Encoding Information with Bits

Recap

What are Bits?

- A bit is the basic unit of information used in modern computers and communication systems.
- A bit is a variable that can assume only two possible values or “states”, commonly denoted by 0 or 1.

Note:

Variables that can assume more than two possible values can be represented by combinations or sequences of bits.

Examples:

- binary numbers
- ASCII codes for letters and text

Binary Digits

Each value is the sum of powers of two.

$$x = \sum_{i=0}^{N-1} 2^i \cdot b_i$$

Example:

If $N = 3$

$$x = 2^2 \cdot b_2 + 2^1 \cdot b_1 + 2^0 \cdot b_0$$

$$= 4 \cdot b_2 + 2 \cdot b_1 + b_0$$

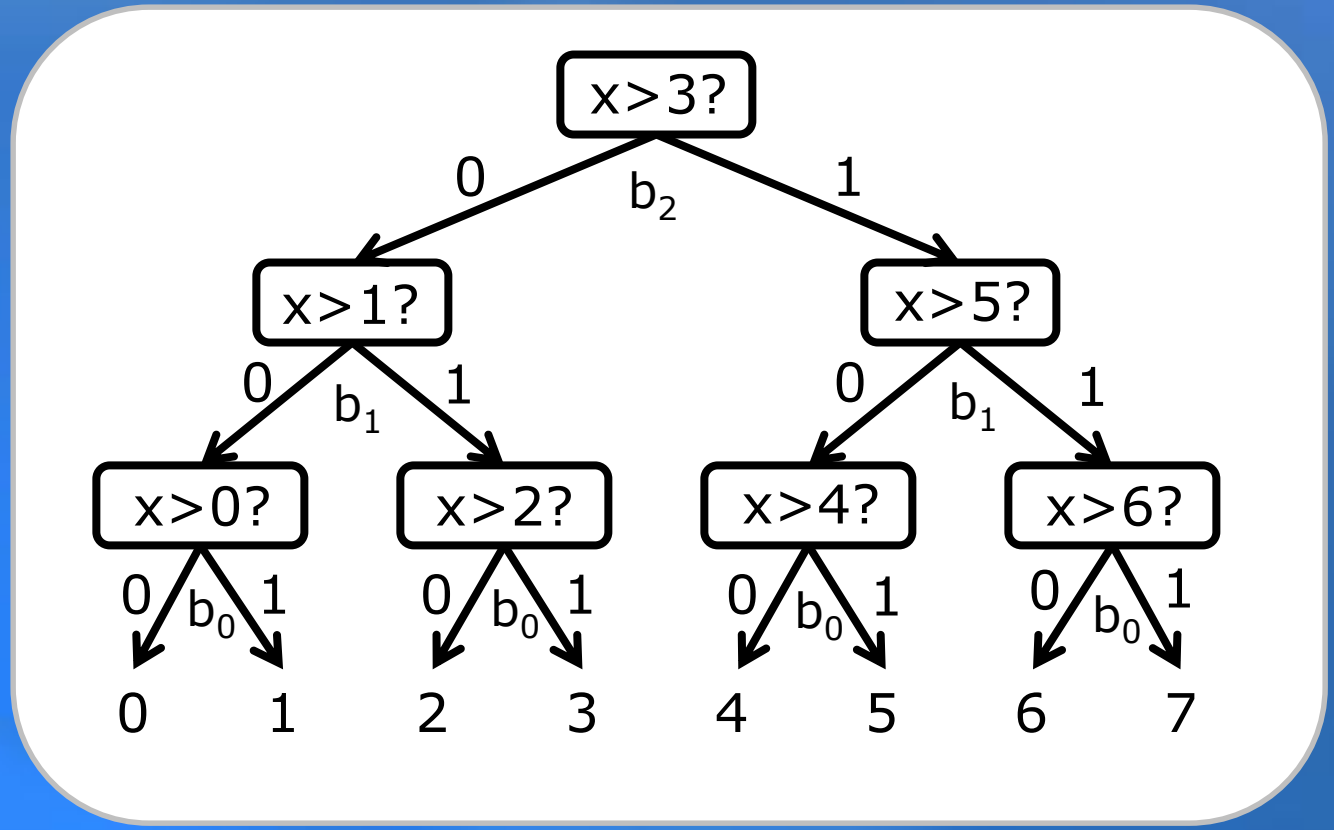
$$5 = 4 \cdot 1 + 2 \cdot 0 + 1 \cdot 1$$

x	b_2	b_1	b_0
0	0	0	0
1	0	0	1
2	0	1	0
3	0	1	1
4	1	0	0
5	1	0	1
6	1	1	0
7	1	1	1

Notation:

- b_{N-1} = Most Significant Bit (MSB)
- b_0 = Least Significant Bit (LSB)

Sequence of Yes/No Questions



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ASCII Codes

American Standard Code for Information Interchange (ASCII) is an 8-bit code that can represent text symbols.

Examples:

E = 01000101

MSB b_7 **LSB** b_0

C = 01000011

0	0011 0000	O	0100 1111	m	0110 1101
1	0011 0001	P	0101 0000	n	0110 1110
2	0011 0010	Q	0101 0001	o	0110 1111
3	0011 0011	R	0101 0010	p	0111 0000
4	0011 0100	S	0101 0011	q	0111 0001
5	0011 0101	T	0101 0100	r	0111 0010
6	0011 0110	U	0101 0101	s	0111 0011
7	0011 0111	V	0101 0110	t	0111 0100
8	0011 1000	W	0101 0111	u	0111 0101
9	0011 1001	X	0101 1000	v	0111 0110
A	0100 0001	Y	0101 1001	w	0111 0111
B	0100 0010	Z	0101 1010	x	0111 1000
C	0100 0011	a	0110 0001	y	0111 1001
D	0100 0100	b	0110 0010	z	0111 1010
E	0100 0101	c	0110 0011	.	0010 1110
F	0100 0110	d	0110 0100	,	0010 0111
G	0100 0111	e	0110 0101	:	0011 1010
H	0100 1000	f	0110 0110	;	0011 1011
I	0100 1001	g	0110 0111	?	0011 1111
J	0100 1010	h	0110 1000	!	0010 0001
K	0100 1011	I	0110 1001	'	0010 1100
L	0100 1100	j	0110 1010	"	0010 0010
M	0100 1101	k	0110 1011	(	0010 1000
N	0100 1110	l	0110 1100	)	0010 1001
				space	0010 0000

Bit Sequences

Assuming LSB appears first in the sequence, ECE would be transmitted as a bit sequence.