

Source Coding :

In computer science, source code is any collection of computer instructions (possibly with comments) written using some human-readable computer language, usually as text. The source code of a program is specially designed to facilitate the work of computer programmers, who specify the actions to be performed by a computer mostly by writing source code. The source code is often transformed by a compiler program into low-level machine code understood by the computer. The machine code might then be stored for execution at a later time. Alternatively, an interpreter can be used to analyze and perform the outcomes of the source code program directly on the fly.

Prefix Coding:

A prefix code is a type of code system (typically a variable-length code) distinguished by its possession of the "prefix property"; which states that there is no valid code word in the system that is a prefix (start) of any other valid code word in the set. For example, a code with code words {9, 59, 55} has the prefix property; a code consisting of {9, 5, 59, 55} does not, because "5" is a prefix of both "59" and "55". A prefix code is an example of a uniquely decodable code: a receiver can identify each word without requiring a special marker between words.

Prefix codes are also known as prefix-free codes, prefix condition codes and instantaneous codes. Although Huffman coding is just one of many algorithms for deriving prefix codes, prefix codes are also widely referred to as "Huffman codes", even when the code was not produced by a Huffman algorithm. The term comma-free code is sometimes also applied as a synonym for prefix-free codes.

Huffman Coding:

In computer science and information theory, Huffman coding is an entropy encoding algorithm used for lossless data compression. The term refers to the use of a variable-length code table for encoding a source symbol (such as a character in a file) where the variable-length code table has been derived in a particular way based on the estimated probability of occurrence for each possible value of the source symbol.

Hamming Code:

In telecommunication, Hamming codes are a family of linear error-correcting codes that generalize the Hamming(7,4)-code invented by Richard Hamming in 1950. Hamming codes can *detect up to two-bit errors or correct one-bit errors without detection of uncorrected errors*. By contrast, the simple parity code cannot correct errors, and can detect only an odd number of bits in error. Hamming codes are perfect codes, that is, they achieve the highest possible rate for codes with their block length and minimum distance 3.

In mathematical terms, Hamming codes are a class of binary linear codes. For each integer $r \geq 2$ there is a code with block length $n = 2^r - 1$ and message length $k = 2^r - r - 1$. Hence the rate of Hamming codes is $R = k/n = 1 - r/(2^r - 1)$, which is highest possible for codes with distance 3 and block length $2^r - 1$. The parity-check matrix of a Hamming code is constructed by listing all columns of length r that are non-zero, which means that the dual code of the Hamming code is the punctured Hadamard code. The parity-check matrix has the property that any two columns are pairwise linearly independent.