

1. How many types of number systems are there? Describe each in detail.

There are several types of number system

- Binary: Used mostly in computers. The binary number system is a numeral system that uses only two digits: 0 and 1.
- Octal: The Octal number system uses 8 digits from 0 to 7.
- Decimal: The decimal number system is widely used in real life. It has 10 digits from 0-9.
- Hexadecimal: This system is mostly commonly used in different memory representations, address representations etc. It has digits from 0-15 where 10-15 are represented by A-F.

2. Explain the below codes

a. BCD code

Binary-coded decimal (BCD) is a binary-encoded representation of decimal numbers where each decimal digit is individually encoded using its binary equivalent. This encoding system is used in various applications where decimal representation is crucial, such as in digital displays, financial calculations, and data processing.

b. Gray code

Gray Code, also known as reflected binary code, is a binary numeral system where two successive values differ in only one bit. This property is known as "unit distance" and makes Gray code particularly useful in various applications.

3. What are the applications of

a. Weighted code.

- Weighted codes provide various advantages in digital systems, including ease of arithmetic operations, error detection, and simplification of certain types of hardware design.
- Weighted codes are used in ADCs and DACs to represent analog signals in a format that can be processed digitally or to convert digital data into analog signals.

b. Non-weighted code.

- Some specialized digital systems use non-weighted codes for unique applications, such as custom error detection schemes or specific encoding/decoding processes.
- Non-weighted codes are advantageous in scenarios where minimizing errors, simplifying design, or meeting specific encoding requirements is critical.

c. Excess-3 code.

- Excess-3 is a self-complementary code used for error detection in digital systems.
- XS-3 code simplifies the design of arithmetic circuits and is used in some older digital systems and calculators.

d. BCD code.

- This is useful in applications where it's important to display or process numbers in a format that closely resembles human-readable decimal numbers.
- BCD is used in digital clocks, calculators, and other electronic devices where numbers need to be displayed in a decimal format.

e. Gray code.

- Gray code is used in rotary encoders to measure the position of a rotating object.
- Used to reduce errors in ADC encoders.
- Also used for Error detection and correction.

f. ASCII code.

Used to represent all the keys on a keyboard.

g. Octal number system.

- Octal numbers are often used as a more compact representation of binary numbers.

- In Unix-like operating systems, file permissions are often represented in octal notation.

h. Hexadecimal system.

- Used to represent numbers or address locations so they are easier to read compared to binary.
- In assembly language programming, hexadecimal is often used to represent opcodes and instruction addresses.

4. State the disadvantage of the 8-4-2-1 code.

- The 8-4-2-1 code does not inherently include mechanisms for detecting or correcting errors.
- The combinations from 10-15 are not used.
- It's complicated to perform arithmetic operations on this code.

5. What are the different ways to represent negative numbers?

We have three methods

- Signed numbers where the MSB of the number is used to represent if the number is positive or negative.
- 1's complement where to represent a negative number, we invert all the bits of its positive counterpart.
- 2's complement where to represent a negative number, we invert all the bits of its positive counterpart and then add '1' to the result.