Lecture 1

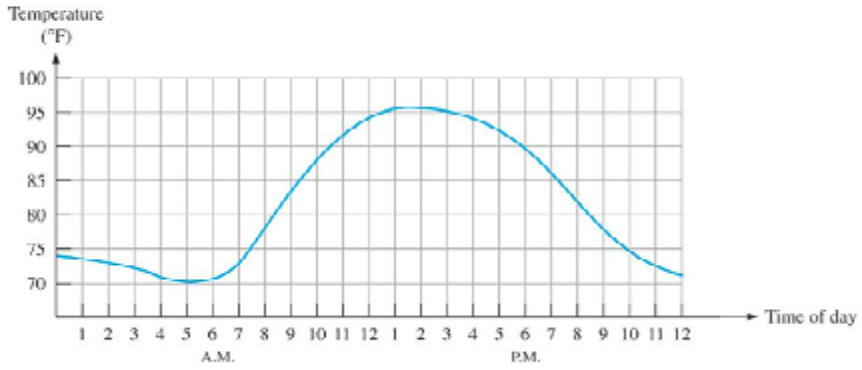
Basics

Electronic circuits can be divided into two broad categories: digital and analog. ***Digital electronics*** involves quantities with discrete values and ***Analog electronics*** involves quantities with continuous values.

An analog quantity is one having continuous values. A digital quantity is one having a discrete set of values.

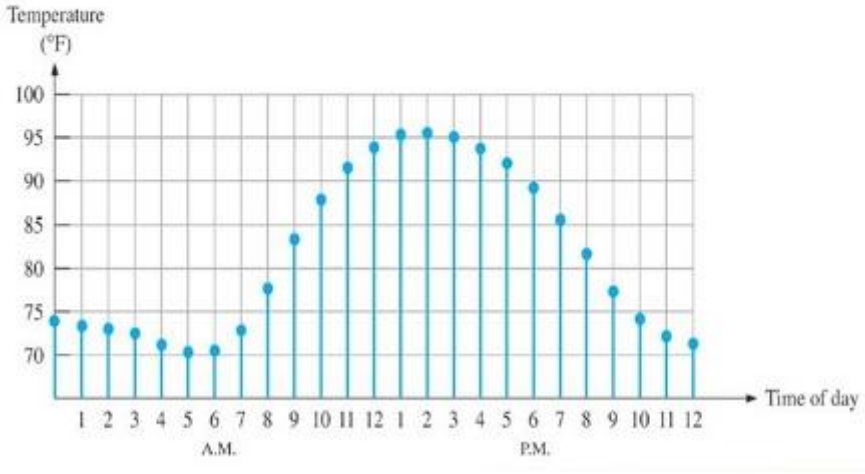
For example, the air temperature changes over a continuous range of values. During a given day, the temperature does not go from say 70 degree to 71 degree instantaneously, it takes on all the infinite values in between. Other examples of analog quantities are time, pressure, distance, sound.

Graph of an analog quantity (temperature versus time).



Rather than graphing the temperature on a continuous basis, suppose just take a temperature reading every hour. Now you have sampled values representing the temperature at discrete points in time (every hour) over a 24 hour period. You have effectively converted an analog quantity to a form that can now be digitized by representing each sampled value by a digital code.

Graph of an analog quantity (temperature versus time).



The term *'digital'* is derived from the way computers perform operations, by computing digits.

The digital advantage:

- Digital data can be processed and transmitted more efficiently and reliably than analog data.
- Can be stored more compactly and reproduced with greater accuracy and clarity.
- Can be programmed, less effected by noise.

The components used to construct digital systems are manufactured in *Integrated Circuit (IC)* form. Integrated Circuits contain a large amount of interconnected digital circuits within a single small package. Medium Scale Integration (MSI) devices provide digital functions and Large Scale Integration (LSI) devices provide complete computer modules.

Digital logic is concerned with the interconnection among digital components and modules and is a term used to denote the design and analysis of digital systems.

Characteristic of a digital system is its manipulation of discrete elements of information.

Digital electronics involves circuits and systems in which there are only **two** possible states. These states are represented by two different voltage levels: A **HIGH** and a **LOW**. The two states can also be represented by current levels: open and closed switches turned ON and OFF.

In digital systems such as computers, combinations of the two states called *codes* are used to represent numbers, symbols, alphabetic characters and other types of information.

The two state number system is called **binary**, and its two digits are 0 and 1. A binary digit is called a **bit.**

In digital circuits, two different voltage levels are used to represent the two bits. Generally, 1 is represented by the higher voltage, which we will refer to as a HIGH and a 0 is represented by the lower voltage level, which we will refer to as a LOW.

HIGH =1 and LOW =0.

Logic Levels: The voltages used to represent a 1 and a 0 are called logic levels. Ideally, one voltage level represents a HIGH and another voltage level represents a LOW. In practical design circuit, HIGH (2-5 V) and LOW (0-0.8 V).

SELF STUDY:

Number Systems:

- Binary, Octal, Decimal, Hexadecimal.
- Conversion.
- Operation: Addition, Subtraction, Multiplication.
- 1’s complement, 2’s complement.