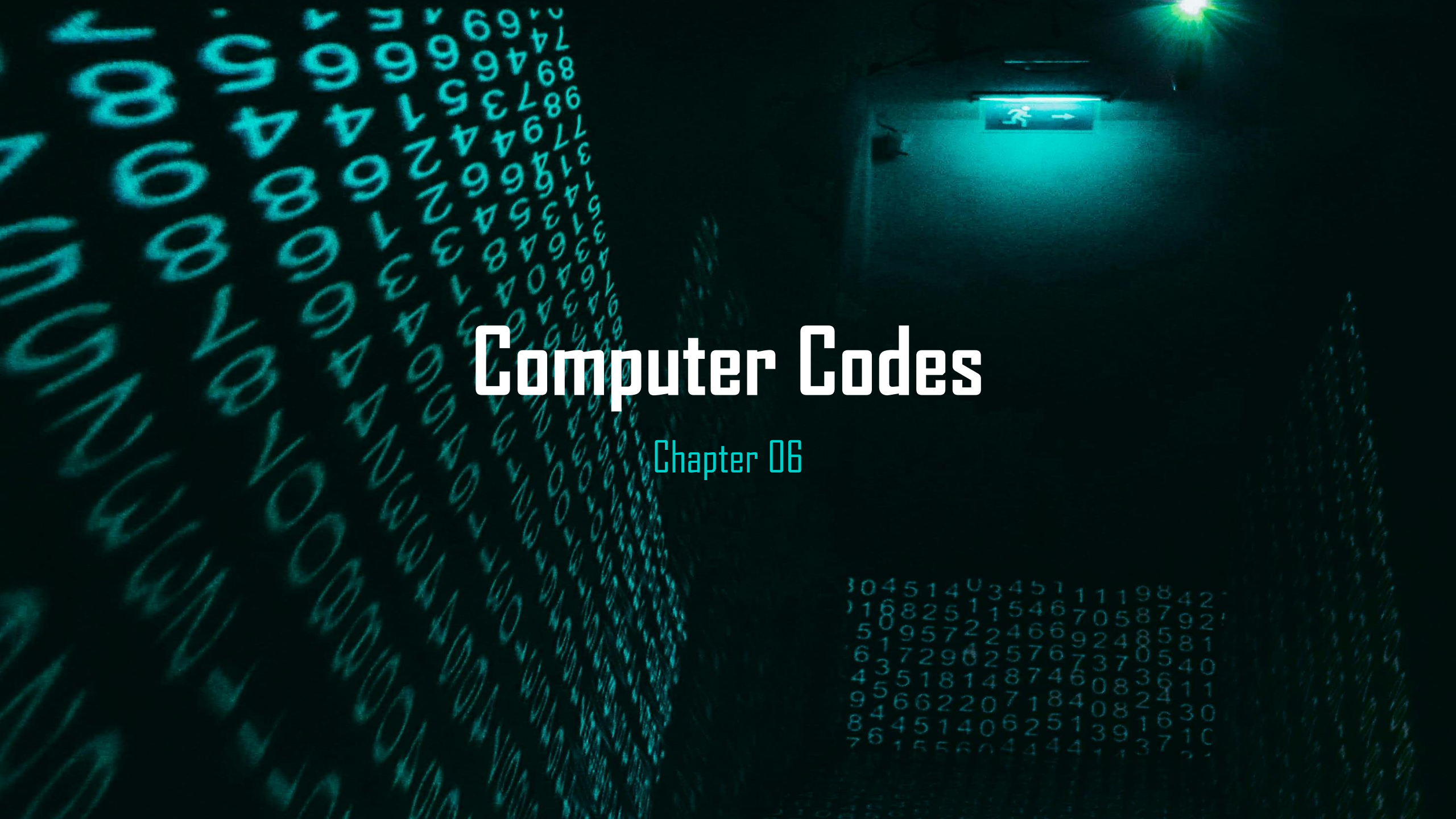

Computer Codes

Chapter 06

What is Computer Code?

- It refers to a system of representing information/data in a structured & standardized manner.
- It is possible to represent any of the character in our language (letter, number, symbol) using electronic switches.
- There are different coding systems, that convert one or more character sets into computer codes. Some are: EBCDIC, BCD, ASCII, Unicode & Excess-3.
- It plays a vital role in representing and manipulating data in computer systems

1. BCD (Binary Coded Decimal) Code

- BCD is a coding system that represents decimal digits(0-9) using binary digits.
- It uses four bits to represent each decimal digit.
- For example, the BCD (8421 code) representation of the decimal number 7 is 0111, and the representation of 91 is 1001 0001.
- BCD is commonly used in digital systems where precise decimal representation is required, such as calculators, digital clocks, and financial applications.

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- It is primarily used for representing decimal digits (0-9) rather than letters.
- Types of BCD code include: 8421(popular), 2421, 5421, 84-2-1, which represent the weight of each position in this 4-bit binary code.
- If the sumation of the 4 bit binary codes is equal to 9, then that code is a self complimenting code.
- The 2421 and 84-2-1 code is a self-complimenting code.

BCD Code types

Decimal	8 4 2 1 BCD	2 4 2 1 BCD	5 4 2 1 BCD	8 4 -2 -1 BCD
0	0 0 0 0	0 0 0 0	0 0 0 0	0 0 0 0
1	0 0 0 1	0 0 0 1	0 0 0 1	0 1 1 1
2	0 0 1 0	0 0 1 0	0 0 1 0	0 1 1 0
3	0 0 1 1	0 0 1 1	0 0 1 1	0 1 0 1
4	0 1 0 0	0 1 0 0	0 1 0 0	0 1 0 0
5	0 1 0 1	1 0 1 1	1 0 0 0	1 0 1 1
6	0 1 1 0	1 1 0 0	1 0 0 1	1 0 1 0
7	0 1 1 1	1 1 0 1	1 0 1 0	1 0 0 1
8	1 0 0 0	1 1 1 0	1 0 1 1	1 0 0 0
9	1 0 0 1	1 1 1 1	1 1 0 0	1 1 1 1

Exercise

1. Convert $(123)_{10}$ to its equivalent BCD = $(0001\ 0010\ 0011)_2$
2. Convert $(324)_{10}$ to its equivalent BCD = $(0011\ 0010\ 0100)_2$
3. Convert $(100000101000)_2$ to its equivalent Decimal = 828
4. Convert $(1001000)_2$ to its equivalent Decimal = 48

1.1. Addition of BCD (8421) Codes

- BCD addition is similar to binary addition, with the exception that when the sum exceeds 9, a correction is applied to convert it back to BCD format.
- Example: 1001 (9)

  \+ 1000 (8)

  1110 (12)

1.2. Subtraction of BCD (8421) codes

- BCD subtraction is similar to binary subtraction, with the exception that when the result becomes negative, a correction is applied to convert it back to BCD format.
- Example: 1 0 0 1

  - 1 1 0 1

  ---

  1 1 1 0

Exercise

1. Add 7 (0111) and 9 (1001) in BCD = 10000 => 0001 0000
2. Add 5 (0101) and 6 (0110) in BCD = 10111 => 0001 0111

2. EBCDIC Code (Extended Binary Coded Decimal Interchange Code)

- EBCDIC is an 8-bit character encoding used by IBM mainframe computers.
- It represents alphanumeric characters, control characters, and special symbols.
- EBCDIC was widely used in older IBM mainframe computers and their associated systems. Although its usage has diminished over time, it may still be encountered in legacy systems.

3. Gray Code (Reflected Binary Code)

- The Gray code is a binary numeral system where successive values differ by only one bit.
- Example: Gray code sequence for 3-bit binary numbers: 000, 001, 011, 010, 110, 111, 101, 100.
- Gray code is often used in applications where a single bit change can lead to significant consequences. Some applications include rotary encoders, error detection and correction systems, and analog-to-digital converters.

4. Excess-3 Code

- Excess-3 code is a self-complementing code used to represent decimal digits.
- It is obtained by adding 3 to the decimal value and converting it to binary.
- Example: Decimal digit 4 in Excess-3 code is represented as 0111.
- Excess-3 code is primarily used in arithmetic circuits and digital calculators to perform arithmetic operations on decimal numbers.

5. ASCII Code (American Standard Code for Information Interchange)

- ASCII is a widely used character encoding that represents characters using 7 bits (extended ASCII uses 8 bits).
- It includes printable characters, control characters, and special symbols.
- ASCII codes are used in various applications, including text processing and communication protocols.

6. Unicode

- Unicode is a universal character encoding standard that supports a wide range of characters from different writing systems.
- It uses 16 bits to represent characters, allowing for the representation of a vast number of characters.
- Unicode includes characters from various scripts, including Latin, Cyrillic, Arabic, Chinese, and many more.
- It enables the representation of characters from various writing systems and languages, making it essential for multilingual applications, internationalization, and global communication.

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Unicode is extensively used in various real-world applications, including:

- **Operating systems and software applications** that support multiple languages and scripts, allowing users to input, display, and process text in different languages simultaneously.
- **Web development**, where Unicode enables the global representation of text content on websites and supports multilingual web pages.
- **Internationalization and localization of software**, enabling the translation and adaptation of applications for different regions and languages.
- **Communication and messaging systems**, facilitating the exchange of multilingual text across different platforms and devices.

- Currently, the most widely used code for character encoding is Unicode. It has largely replaced ASCII in modern computing systems due to its support for a broader range of characters and scripts. Unicode is used extensively in operating systems, web browsers, text editors, and any application that deals with multilingual text.

- It's worth noting that while Unicode is the dominant character encoding, legacy systems or specific industries may still use other codes such as EBCDIC for compatibility reasons or historical purposes. However, for general purposes and modern computing, Unicode is the de facto standard.


THE END