

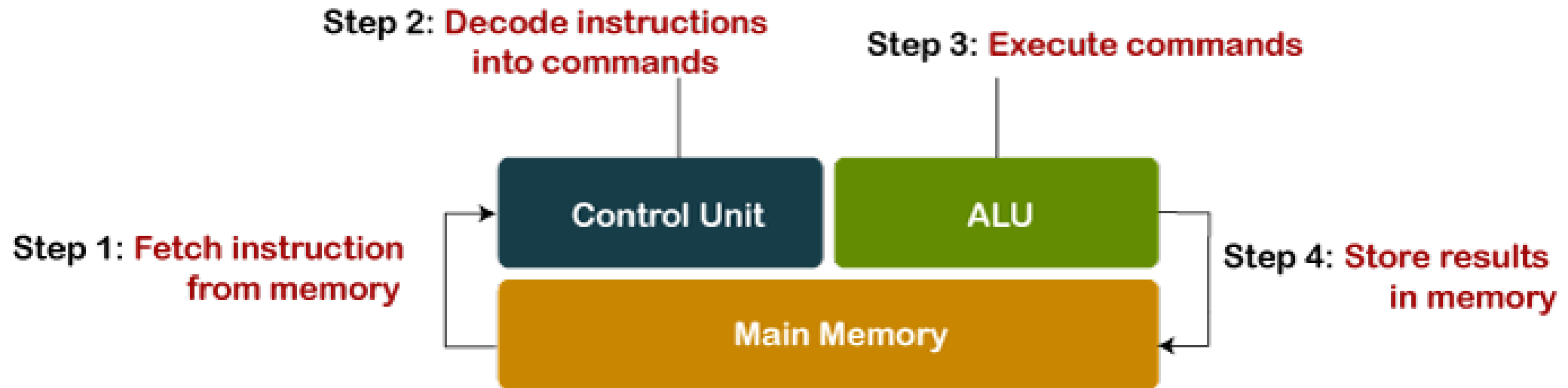
ALU (Arithmetic Logic Unit)

Lecturer Dalia adil

What is ALU (Arithmetic Logic Unit)?

- ▶ ALU is a main component of the central processing unit, which stands for arithmetic logic unit and performs arithmetic and logic operations.
- ▶ It is also known as an integer unit (IU) that is an integrated circuit within a CPU, which is the last component to perform calculations in the processor.
- ▶ It has the ability to perform all processes related to arithmetic and logic operations such as addition, subtraction, and shifting operations, including Boolean comparisons (XOR, OR, AND, and NOT operations)
- ▶ The arithmetic logic unit is split into AU (arithmetic unit) and LU (logic unit).
- ▶ When the ALU completes the processing of input, the information is sent to the computer's memory.

Machine Cycle




The operations performed by ALU are:

- ▶ **Logical Operations:** The logical operations consist of NOR, NOT, AND, NAND, OR, XOR, and more.
- ▶ **Bit-Shifting Operations:** It is responsible for displacement in the locations of the bits to the by right or left by a certain number of places that are known as a **multiplication** operation.
- ▶ **Arithmetic Operations:** Although it performs multiplication and division, this refers to bit addition and subtraction. But multiplication and division operations are more costly to make. In the place of multiplication, addition can be used as a substitute and subtraction for division.

Configurations of the ALU

The description of how ALU interacts with the processor is given below. Every arithmetic logic unit includes the following configurations:

- ▶ Instruction Set Architecture
 - ▶ Accumulator
 - ▶ Stack
 - ▶ Register to Register
 - ▶ Register Stack
 - ▶ Register Memory
- 

Advantages of ALU

ALU has various advantages, which are as follows:

- ▶ It supports parallel architecture and applications with high performance.
- ▶ It has the capability of performing instructions on a very large set and has a high range of accuracy.
- ▶ Two arithmetic operations in the same code like addition and multiplication or addition and subtraction, or any two operands can be combined by the ALU. For case, $A+B*C$.
- ▶ In general, it is very fast; hence, it provides results quickly.
- ▶ There are no sensitivity issues and no memory wastage with ALU.
- ▶ They are less expensive and minimize the logic gate requirements.

Disadvantages of ALU

The disadvantages of ALU are discussed below:

- ▶ With the ALU, floating variables have more delays, and the designed controller is not easy to understand.
 - ▶ The bugs would occur in our result if memory space were definite.
 - ▶ It is difficult to understand amateurs as their circuit is complex; also, the concept of pipelining is complex to understand.
 - ▶ A proven disadvantage of ALU is that there are irregularities in latencies.
 - ▶ Another demerit is rounding off, which impacts accuracy.
- 