

# MSB & LSB

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## MSB & LSB

In computer science and information theory, a bit is the smallest possible meaningful piece of information. It is most often expressed as a digit of the binary numeral system: either 0 or 1. A string of 8 bits is called a byte.

If we take, for example, the binary number 11100111 (231 in decimal), and send it as a string of data of a network, we can send it in two ways: starting from left to right, or starting right to left. These two orderings are commonly called Most Significant Bit First, and Least Significant Bit First, respectively.

In this case, we referred to the first, or left-most bit as the Most Significant Bit the MSB is the bit in a binary sequence that carries the greatest numerical value. For simpler reference, if we take a look at the equivalent decimal number, 231, the most significant digit is the leading 2. Compared to the other two digits, the leading 2 determines the greatest part of the number's numerical value, as it signifies the hundreds in the number. Analogous to this, the leading 1 in our binary number is its most significant bit. The MSB can also be used to denote the sign bit of a binary number in it's one's or two's complement notation, with 1 meaning it's a negative number, and 0 meaning it's a positive number.

The least significant bit is the right-most bit in a string. It is called that because it has the least effect on the value of the binary number, in the same way as the unit digit in a decimal number has the least effect on the number's value. The LSB also determines whether the given number is odd or even. The number 11100111 is an odd number, since it's LSB (1) is an odd number. If we use the term least significant bits (plural), we are commonly referring to the several bits closest to, and including, the LSB. Another property of the least significant bits is that they often change drastically if the number changes. For example, if we add 1 to our example number, 11100111, we will get 11101000. The result of this minimal addition is that the four least significant bits have changed their value.

Some important uses for the LSB are hash functions and checksums. A hash function is a function that can be used to assign an index value to digital data, enabling faster lookups of items in a database or a large table. A checksum is a small piece of data that's used in the verification process for packets sent over a network.

When a byte is serialized into a stream of bits and transmitted serially, it becomes important to know whether it's transmitted LSbit-first or MSbit-first. The transmitter can send the bits in either order, and the contract whether it's LSbit-first or MSbit-first is established in the datasheet.

Example:

MSB stands for most significant bit, while LSB is least significant bit. In binary terms, the MSB is the bit that has the greatest effect on the number, and it is the left-most bit. For example, for a binary number 0011 0101, the Most Significant 4 bits would be 0011. The Least Significant 4 bits would be 0101. The left-most bit is the most significant, because for the binary 0011 0101, the value is 53. If you flip the left-most bit from 0 to 1, you have 1011 0101, which gives you 181. Flipping the LSB on the right will give you 0011 0100, which is 52. Hence the name Most Significant and Least Significant.

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