Encoding Techniques

Encoding techniques are methods used to convert data into a specific format for efficient storage, transmission, or processing. These techniques are widely applied in fields such as telecommunications, data storage, and information security to optimize performance and ensure data integrity.
In addition to encoding, **encryption** is a crucial technique used to secure data by converting it into a coded format that is only decipherable with the appropriate key, ensuring privacy and protection against unauthorized access.

BCD

BCD (***Binary-Coded Decimal***) is a method of encoding decimal numbers where each digit is represented by its own binary sequence, typically using 4 bits. This coding simplifies the conversion between binary and decimal systems, making it useful in applications like digital clocks, calculators, and financial systems, where precise decimal representation is important. BCD is particularly favored in hardware-level computations for improved accuracy in handling decimal data.

Exercise

In a communication system, we want to transmit numbers from 40 to 119 using a fixed-length BCD code with parity checking.

a) What will be the length of the encoded messages if each decimal digit is encoded with 4 bits in BCD encoding?

W.I.P.

b) Create a possible structure of the code table that assigns the binary representation of digits to the numbers, supplemented with a parity bit. What will be the code for the numbers 42, 87, 100, and 111 in the system?

W.I.P.

c) What will be the entropy and redundancy of this code if the occurrence of numbers in the range 40 $\leq$ n $\leq$ 69 is four times more frequent than the occurrence of numbers in the range $\leq$ ≤ n ≤ $\leq$?

W.I.P.

d) How many bits would the messages be if we used pure binary coding with parity checking?

W.I.P.

LZW

LZW (***Lempel-Ziv-Welch***) coding is a lossless data compression algorithm that replaces repeated

sequences of data with shorter codes, thus reducing file size without losing information. It is widely used in applications such as image compression (e.g., GIF), PDF files, and in systems that require efficient storage and transmission, like data archives and network protocols.

Exercise

W.I.P.

Huffmann

Huffman coding is a lossless data compression algorithm that assigns variable-length codes to input characters based on their frequencies: more frequent characters receiving more shorter codes. This technique efficiently reduces the size of data for storage or transmission. It is widely used in applications such as file compression (e.g., ZIP), multimedia encoding (e.g., JPEG and MP3), and in communication systems where optimizing bandwidth is crucial.

Exercise

W.I.P.

RSA

RSA (***Rivest-Shamir-Adleman***) is a widely used asymmetric cryptographic algorithm that secures data through a pair of public and private keys, enabling secure encryption and decryption. Its strength lies in the difficulty of factoring large prime numbers, providing robust protection for sensitive information. RSA is commonly applied in secure communication protocols, such as SSL/TLS for internet security, digital signatures, and email encryption.

Exercise

W.I.P.