

Data and Program Representation

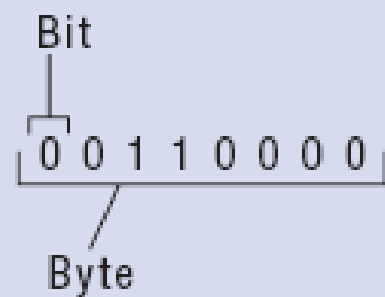
- In order to be understood by a computer, data and programs need to be represented appropriately
- Coding systems:
- Digital computers:
- Digital data representation:

Digital Data Representation

- Bit:
- Byte =
- Byte terminology used to express the size of documents and other files, programs, etc.
- Prefixes are often used to express larger quantities of bytes: _____ (KB), _____ (MB), _____ (GB), _____ (TB), etc.

FIGURE 2-2
Bits and bytes.

Document size, storage capacity, and memory capacity are all measured in bytes.

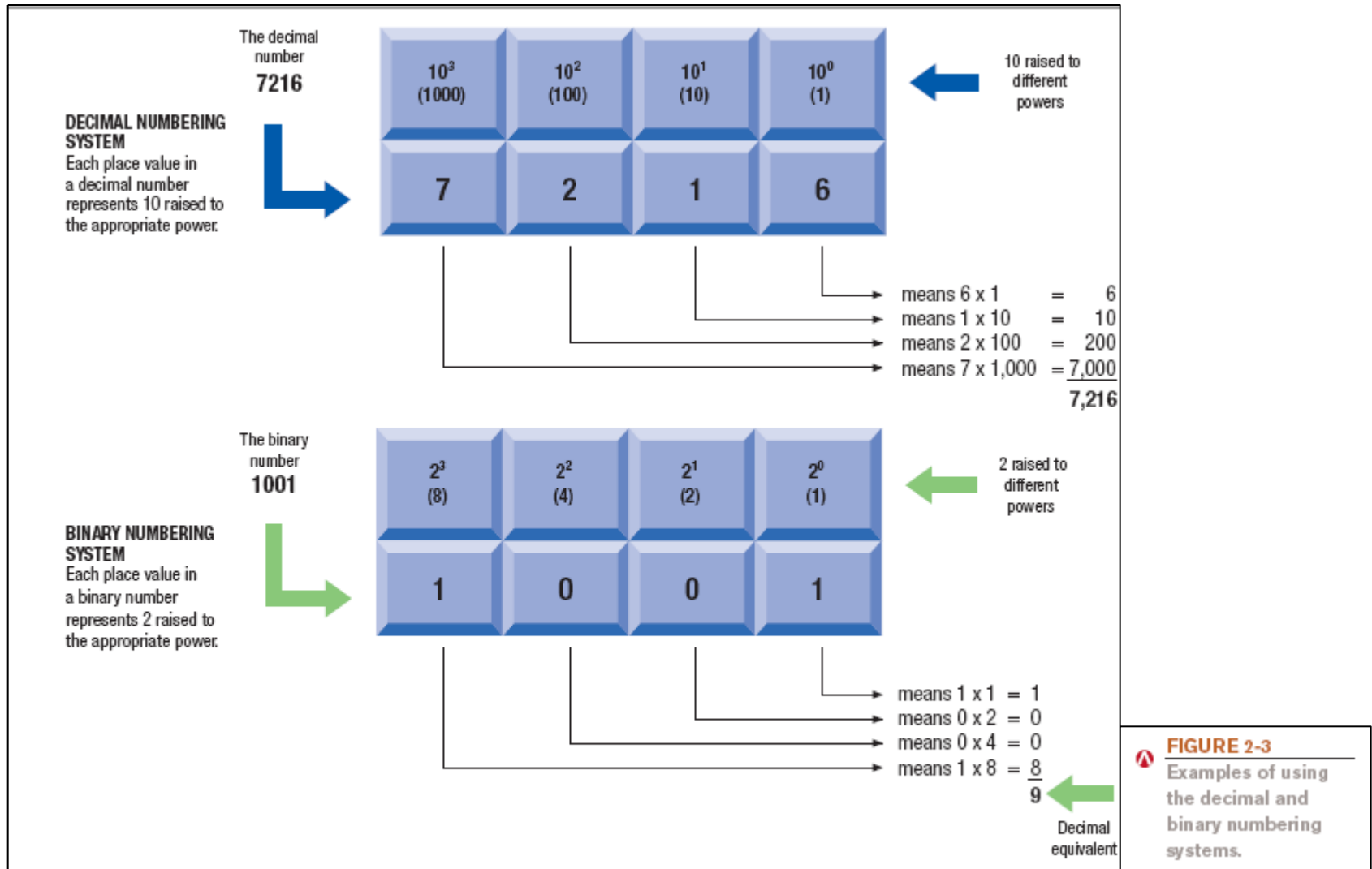


Abbreviation	Approximate Size
KB	1 thousand bytes
MB	1 million bytes
GB	1 billion bytes
TB	1 trillion bytes
PB	1,000 terabytes

The Binary Numbering System

- Numbering system: A way of representing numbers
- Decimal numbering system
 -
- Binary numbering system
 - .
- In both systems, the position of the digits determines the power to which the base number (such as 10 or 2) is raised

The Binary Numbering System



Coding Systems for Text-Based Data

- ASCII and EBCDIC
 - ASCII:
 - EBCDIC:

CHARACTER	ASCII
0	00110000
1	00110001
2	00110010
3	00110011
4	00110100
5	00110101
A	01000001
B	01000010
C	01000011
D	01000100
E	01000101
F	01000110
+	00101011
!	00100001
#	00100011

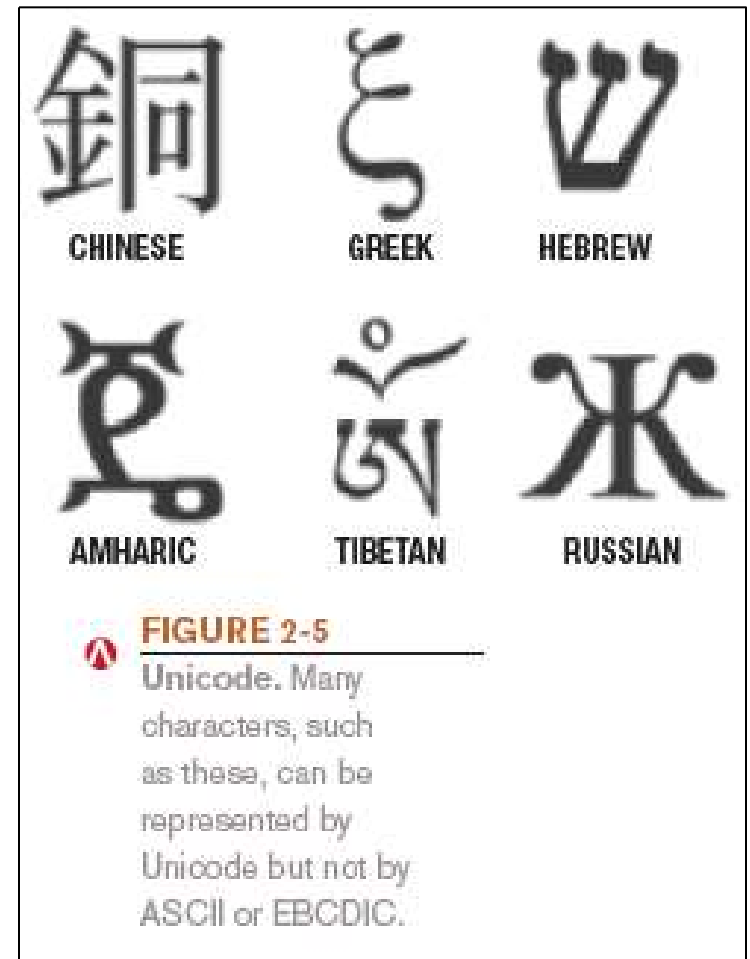


FIGURE 2-4

Some extended ASCII
code examples.

Coding Systems for Text-Based Data

- Unicode: newer code
- Replacing _____ as the primary text-coding system



Coding Systems for Other Types of Data

- Graphics (still images such as photos or drawings)
 - Bitmapped images: A variety of bit depths are possible (4, 8, 24 bits)
 - .



One sample pixel:
1110

16-COLOR IMAGE

The color of each pixel is represented using one half byte (4 bits).



One sample pixel:
01110110

256-COLOR IMAGE

The color of each pixel is represented using one byte (8 bits).



One sample pixel:
101001100100110111001011

PHOTOGRAPHIC-QUALITY (TRUE COLOR) IMAGE (16.8 million colors)

The color of each pixel is represented using three bytes (24 bits).



FIGURE 2-6

Representing graphics data. With bitmapped images, the color of each pixel is represented by bits; the more bits used, the better the image quality.

Coding Systems for Other Types of Data

- Audio data:
 - Often compressed when sent over the Internet
 - .
- Video data:
 - Amount of data can be substantial, but can be compressed

Representing Programs: Machine Language

- Machine language:
 - Early programs were written in machine language.
 - Today's programs still need to be translated into machine language in order to be understood by the computer
- Most programs are written in other programming languages
 - Language translators are used to translate the programs into machine language

Quick Quiz

1. Another way to say “one million bytes” is
 - a. one kilobyte
 - b. one gigabyte
 - c. one megabyte
2. True or False: MP3 files are stored using 0s and 1s.
3. The _____ numbering system is used by computers to perform mathematical computations.