CSE 231
DIGITAL LOGIC DESIGN

DR. S. M. MAHFUZ ALAM

ASSOCIATE PROFESSOR (ADJUNCT)

DEPARTMENT OF ECE

NORTHSOUTH UNIVERSITY

- TEXT BOOKS:

1. R. J. Tocci, N. S. Widmer & G. L. Moss, 2007, Digital System: Principles and Applications, 10th Ed., Pearson Education, ISBN 13: 978-1-292-16200-3
2. M Morris Mano & M D Ciletti, 2012, Digital Design, 5th Ed., Pearson Education, ISBN-13: 978-0-13-277420-8

- REFERENCE BOOK:

3. T. L. Floyd, 2018, Digital Fundamentals, 11th Ed., Pearson Education, ISBN: 978-93-325-8460-0

- DECLARATION:

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ANALOG AND DIGITAL SIGNAL

- ANALOG SIGNAL:
- In analog signal, quantity is represented by a continuously variable, proportional indicator [1].
- Analog signal can vary over a range of values.

Example:

- Analog speed meter in automobile.
- Analog thermometer.

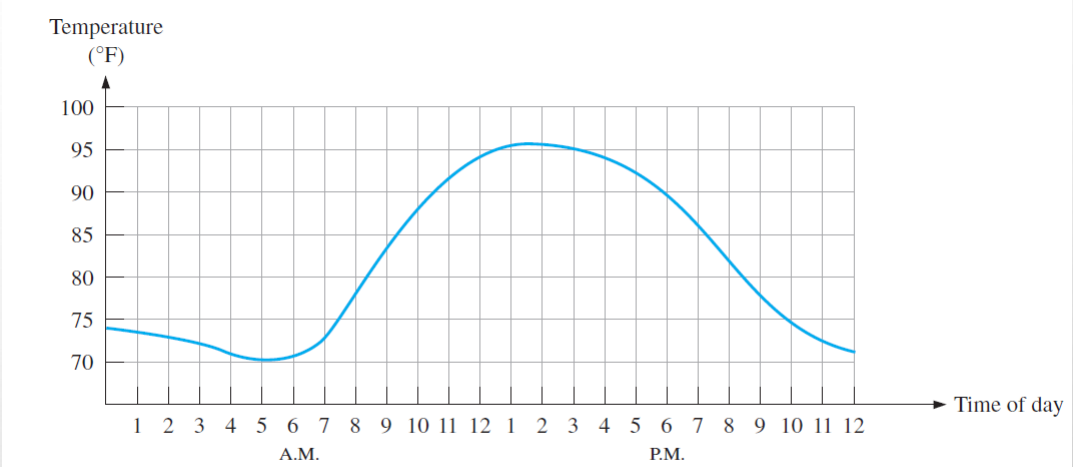

FIGURE 1–1 Graph of an analog quantity (temperature versus time).

Ref: (3), Page 16

- SIGNIFICANCE:
- All the real-life signals are analog signals.

ANALOG AND DIGITAL SIGNAL

- ANALOG SYSTEM:
- The system that performs operation on analog signals.

Example:

- Public address system

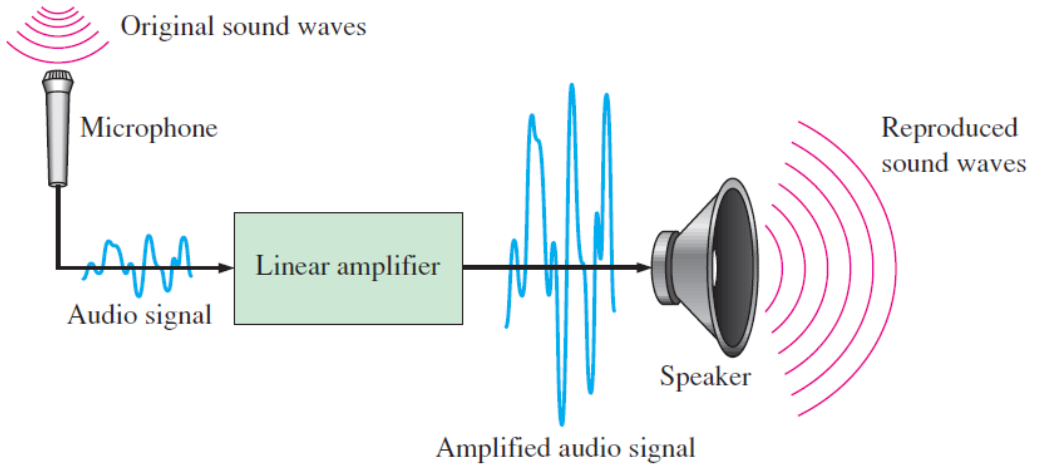

FIGURE 1–3 A basic audio public address system.

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ANALOG AND DIGITAL SIGNAL

- <u>DIGITAL SIGNAL:</u>
- In digital signal, quantity is represented by specific number of digits [1].
- Digital signal can vary by step/steps.

Example:

- Digital thermometer.
- Fuel indicator at gas station.

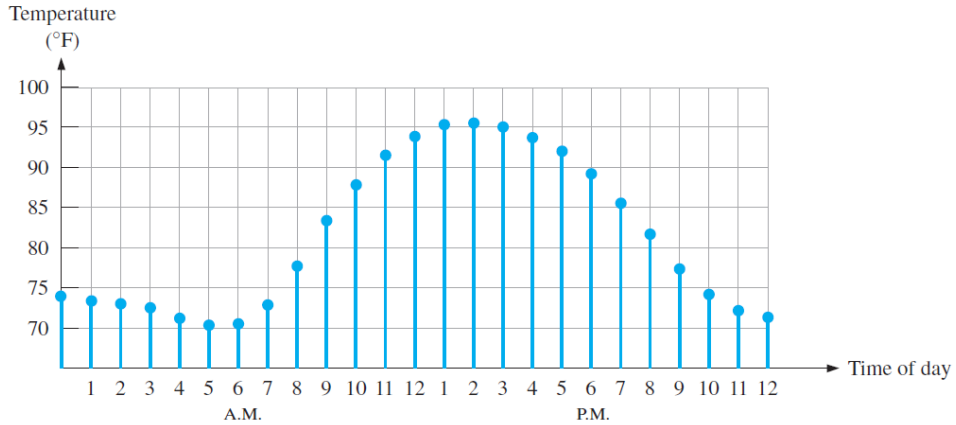

FIGURE 1–2 Sampled-value representation (quantization) of the analog quantity in Figure 1–1. Each value represented by a dot can be digitized by representing it as a digital code that consists of a series of 1s and 0s.

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ANALOG AND DIGITAL SIGNAL

- BRAIN STORMING:

EXAMPLE 1-1

Which of the following involve analog quantities and which involve digital quantities?

(a) Elevation using a ladder
(b) Elevation using a ramp
(c) Current flowing from an electrical outlet through a motor
(d) Height of a child measured by a yard stick ruler
(e) Height of a child measured by putting a mark on the wall
(f) Amount of rocks in a bucket
(g) Amount of sand in a bucket
(h) Volume of water in a bucket

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ANALOG AND DIGITAL SIGNAL

- <u>ADVANTAGES OF DIGITAL TECHNIQUE:</u>
  - Digital circuits are easier to design
  - Information storage is easy.
  - Accuracy and precision are easier to maintain throughout the system.
  - Operations can be programmed.
  - Digital circuits are less affected by noise.
  - More digital circuitry can be fabricated on IC chips.

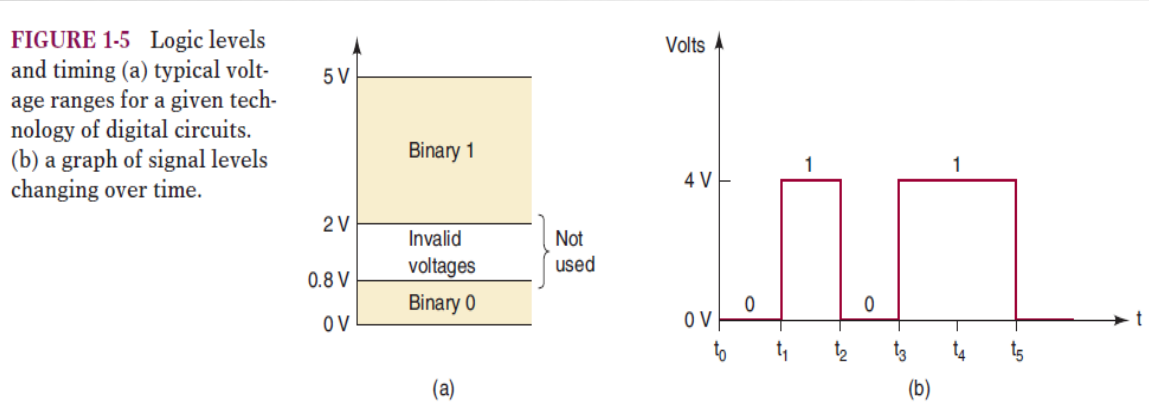

FIGURE 1-5 Logic levels and timing (a) typical voltage ranges for a given technology of digital circuits. (b) a graph of signal levels changing over time.

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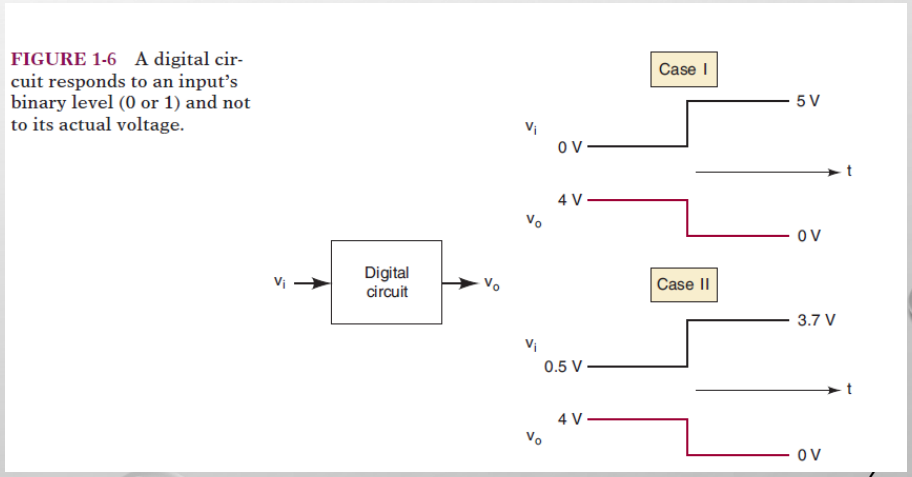

FIGURE 1-6 A digital circuit responds to an input's binary level (0 or 1) and not to its actual voltage.

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ANALOG AND DIGITAL SIGNAL

- LIMITATIONS OF DIGITAL TECHNIQUE:
  - The real world is analog and digitizing always introduces some error.
  - Processing digitized signals takes time.
- HOW TO RESOLVE THE PROBLEM TAKING ADVANTAGES OF DIGITAL TECHNIQUES:
  - Convert the physical variable to an analog electrical signal.
  - Convert analog electrical signal into digital form.
  - Operate/process on the digital form
  - Convert the digital outputs back to real-world analog form.

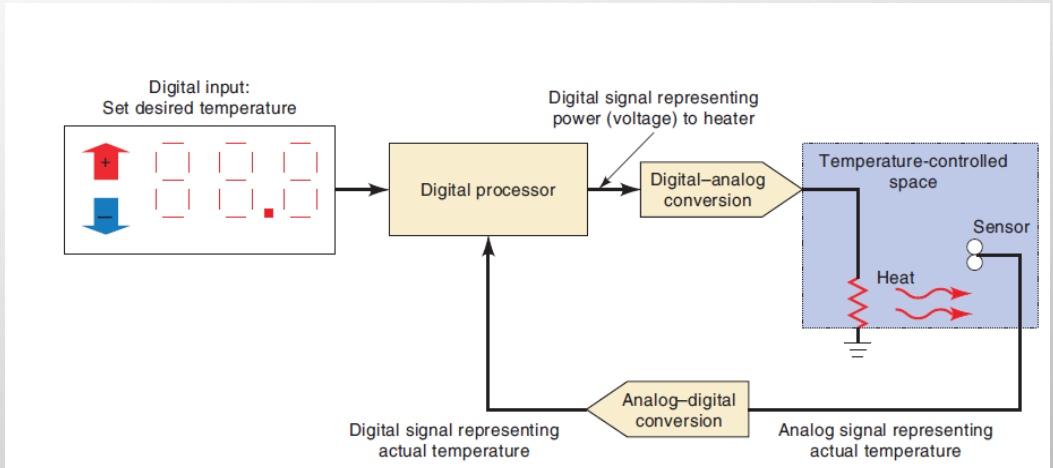

FIGURE 1-12 Diagram of a precision digital temperature control system.

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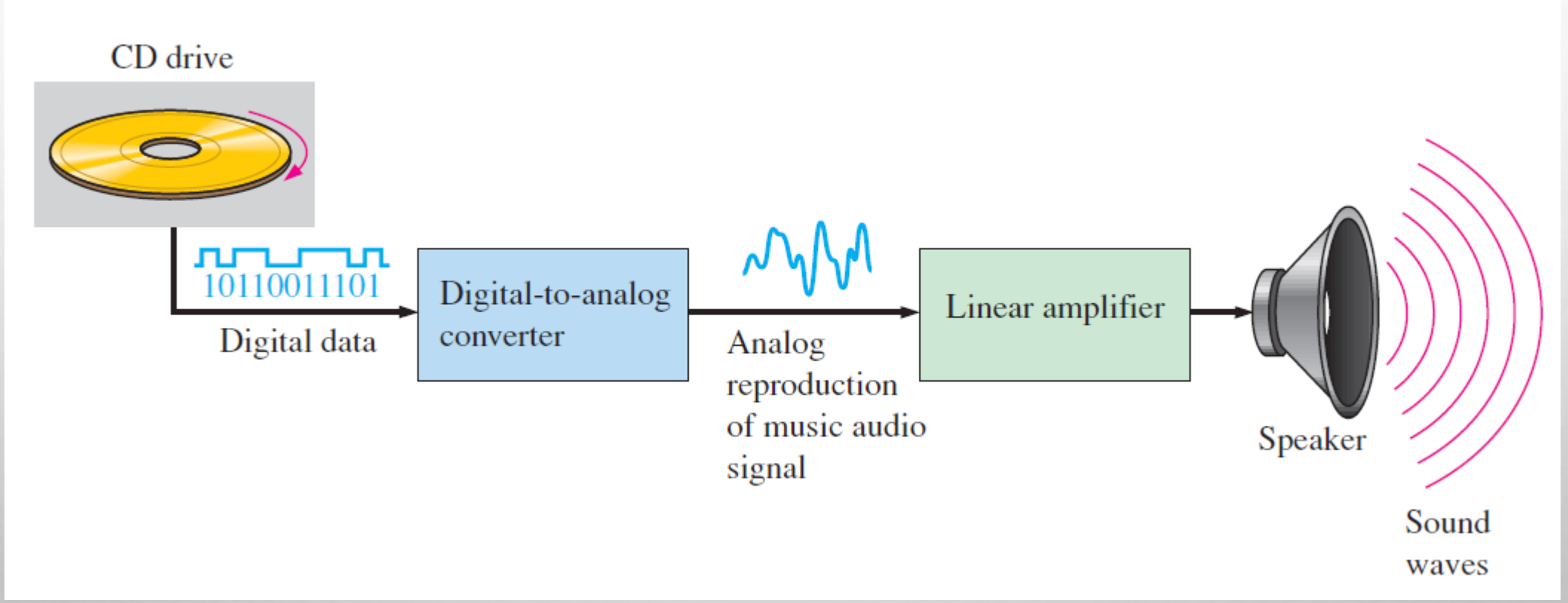
ANALOG AND DIGITAL SIGNAL

- A SYSTEM USING DIGITAL AND ANALOG TECHNIQUES:



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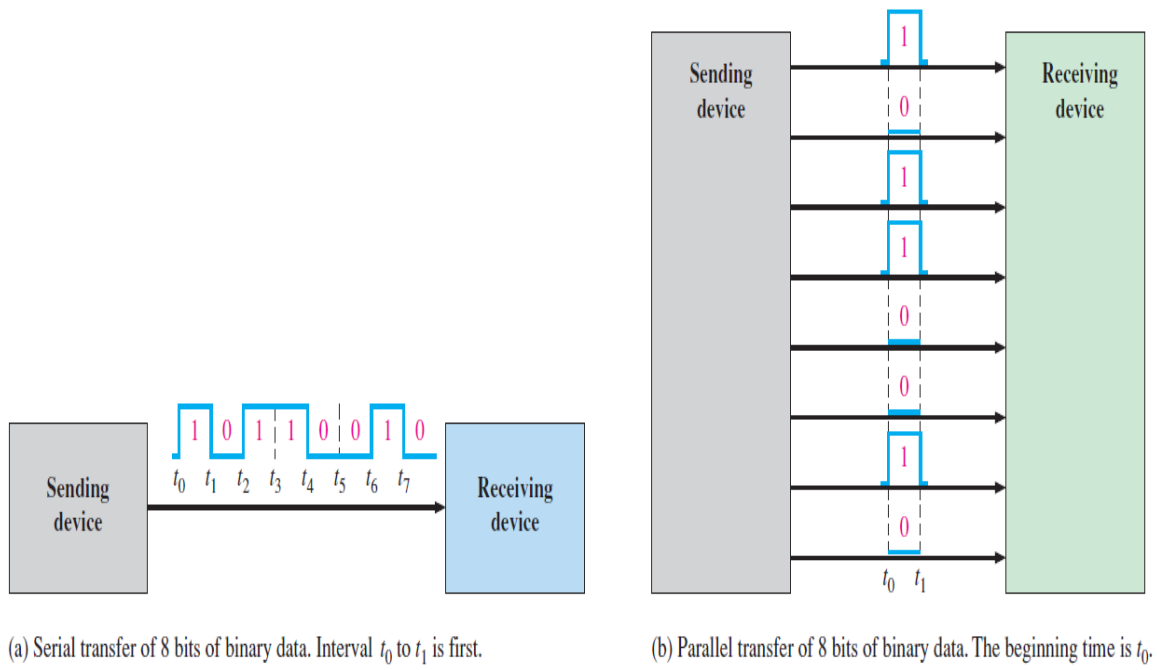
DIGITAL SYSTEM APPLICATIONS

- PARALLEL AND SERIES TRANSMISSION:



(a) Serial transfer of 8 bits of binary data. Interval t_0 to t_1 is first.

(b) Parallel transfer of 8 bits of binary data. The beginning time is t_0.

FIGURE 1-13 Illustration of serial and parallel transfer of binary data. Only the data lines are shown.

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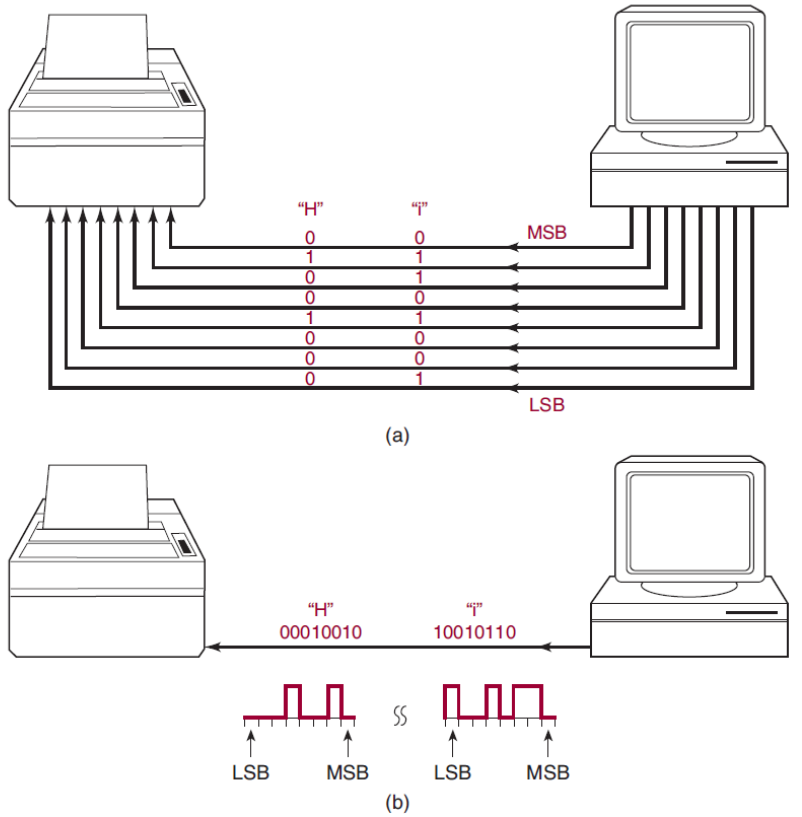
FIGURE 1-19 (a) Parallel transmission uses one connecting line per bit, and all bits are transmitted simultaneously; (b) serial transmission uses only one signal line, and the individual bits are transmitted serially (one at a time).



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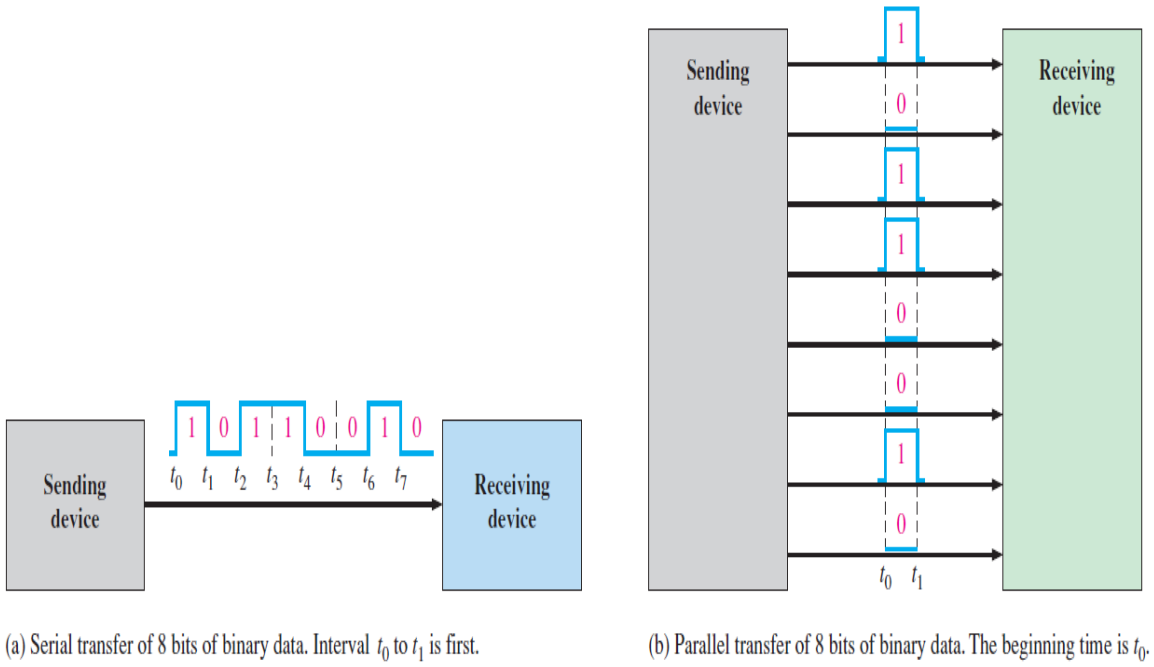

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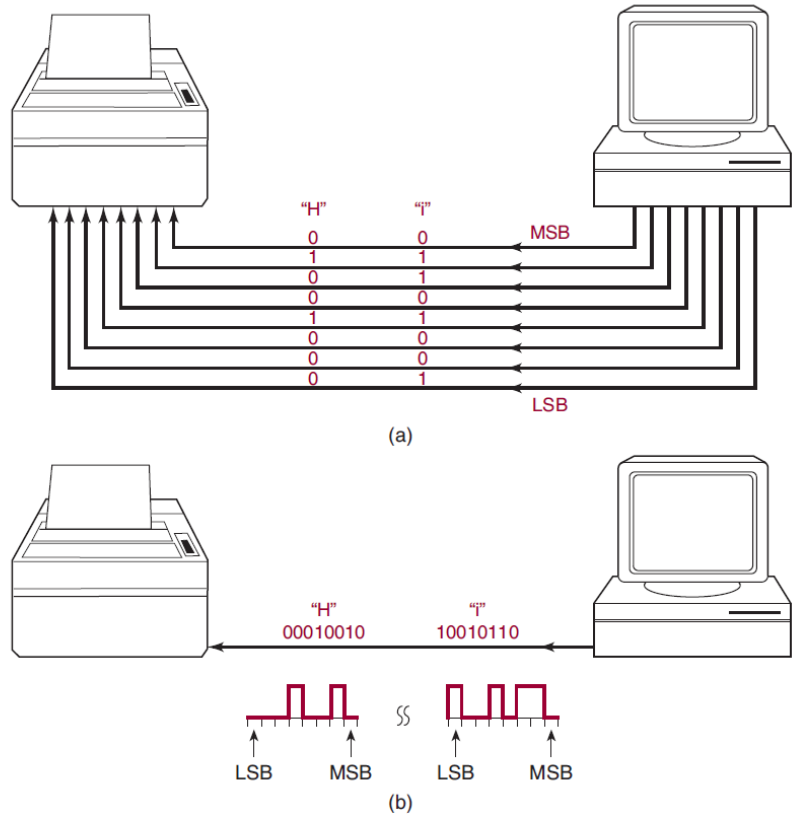

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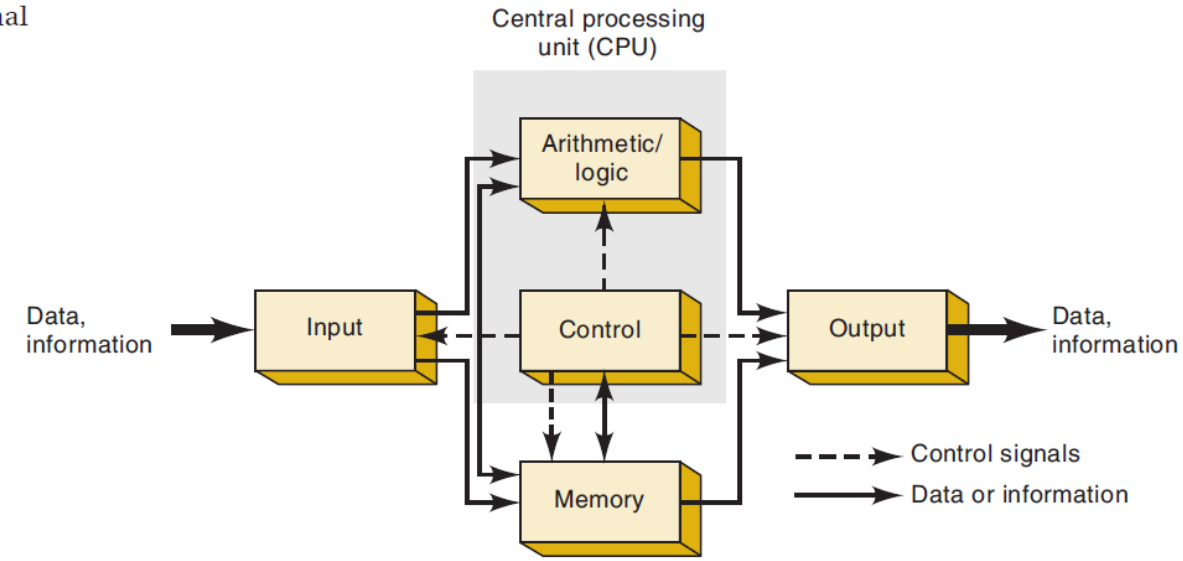
DIGITAL SYSTEM APPLICATIONS

- <u>DIGITAL COMPUTERS:</u>
- Digital computer has the following components:
  - Input unit
  - Memory unit
  - Control unit
  - Arithmetic/logic unit
  - Output unit

FIGURE 1-21 Functional diagram of a digital computer.



Ref: (3), Pages 48-49