

# The CPU

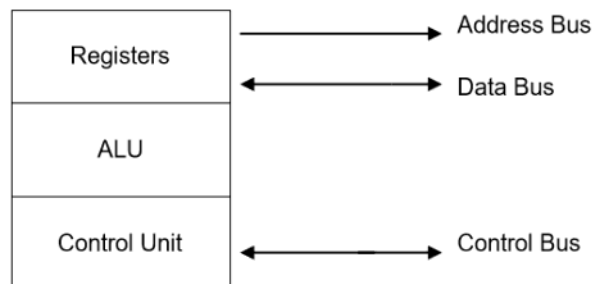
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## The CPU

1. Study this diagram of the Central Processing Unit. Answer the following questions.



- a) What does ALU mean?

Arithmetic Logic Unit

- b) What is a register?

temporary storage area for data or instructions

- c) What does the control unit do?

directs the operations-> makes the computer carry out each instruction of a program in the right order and controls the hardware

2. Listen to Part 1. Check your answers to task 1.

3. Listen again to find the answers to these questions.

- a) What sort of functions does the ALU perform?

performs arithmetic functions such as add and subtract

- b) Name a logic operation performed by the ALU.

and, or and not

- c) Which part of the CPU controls printers?

control unit

- d) What is the difference between registers and main memory?

register: temporary storage that holds data or instructions that are immediately required

main memory: stores data required in the near future

4. Listen to Part 2 and try to answer these questions

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**4. Listen to Part 2 and try to answer these questions.**

a) What is the function of buses?

they carry electrical signals between different parts of the computer

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b) Which buses are bidirectional?

the data bus, the control bus

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c) What kind of information is carried by the data bus?

data and instructions

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d) What does unidirectional mean?

data flows in one way only

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### How the CPU executes program instructions

Let us examine the way the central processing unit, in association with memory, executes a computer program. Many personal computers can execute instructions in less than one-millionth of a second, whereas supercomputers can execute instructions in less than one-billionth of a second.

Before an instruction can be executed, program instructions and data must be placed into memory from an input device or a secondary storage device. The data will probably make a temporary stop in a register. Once the necessary data and instruction are in memory, the central processing unit performs the following four steps for each instruction:

1. The control unit fetches (gets) the instruction from memory.
2. The control unit decodes the instruction (decides what it means) and directs that the necessary data be moved from memory to the arithmetic/logic unit. These first two steps together are called instruction time, or I-time.
3. The arithmetic/logic unit executes the arithmetic or logical instruction. That is, the ALU is given control and performs the actual operation on the data.
4. The arithmetic/logic unit stores the result of this operation in memory or in a register.

Steps 3 and 4 together are called execution time, or E-time. The control unit eventually directs memory to release the result to an output device or a secondary storage device. The combination of I-time and E-time is called the machine cycle.

### 5. Read this text to find the answers to the following question.

- a) What are the *Fetch* and *Decode* steps together called?

instruction time or i-time

- b) Which steps together are called E-time?

alu executes the arithmetic or logical instructions      alu stores results in register or memory

- c) What must be put into memory before an instruction can be executed?

program instructions and data

- d) Where will the data be stored temporarily?

register

- e) Where does the ALU store the results of its operations?

memory, register

- f) What happens to the results eventually?

they are released to an output device or a secondary storagedevice

- g) What is the machine cycle?

combination of i-time and E-time

## THE CPU – Tapescript

### Part 1

The Central Processing Unit, the CPU, has three main parts: the Control Unit, the Arithmetic and Logic Unit, and Registers. These components are connected to the rest of the computer by buses.

The Arithmetic and Logic Unit, ALU for short, performs arithmetic functions such as ADD and SUBTRACT, and logic operations such as AND, OR, and NOT.

The Control Unit makes the computer carry out each instruction of a program in the right order and controls the operation of all hardware, including input and output devices and the other parts of the CPU.

Registers are temporary storage areas for instructions or data. They work under the direction of the control unit. They hold the instructions or data *immediately* required for an operation, whereas main memory stores data required *in the near future*. Registers work at high speed.

### Part 2

A bus is a group of parallel wires which carry electrical signals between different parts of the computer. Some buses are bidirectional. They allow data to flow in either direction. Most computers have three main buses: the data bus, the address bus, and the control bus.

The data bus is a bidirectional bus. It carries data and instructions from the memory to the CPU and from the CPU to memory.

The address bus is a unidirectional bus. Data flows one way only. It carries addresses from the processor to memory. The addresses identify places in the memory where data or instructions may be found or stored.

The control bus is bidirectional. It carries instructions to and from the CPU and other parts of the computer. It's a collection of lines which carry different signals. For example, the clock line carries a signal from the clock chip to synchronize the operations of the processor.