



Digital Logic Design

CHAPTER – I

Introduction to Digital Logic Design

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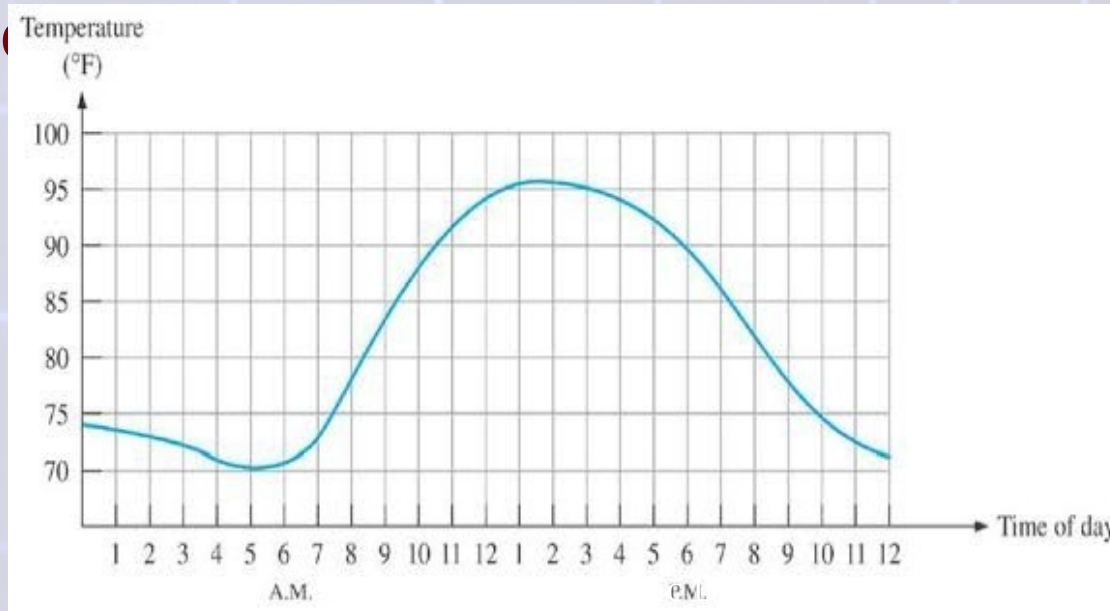
Introduction

- In today's world, the term “Digital” has become part of our everyday vocabulary because of the dramatic way that the digital circuits and digital techniques have become so widely used in almost all areas of our life:
 - Automation
 - Robots and so on
- Generally digital circuits are favorable in speed, ease of design, Programmability, flexibility and functionality.



Digital and Analog Quantity

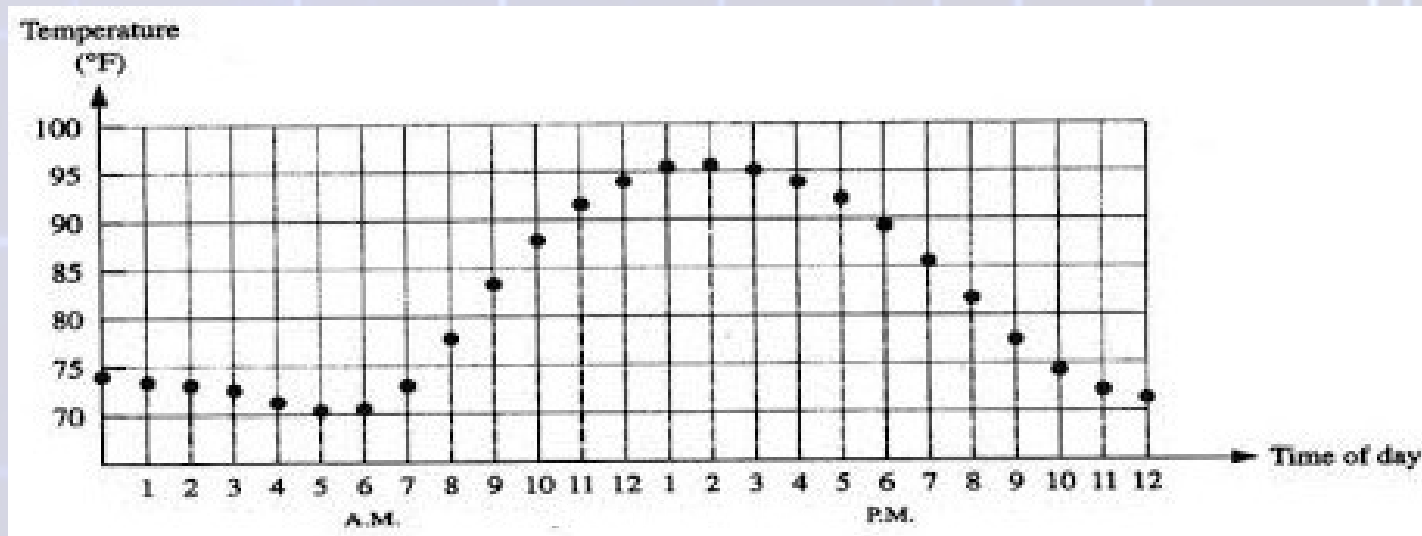
- Analog Quantity:
 - The quantity that has **continuous** values is called as the analog quantity.
 - Example of analog quantity are:
 - Time, Temperature, Pressure, Distance and Speed





Digital and Analog Quantity

- Digital Quantity:
 - The quantity that has a **discrete** set of values is called as the digital quantity.
 - Digital system will take information at certain defined times and display it in the form digits and symbols on some display.





Advantage of Digital over Analog

- Digital data can be processed and transmitted more efficiently and reliably than analog.
- It can store huge amount of data in lesser space and with least chance of error.
- Noise does not affect digital data as compare to analog signals.



Binary Digit, Logic Level and Digital Waveform.



Binary Digit

- Digital electronics involves circuits and system in which there are two types possible states.
- These states are represented by two different voltage levels: **HIGH** and **LOW**.
- In digital systems such as computers, two states called **digital** are used to represent symbols, alphabetic character and other types of information.
- The two-state number system is called **binary** and its two digit are called **Binary Digit: 0 and 1**.



Binary Digit

- Each of the Binary digit, 0 and 1, is called **bit**.

In digital circuits, two different voltage levels are used to represent the two bits.

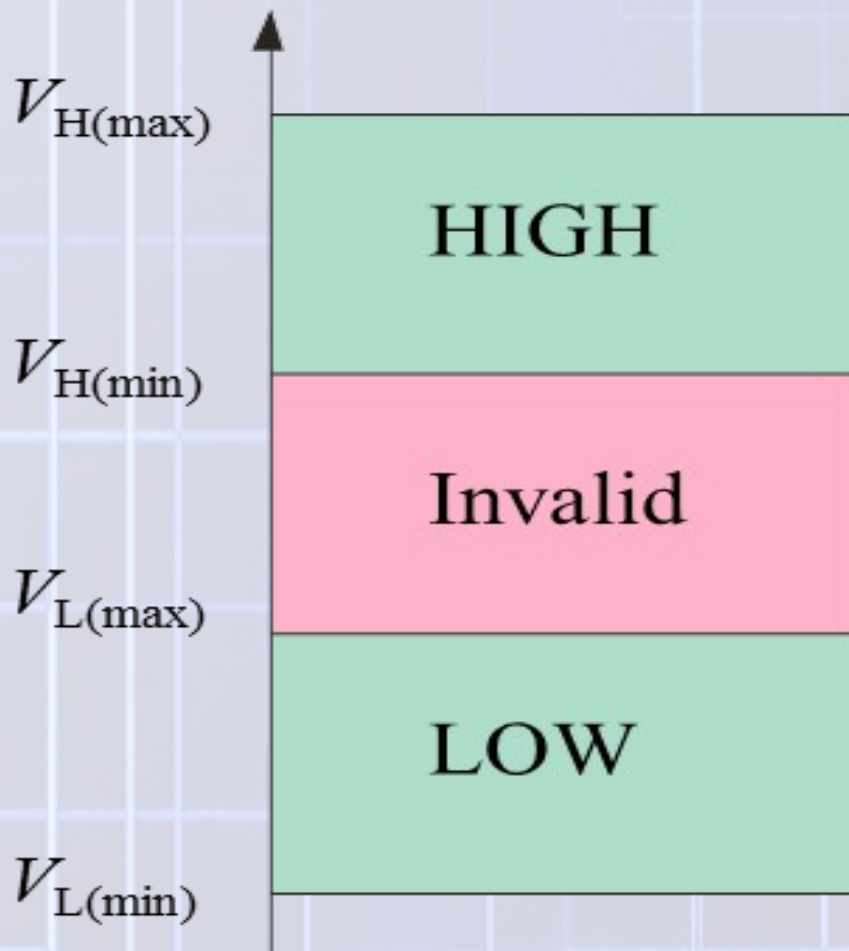
- Generally;
 - 1 is represented by the higher voltage (**HIGH**) and
 - 0 is represented by the lower voltage (**LOW**).



Logic Levels

- The voltage used to represent a 1 and 0 are **logic levels**.
- Ideally, one voltage level represents a HIGH and another voltage level represents a LOW.
- In a practical digital circuit, however, a HIGH can ~~voltage~~ **range** between a specified minimum value and specified maximum value. Likewise for a LOW voltage levels.
- There can be no overlap between the accepted range of HIGH levels and the accepted range of LOW levels.

Logic Levels



- The voltage values between $V_{H(min)}$ and $V_{L(max)}$ are **unacceptable** for proper operation.

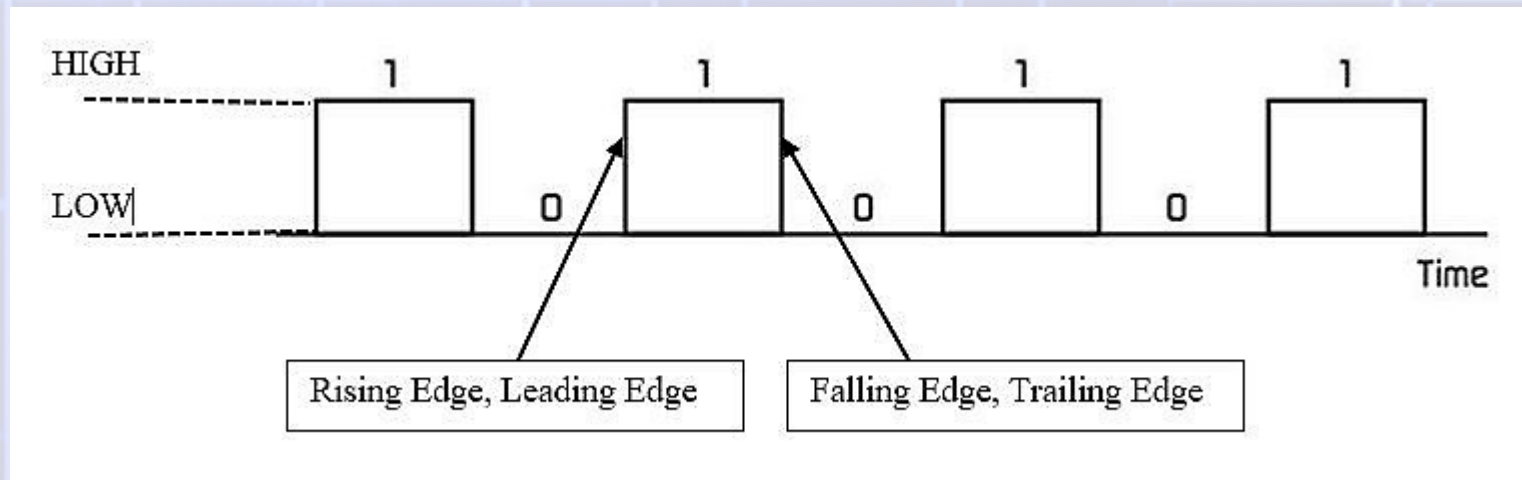
- The voltage values between $V_{H(max)}$ and $V_{H(min)}$ are **HIGH**.

- The voltage values between $V_{L(max)}$ and $V_{L(min)}$ are **LOW**.

Digital Waveform

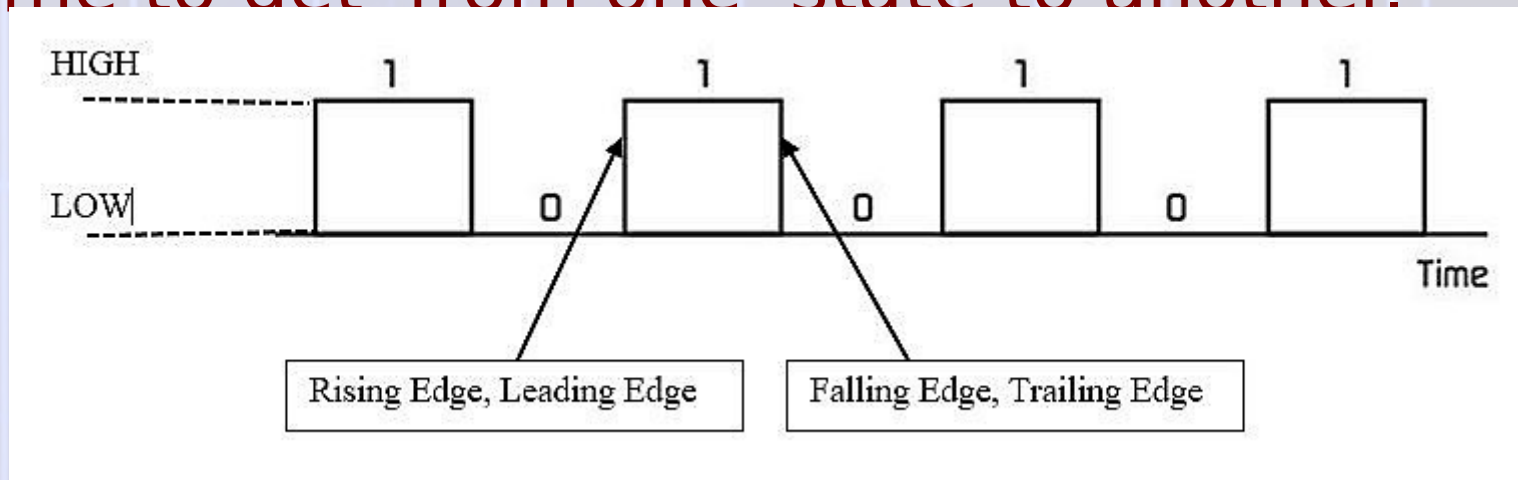
- Digital waveforms consists of voltage levels that are changing back and forth between the HIGH and LOW levels or states.

usually, digital waveforms are represented as relative to time.

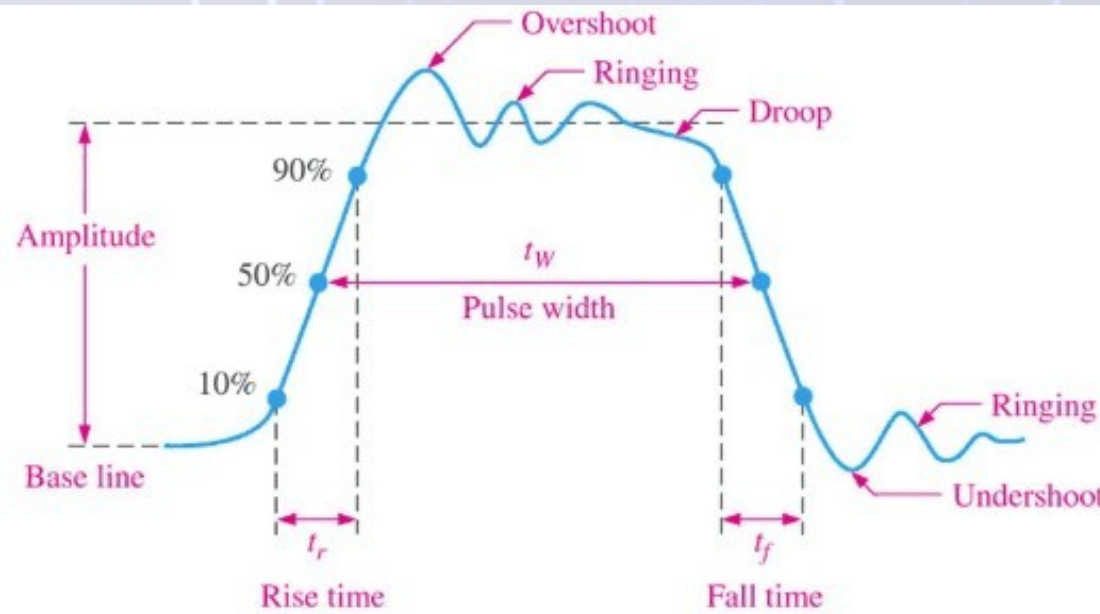


Digital Waveform

- Pulse have two edge:
 - A leading edge where pulse goes to HIGH from LOW state and falling edge where pulse revert
 - Sudden transition from one state to other is **impractical**. Depending on practical consideration it will take small amount of time to get from one state to another.



Digital Waveform



- Important terms
 - Rise Time
 - Fall Time
 - Amplitude
 - Pulse Width

fig.1.3: practical signal representation of a pulse.

Rise Time → time required for pulse to go from LOW level to HIGH.

Amplitude → the maximum value of a digital waveform to reach HIGH level.

Pulse Width → the time gap between the raising edge and falling edge.



Digital Logic Design

- Digital logic design is a system in electrical and computer engineering that uses simple number value to produce input and output operations.
- Digital logics are rooted in binary code.
- This system facilitates the design of electronic circuits, including logic gates with functions that include AND, OR and NOT commands.
- The value system translates input signals into specific output. These functions facilitate computing, robotics, and other electronics applications.