

Control Unit Organization

This presentation covers the organization of control units in computer architecture, detailing instruction types, micro instruction formats, fetch and execution cycles, and the differences between hardwired and micro-programmed control units, along with computer arithmetic operations.



Basic Concept of Instruction

Definition of Instruction

An instruction is a binary coded operation that a computer can execute.

Instruction Types

Instructions can be classified into various types like data transfer and arithmetic operations.

Micro Instruction Formats

Micro instructions define specific operations at a finer level than machine instructions.

Fetch and Execution Cycle

The fetch and execution cycle is a fundamental process in computers that allows for the continuous execution of instructions and effective data processing.

Fetch Cycle

The fetch cycle retrieves an instruction from memory.

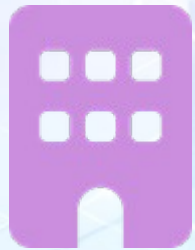
Execution Cycle

During the execution cycle, the control unit interprets the fetched instruction.

Cycle Repetition

The fetch and execution cycle is repeated continuously.

Hardwired Control Unit



Architecture

A hardwired control unit uses fixed logic circuits to generate control signals, leading to faster operation but less flexibility in design and modification.



Signal Generation

Control signals are generated through combinational logic, which directly maps input states (instructions) to output signals (control actions).



Limitations

While hardwired control units are efficient, they lack the adaptability of programmable units, making them less suitable for complex instruction sets.

Micro-programmed Control Unit



Microprogram Sequencer

Uses a sequence of micro instructions stored in memory to control the execution of machine instructions.



Control Memory

Utilizes control memory to store micro instructions, allowing modification or expansion of instruction sets.



Sequencing and Execution

Execution of micro instructions occurs in a sequence dictated by the microprogram sequencer.

Computer Arithmetic: Addition and Subtraction

Binary Addition

Adding binary numbers using carry bits for sums greater than one.

Two's Complement Representation

Simplifies signed arithmetic allowing direct addition and subtraction.

Signed Addition and Subtraction

Uses two's complement for addition and subtraction.



Multiplication and Division



Binary Multiplication

Involves shifting and adding partial products.



Booth's Algorithm

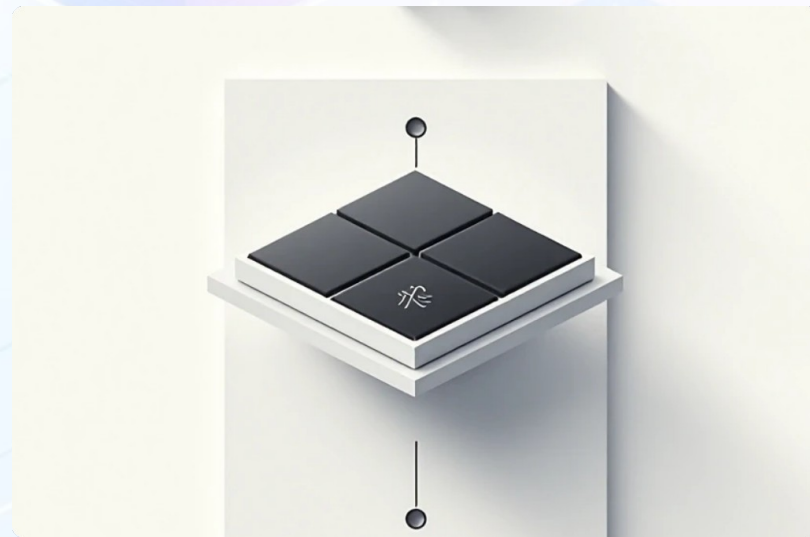
Efficiently reduces required additions.



Division Operations

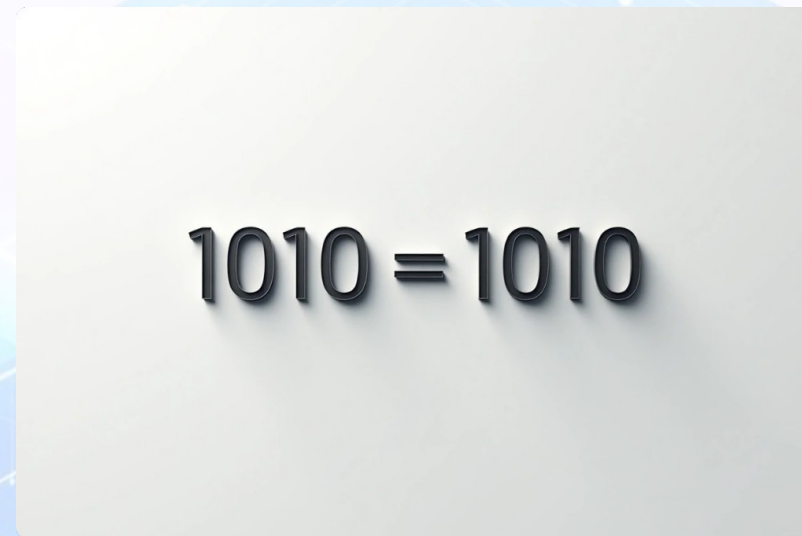
Utilizes shift-and-subtract methods.

Conclusion of Control Unit and Arithmetic Operations



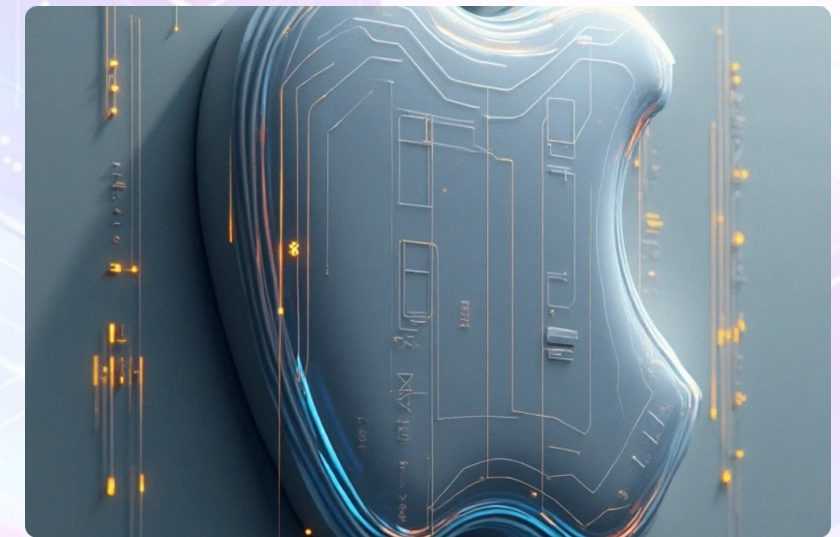
Control Unit Importance

Understanding the organization and functioning of control units is crucial for grasping computer architecture and instruction execution.



Arithmetic Operations

Mastery of binary arithmetic is essential for efficient programming and hardware design, impacting overall system performance.



Future Directions

Continued advancements in control unit design and arithmetic algorithms will enhance the efficiency and capability of future computing systems.