

Digital Systems & Circuits

Study Guide

Digital Systems & Boolean Algebra

Q.1 What are digital systems?

Digital systems are the basis of the present-day electronics and computing. They process digital data in the form of '0' and '1'.

Q.2 What do you know about Analog systems?

Analog signals are continuous time-varying signals.

Q.3 How is ADC processed?

ADC (Analog to Digital Converter) is the process of converting continuous signals into discrete signals that can be processed by digital devices, for example, computers and smartphones.

Q.4 How is DAC processed?

DAC (Digital to Analog Converter) converts the digital signal back to the analog signal.

Q.5 Define Digital Logic.

Digital logic is the basis of all digital systems. This is the technique we use to process digital information in the form of binary numbers.

Q.6 What is Boolean Algebra?

Boolean algebra is a sub-discipline of mathematics based on operations involving binary variables.

Q.7 What do you know about AND Operation?

In the case of an AND operation, the output is 1 only when both input values are 1. Otherwise, the output is 0.

Q.8 What do you know about OR Operation?

In an OR gate, the result is 0 only when both the input values are 0. Otherwise, the output is 1.

Q.9 What do you know about NOT Operation?

The NOT operation is the simplest logical operation in Boolean algebra, which accepts a single binary input and gives its opposite as the output.

A	NOT (A)
0	1
1	0

Q.10 What are Boolean Functions?

Boolean functions are mathematical expressions that represent logical operations involving binary variables. Example: AND, OR, NOT.

Q.11 What are the basic logic gates and their truth tables?

- **AND Gate:** Outputs 1 when all inputs are 1.
- **OR Gate:** Returns 1 if at least one input is 1.
- **NOT Gate:** Returns the complement of the input.

These basic gates serve as the foundation for NAND, NOR, XOR, and XNOR gates.

Digital Circuits & Advanced Concepts

Q.12 What is the crucial element of a digital circuit?

A crucial element of digital circuit design is the logical diagram, which represents the structure of the circuit by showing connections between logic gates.

Q.13 Why do we use adder circuits?

Adder circuits are widely used in digital electronic systems with the principal application in arithmetic operations.

Q.14 Differentiate between Half and Full adder.

- A **half-adder** is a digital circuit used to compute the addition of two single-bit binary numbers.
- A **full-adder** is a more complex circuit that adds three single-bit numbers: two main bits and a carry bit from a previous addition.

Q.15 Define K-map.

A Karnaugh map (K-map) is a graphic aid that is employed in the simplification of Boolean expressions and minimizing logic functions without the use of complex algebraic operations.

Q.16 What is a multiplexer, and how does it work in digital circuits?

A multiplexer (MUX) chooses one of many input signals and sends it to the output based on control signals.

Q.17 Explain the word 'propagation delay' in terms of digital logic gates.

Propagation delay is the time it takes for an input change to result in an output change in a logic gate. It influences the overall performance of digital circuits.

Q.18 What do you know about minterm?

In Boolean algebra, a minterm is a particular product term whereby every variable of the function is present in either its true form or its complement. Each minterm corresponds to one and only one set of variable values that makes the Boolean function equal to true or 1.

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