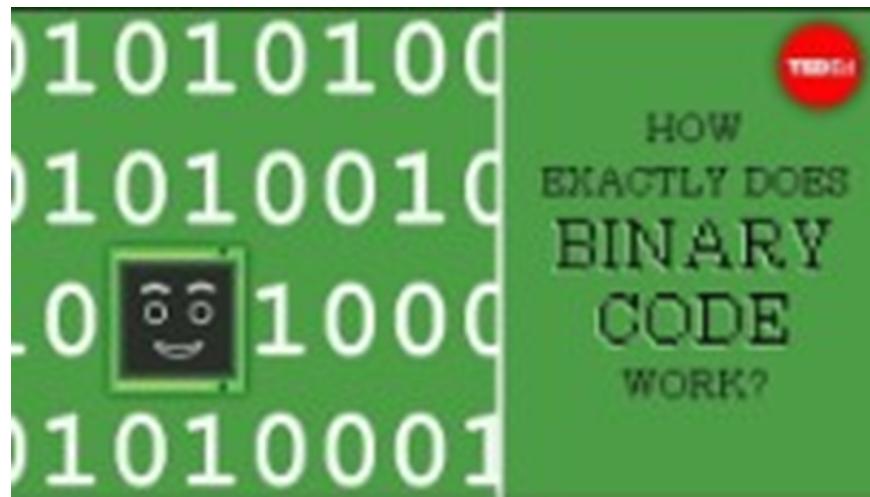


28/11/2025 - Matemáticas Discretas → (UdeG)

→ Apuntes antiguos:

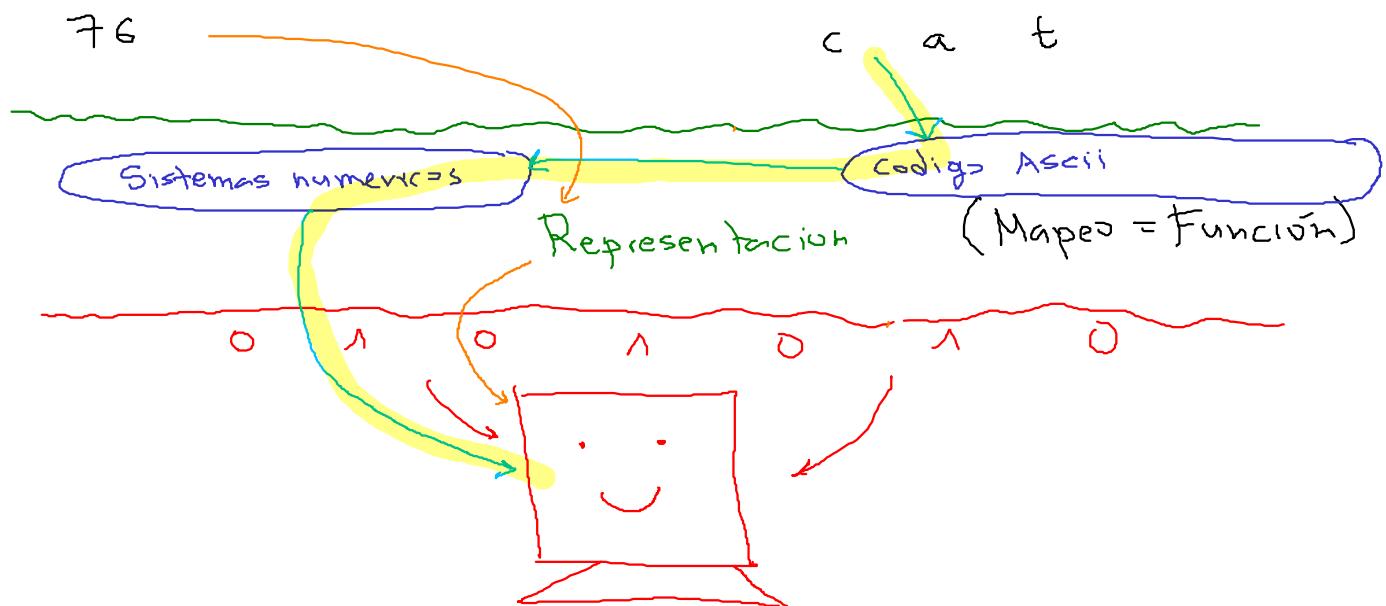
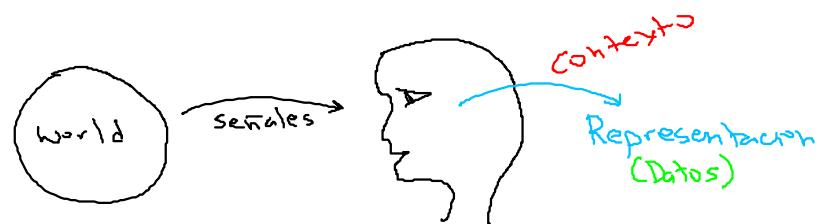
1. Introducción:

https://www.ted.com/talks/jose_americano_n_l_f_de_freitas_how_exactly_does_binary_code_work



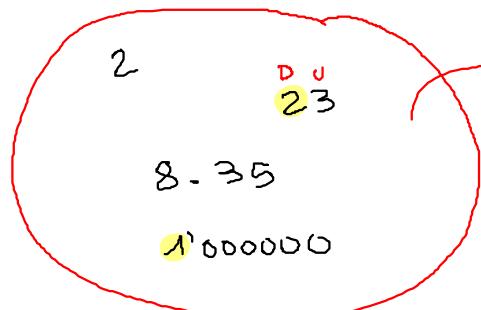
2. Información

{
Claude Shannon



3. Sistemas numéricos.

Sistemas numéricos posicionales



$$N = d_n \dots d_1 d_0 \cdot d_{-1} d_{-2} \dots d_{-m}$$

Números: N

$$\begin{matrix} & & & & & \\ \text{d}_n & \text{d}_0 & & & & \\ \text{d}_{-1} & \text{d}_{-2} & & & & \end{matrix} = 2 \times 10^0 + 3 \times 10^{-1} + \dots$$

$$N_b = \sum_{i=-m}^n d_i \cdot b^i$$

$$b = 2$$

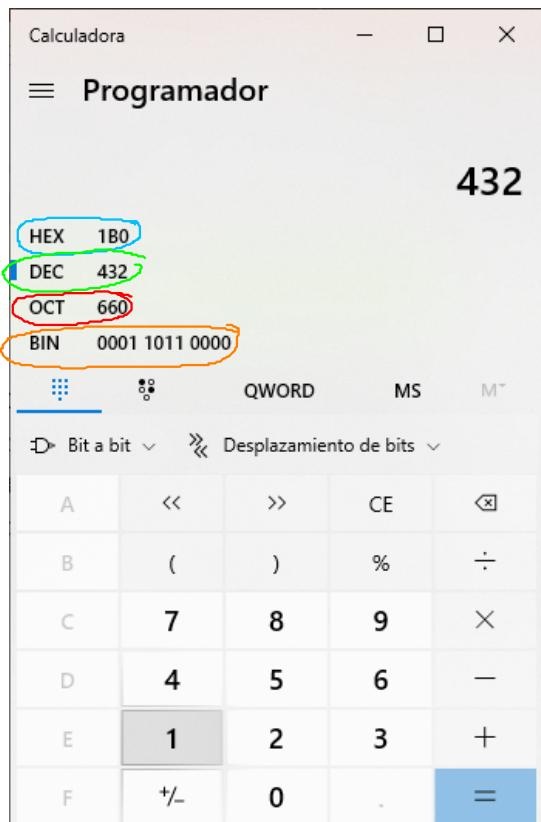
$$0001\ 1010000_2$$

$$\begin{matrix} & & \\ b & = & 10 \\ & & N = 432 \end{matrix}$$

$$432_{10}$$

$$\begin{matrix} & & \\ b & = & 8 \\ & & 660_8 \end{matrix}$$

$$\begin{matrix} & & \\ b & = & 16 \\ & & 1B0_{16} \end{matrix}$$



$$\begin{aligned} 25.4_6 &= 2(6^1) + 5(6^0) + 4(6^{-1}) \\ &\quad \xrightarrow{b=6} = 2(6) + 5(1) + 4(0.17) \\ &= 12 + 5 + 0.68 \\ &= 17.68_{10} \end{aligned}$$

Expansión

Base
m

Base
10

3. Sistemas numéricos

Decimal, binario, octal y hexadecimal

$b=10$

$b=2$

$b=8$

$b=16$

Decimales:

- base: $b=10$

- Dígitos: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9

- Ejemplos: 23.6₁₀

123₁₀

666

- 7

Binarios:

- base: $b=2$

- Dígitos: 0, 1

~~0 1 2~~₂

01100001₂

11.01₂

Octal:

- base: $b=8$

- Dígitos: 0, 1, 2, 3, 4, 5, 6, 7

1203₈

~~18~~₈

Hexadecimales:

- base: $b=16$

- Dígitos: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, F

(10) (11) (12) (13) (14) (15)

12E₁₆

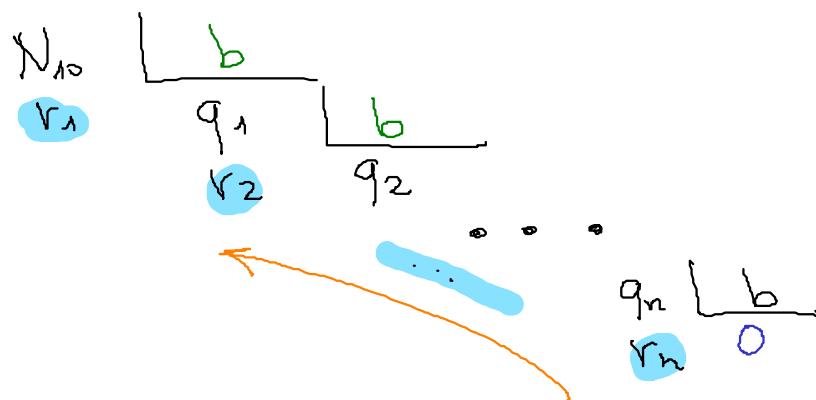
~~CA3~~₁₆

12FF₁₆

$$\begin{aligned}
 & \text{2} \ 1 \ 0 \\
 1 \ \text{AD}_{16} &= 1(16^2) + A(16^1) + D(16^0) \\
 b = 16 &= 1(256) + 10(16) + 13(1) \\
 &= 429_{10}
 \end{aligned}$$



4. Divisiones Sucesivas



$$N_b = r_n r_{n-1} \dots r_1$$

Calculadora

$- \quad \square \quad \times$

$\equiv \text{Programador}$

432

HEX	1B0
DEC	432
OCT	660
BIN	0001 1011 0000

Bit a bit Desplazamiento de bits

A	\ll	\gg	CE	\otimes
B	()	%	\div
C	7	8	9	\times
D	4	5	6	-
E	1	2	3	+
F	$+_$	0	.	=

$$N = 432_{10}$$

$$1. N_2 = ?$$

✓ $N_2 = 110110000$

$$2. N_8 = ?$$

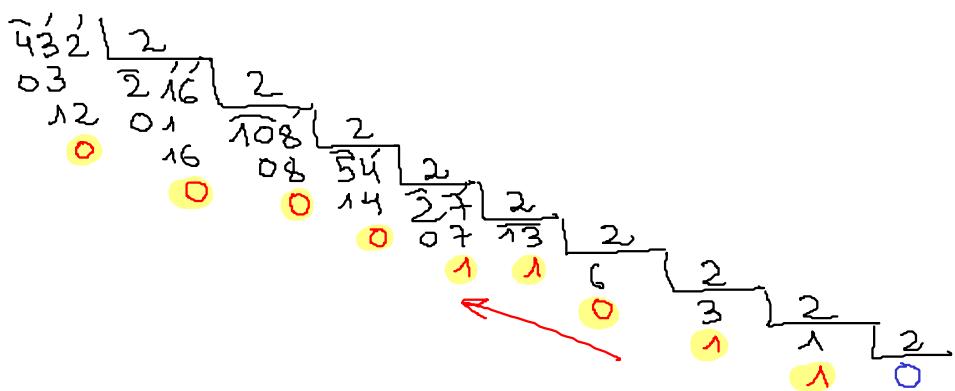
$$N_8 = 660_8$$

$$2. N_{16} = ?$$

$$N_{16} = 1B0_{16}$$

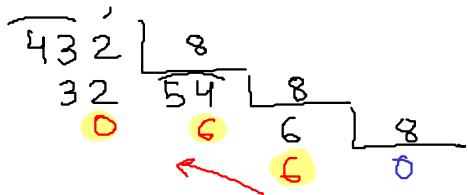
$$N_{10} = 432 = 432_{10} \rightarrow N_2 = ?$$

$$b = 2$$



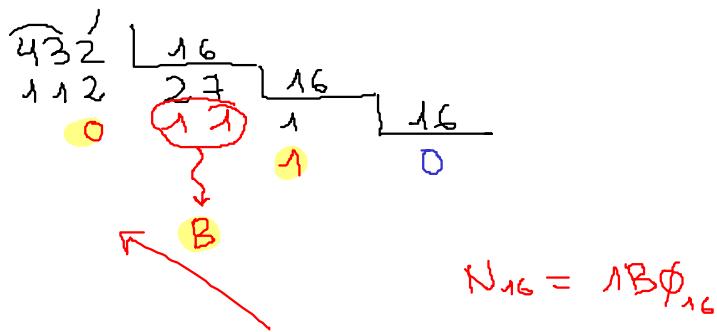
$$N_2 = 1101100000_2$$

$$N_{10} = 432 = 432_{10} \rightarrow N_8 = ?$$



$$N_8 = 660_8$$

$$N_{10} = 432 = 432_{10} \rightarrow N_{16} = ?$$

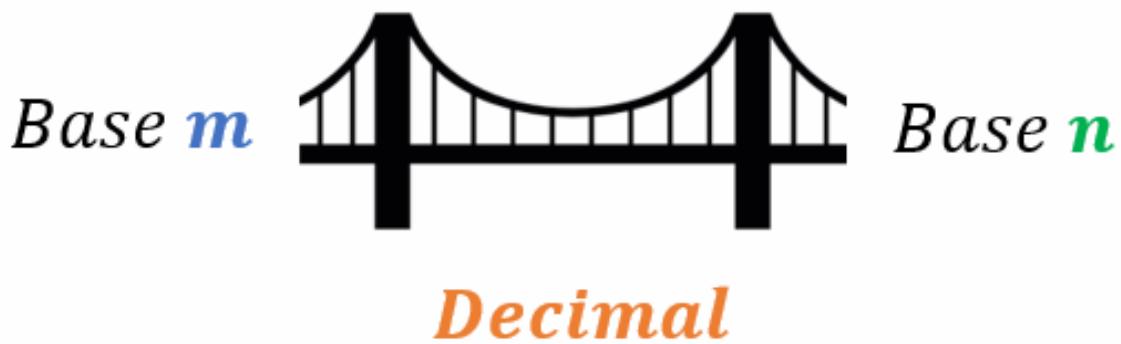


$$N_{16} = 1B0_{16}$$



$$\begin{aligned}m &\neq 10 \\n &\neq 10\end{aligned}$$

5. Método del Puente



Ejemplo: $42_5 \rightarrow N_9 = ?$

P1. $42_5 \rightarrow N_{10} = ?$

$$\begin{aligned}
 42_5 &= 4(5^1) + 2(5^0) \\
 &= 4(5) + 2(1) \\
 &= 20 + 2 \\
 &= 22
 \end{aligned}$$

$42_5 = 22_{10}$

P2. $22_{10} \rightarrow N_9 = ?$

$$\begin{array}{r}
 22 \longdiv{9} \\
 4 \quad 2 \longdiv{9} \\
 \downarrow \quad \downarrow \\
 2 \quad 0
 \end{array}$$

$22_{10} = 24_9$

$42_5 = 24_9$

6. Método Directo (Binaria, octal, hexadecimal)

$$\begin{array}{c}
 b=2 \\
 b=8=2^3 \\
 b=16=2^4
 \end{array}$$

$$\begin{array}{r}
 7 \longdiv{2} \\
 3 \quad 1 \quad 1 \\
 \downarrow \quad \downarrow \quad \downarrow \\
 1 \quad 1 \quad 1
 \end{array}$$

$7 = 111_2$

$$\begin{array}{r}
 12 \longdiv{2} \\
 6 \quad 3 \quad 1 \\
 \downarrow \quad \downarrow \quad \downarrow \\
 0 \quad 1 \quad 1
 \end{array}$$

$12 = 1100_2$

Octal	Binario	Hexadecimal	Binario
0	000	0	00000
1	001	1	00001
2	010	2	00100
3	011	3	00111
4	100	4	01000
5	101	5	01001
6	110	6	01100
7	111	7	01111
		8	10000
		9	10001
		A(10)	10100
		B(11)	10101
		C(12)	11000
		D(13)	11001
		E(14)	11100
		F(15)	11111

Ejemplo:

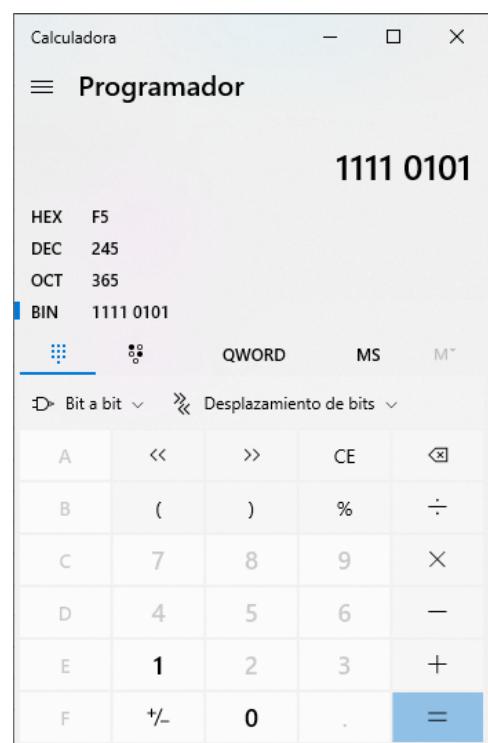
$$175_8 \longrightarrow N_2 = ?$$

$$175_8 = \underbrace{1}_{001} \underbrace{7}_{111} \underbrace{5}_{101} = \underbrace{\text{001}}_{1} \underbrace{\text{111}}_{7} \underbrace{\text{101}}_5_2$$

$$0001110101_2 = N_{16} = ?$$

$$b=8 \quad \underbrace{0001}_{0} \underbrace{11}_{3} \underbrace{10}_{6} \underbrace{01}_{5} = 365_8$$

$$b=16 \quad \underbrace{0001}_{0} \underbrace{11}_{F} \underbrace{10}_{5} = F5_{16}$$



$$1A_{16} \longrightarrow N_8 = ?$$

$$\text{P1. } 1A_{16} \longrightarrow N_2$$

$$1A_{16} = \underbrace{1}_{0001} \underbrace{A}_{1010} = \underbrace{\text{0001}}_{1} \underbrace{\text{1010}}_2 = 11010_2$$

P2. $N_2 \longrightarrow N_8$

$$b=8 \quad \begin{array}{r} \underline{\text{0}} \quad \underline{\text{1}} \quad \underline{\text{10}} \quad \underline{\text{10}} \\ \text{3} \quad \text{2} \end{array} = 32_8$$

$$1A_{16} = 32_8$$

Apuntes nuevos (agregados el 28/11/2025)