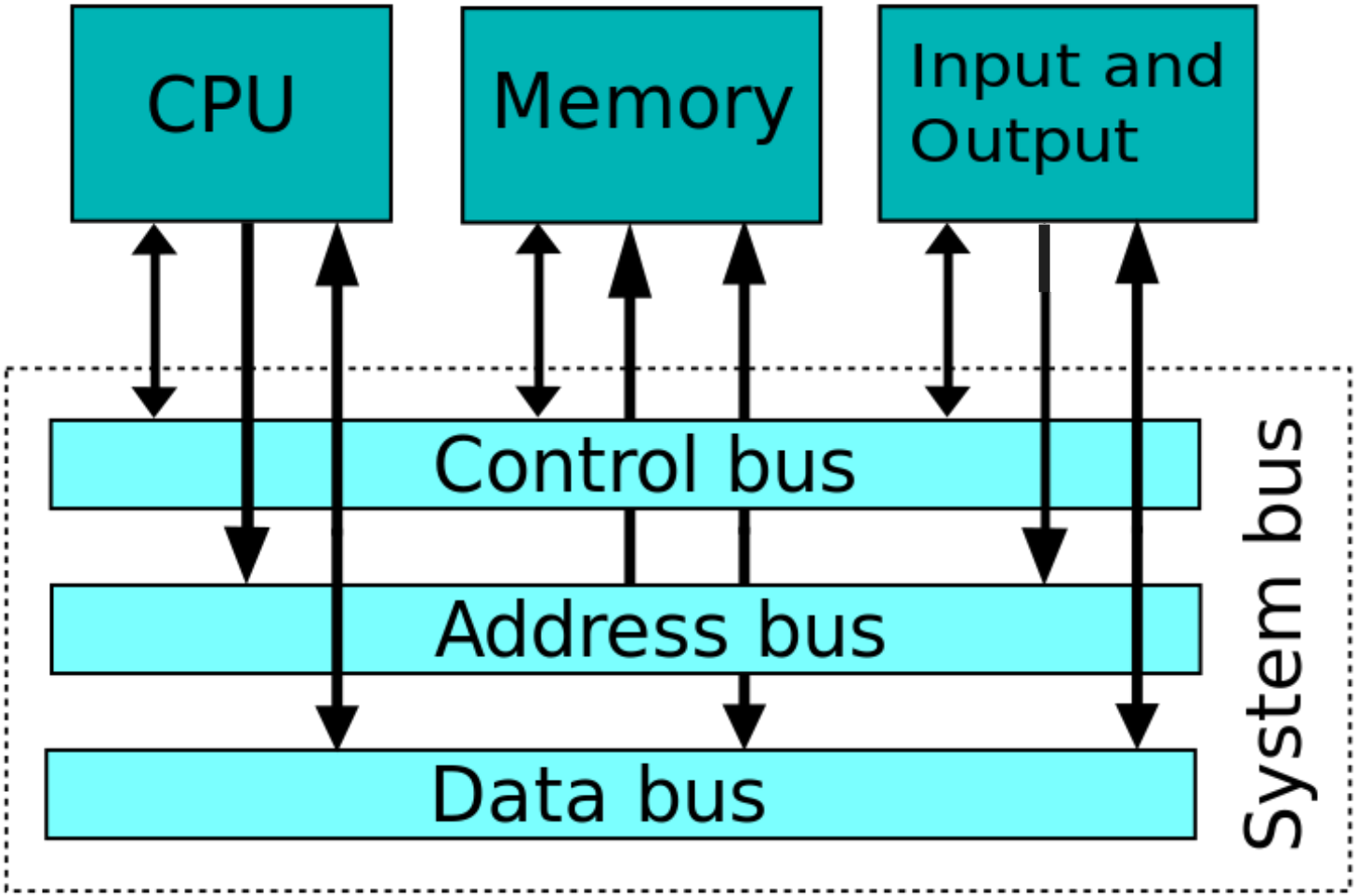
Keyword
System bus (external bus) – the main highway connecting the processor, main memory and I/O controllers;
it is made up of a data bus, an address bus and a control bus.

Keywords

Data bus - Carries data between the processor, the memory unit and the input/output devices

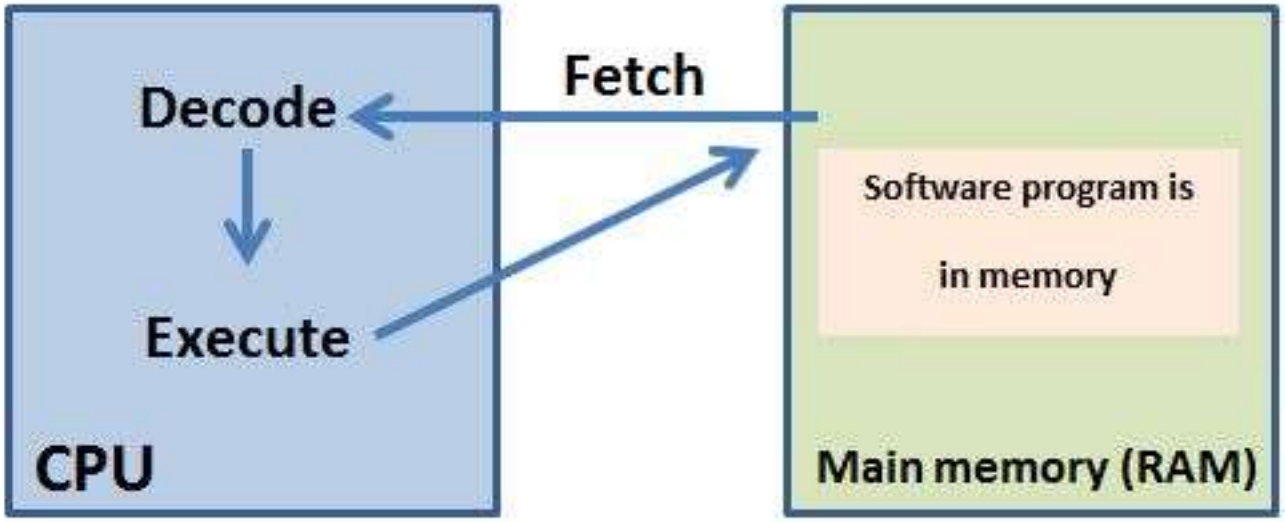
Address bus - Carries the addresses of data (but not the data) between the processor and memory

Control bus - Carries control signals/commands from the CPU (and status signals from other devices) in order to control and coordinate all the activities within the computer



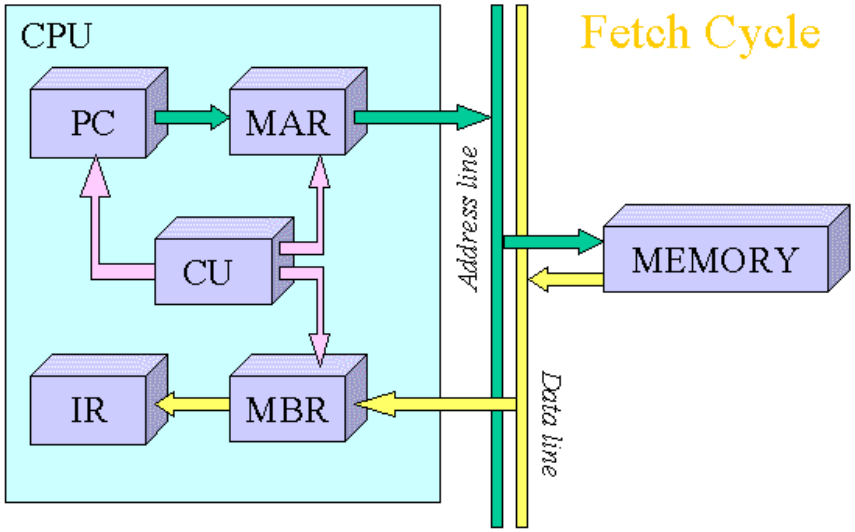
The **fetch execute cycle** is the basic operation (instruction) cycle of a computer (also known as the fetch decode execute cycle).

During the fetch execute cycle, the computer retrieves a program instruction from its memory. It then establishes and carries out the actions that are required for that instruction.



Registers

Registers are high speed storage areas in the CPU. All data must be stored in a register before it can be processed.



MAR	Memory Address Register
MDR/MBR	Memory Data Register
AC	Accumulator
PC	Program Counter
CIR	Current Instruction Register

QQQ

Name three internal components of a processor.

Control Unit

ALU

Registers

Control Unit

AC

I/O controllers

Answer

Name three internal components of a processor.

Control Unit

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QQQ

What is a computer bus?

Part of the processor that processes and manipulates data.

A set of parallel wires connecting independent components of computer system

Answer

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QQQ

What is an I/O controller?

Component which transfers data between the processor and main memory.

Is an electronic circuit than one side connects to the system bus and on the other side connects to an I/O device.

Answer

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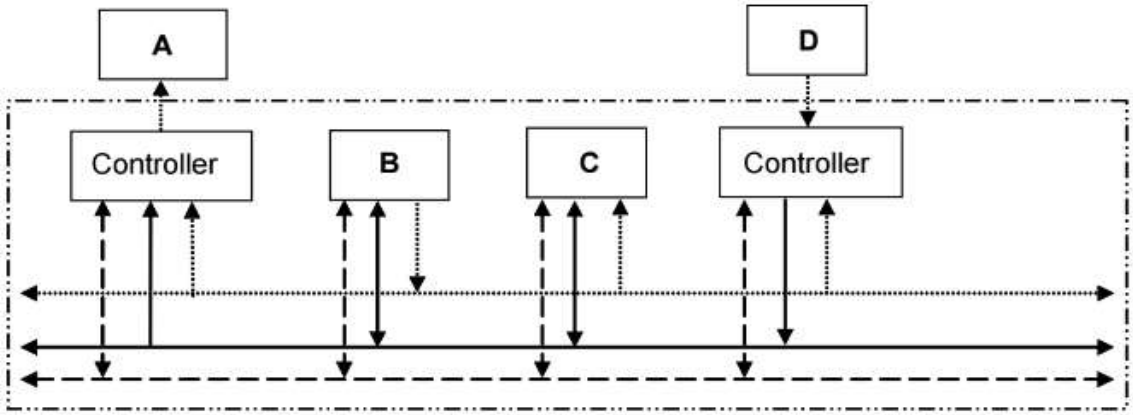
QQQ

The figure below shows how components of a computer system can be connected.

Write in the corresponding space below, the correct name for each of **A**, **B**, **C** and **D** from the figure above using only the following:



A = Visual Display Unit

B = Processor

C = Main Memory

D = Keyboard

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B = Main Memory

C =Processor

D = Visual Display Unit

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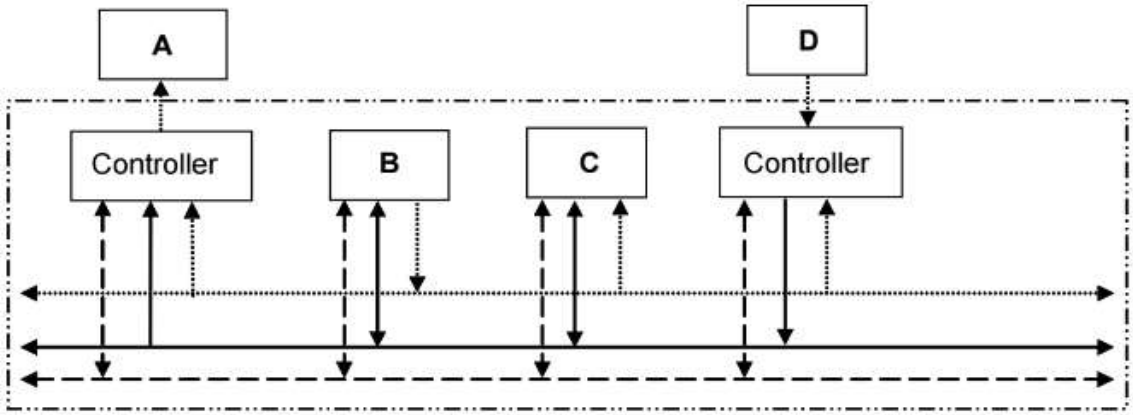

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QQQ

Explain the role of the address bus.

Used to specify a physical address in memory so that the data bus can access it

Stores data and instructions that will be used by the processor

Answer

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QQQ

Explain the role of the data bus.

Part of the motherboard that processes and manipulates data.

Transfers data between the processor and main memory

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QQQ

Explain the role of the cache

The cache is extremely fast memory in the CPU
It stores regularly used data or instructions
The CPU can access data stored in the cache much faster than retrieving it from RAM

The cache carries control signals/commands from the CPU in order to control and coordinate all the activities within the computer

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QQQ

State functions of the Control Unit

- CU manages the execution of instructions
- It chooses through which output device to output information
- It controls the flow of data between the CPU and other parts of computer system (such us memory, i/o devices)

- Part of the processor that processes and manipulates data
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Formative Assessment 3

Revision

- Explain the purpose of ALU.
- System bus includes …
- Name three main parts of processor.
- How data is stored in computer memory?

Reflection

- What knows?
- What remained unclear
- What is necessary to work on