

## EJEMPLOS DE CAMBIO DE BASE (extraídos de Lameres 2017)

De base 2 a base 10

Example: Convert  $101.11_2$  to Decimal:

	<b>1</b>	<b>0</b>	<b>1</b>	<b>.</b>	<b>1</b>	<b>1</b> <sub>2</sub>
	↓	↓	↓		↓	↓
Position (p) →	<b>2</b>	<b>1</b>	<b>0</b>		<b>-1</b>	<b>-2</b>
	↓	↓	↓		↓	↓
Weight →	<b>(2)<sup>2</sup></b>	<b>(2)<sup>1</sup></b>	<b>(2)<sup>0</sup></b>		<b>(2)<sup>-1</sup></b>	<b>(2)<sup>-2</sup></b>

↓

$$\text{Value} = \sum_{i=-2}^2 d_i \cdot 2^i$$

↓

$$\text{Value} = 1 \cdot 2^2 + 0 \cdot 2^1 + 1 \cdot 2^0 + 1 \cdot 2^{-1} + 1 \cdot 2^{-2}$$

↓

$$\text{Value} = 1 \cdot (4) + 0 \cdot (2) + 1 \cdot (1) + 1 \cdot (1/2) + 1 \cdot (1/4)$$

↓

$$\text{Value} = 4 + 0 + 1 + 0.5 + 0.25$$

↓

$$\text{Value} = 5.75_{10}$$

De base 8 a base 10

Example: Convert  $17.17_8$  to Decimal:

	<b>1</b>	<b>7</b>	<b>.</b>	<b>1</b>	<b>7</b> <sub>8</sub>
	↓	↓		↓	↓
Position (p) →	<b>1</b>	<b>0</b>		<b>-1</b>	<b>-2</b>
	↓	↓		↓	↓
Weight →	<b>(8)<sup>1</sup></b>	<b>(8)<sup>0</sup></b>		<b>(8)<sup>-1</sup></b>	<b>(8)<sup>-2</sup></b>

↓

$$\text{Value} = \sum_{i=-2}^1 d_i \cdot 8^i$$

↓

$$\text{Value} = 1 \cdot 8^1 + 7 \cdot 8^0 + 1 \cdot 8^{-1} + 7 \cdot 8^{-2}$$

↓

$$\text{Value} = 1 \cdot (8) + 7 \cdot (1) + 1 \cdot (1/8) + 7 \cdot (1/64)$$

↓

$$\text{Value} = 8 + 7 + 0.125 + 0.109375$$

↓

$$\text{Value} = 15.234375_{10}$$

## De base 16 a base 10

Example: Convert  $1AB.EF_{16}$  to Decimal:

	<b>1</b>	<b>A</b>	<b>B</b>	<b>.</b>	<b>E</b>	<b>F</b> <sub>16</sub>
	↓	↓	↓	↓	↓	↓
Position (p) →	2	1	0	-1	-2	
	↓	↓	↓	↓	↓	↓
Weight →	$(16)^2$	$(16)^1$	$(16)^0$	$(16)^{-1}$	$(16)^{-2}$	

↓

$$\text{Value} = \sum_{i=-2}^2 d_i \cdot 16^i$$

↓

$$\text{Value} = 1 \cdot 16^2 + A \cdot 16^1 + B \cdot 16^0 + E \cdot 16^{-1} + F \cdot 16^{-2}$$

↓

$$\text{Value} = 1 \cdot (256) + 10 \cdot (16) + 11 \cdot (1) + 14 \cdot (1/16) + 15 \cdot (1/256)$$

↓

$$\text{Value} = 256 + 160 + 11 + 0.875 + 0.05859375$$

↓

$$\text{Value} = 427.93359375_{10}$$

## De base 10 a base 2

Example: Convert  $11.375_{10}$  to Binary:

**11.375<sub>10</sub>**

Part 1: Converting the whole number portion:

		<u>Quotient</u>	<u>Remainder</u>	
Step 1:	$2 \overline{) 11}$	5	1	LSB
Step 2:	$2 \overline{) 5}$	2	1	Next highest order bit
Step 3:	$2 \overline{) 2}$	1	0	Next highest order bit
Step 4:	$2 \overline{) 1}$	0	1	MSB
		Done		
			Converted Whole Number = 1011 <sub>2</sub>	

Part 2: Converting the fractional number portion:

		<u>Product</u>	<u>Whole Number</u>	
Step 1:	$2 \cdot (0.375)$	0.75	0	MSB
Step 2:	$2 \cdot (0.75)$	1.50	1	Next lower order bit
Step 3:	$2 \cdot (0.5)$	1.00	1	LSB
		Done		
			Converted Fractional Number = .011 <sub>2</sub>	

Part 3: Combine the two components to form the new number:

**1011.011<sub>2</sub>**

## De base 10 a base 8

Example: Convert  $10.4_{10}$  to Octal with an Accuracy of 4 fractional digits:

**$10.4_{10}$**

Part 1: Converting the whole number portion:

	<u>Quotient</u>	<u>Remainder</u>	
Step 1: $8 \overline{) 10}$	1	2	Least significant digit
Step 2: $8 \overline{) 1}$	0	1	Most significant digit
	Done	Converted Whole Number = $12_8$	

Part 2: Converting the fractional number portion:

	<u>Product</u>	<u>Whole Number</u>	
Step 1: $8 \cdot (0.4)$	3.2	3	Most significant digit
Step 2: $8 \cdot (0.2)$	1.6	1	Next lower order digit
Step 3: $8 \cdot (0.6)$	4.8	4	Next lower order digit
Step 4: $8 \cdot (0.8)$	6.4	6	Least significant digit
	Done because we have achieved the desired accuracy	Converted Fractional Number = $.3146_8$	

Part 3: Combine the two components to form the new number:

**$12.3146_8$**

## De base 10 a base 16

Example: Convert  $254.655_{10}$  to Hexadecimal with an Accuracy of 3 fractional digits:

**$254.655_{10}$**

Part 1: Converting the whole number portion:

		<u>Quotient</u>	<u>Remainder</u>	
Step 1:	$16 \overline{)254}$	15 ( $F_{16}$ )	14 ( $E_{16}$ )	Least significant digit
Step 2:	$16 \overline{)15}$	0	15 ( $F_{16}$ )	Most significant digit
		Done	Converted Whole Number = $FE_{16}$	

Part 2: Converting the fractional number portion:

		<u>Product</u>	<u>Whole Number</u>	
Step 1:	$16 \cdot (0.655)$	<u>10.48</u>	10 ( $A_{16}$ )	Most significant digit
Step 2:	$16 \cdot (0.48)$	<u>7.68</u>	7	Next lower order digit
Step 3:	$16 \cdot (0.68)$	<u>10.88</u>	10 ( $A_{16}$ )	Least significant digit
		Done because we have achieved the desired accuracy	Converted Fractional Number = $.A7A_{16}$	

Part 3: Combine the two components to form the new number:

**$FE.A7A_{16}$**

# CONVERSIÓN ENTRE LAS BASES 2, 8 Y 16 SIN PASAR POR BASE 10

## De base 2 a base 8

Example: Convert  $10111.01_2$  to Octal:

$10111.01_2$

Part 1: Form groups of 3 bits representing octal symbols.

$(010)(111).(010)_2$

↓ ↓ ↓

Whole number groupings start at the radix point and work left. Leading 0's are added as necessary.

Fractional number groupings start at the radix point and work right. Trailing 0's are added as necessary.

Part 2: Perform a direct substitution of the bit groupings with the equivalent octal symbol.

$(010)(111).(010)_2$

↘ ↘ ↘

$27.2_8$

## De base 8 a base 2

Example: Convert  $347.12_8$  to Binary:

$347.12_8$

Part 1: Each of the octal symbols is replaced with its 3 bit binary equivalent.

$347.12_8$

↙ ↘ ↙ ↘ ↙ ↘ ↙ ↘ ↙ ↘

$(011)(100)(111).(001)(010)_2$

↖ ↗ ↖ ↗ ↖ ↗ ↖ ↗ ↖ ↗

Leading and Trailing 0's can be removed

↓

$11100111.00101_2$

## De base 2 a base 16

Example: Convert  $111011.11111_2$  to Hexadecimal:

**$111011.11111_2$**

Part 1: Form groups of 4 bits representing hex symbols.

**$(0011)(1011).(1111)(1000)_2$**

Whole number groupings start at the radix point and work left. Leading 0's are added as necessary.

Fractional number groupings start at the radix point and work right. Trailing 0's are added as necessary.

Part 2: Perform a direct substitution of the bit groupings with the equivalent hex symbol.

**$(0011)(1011).(1111)(1000)_2$**

**$3B.F8_{16}$**

## De base 16 a base 2

Example: Convert  $1B.A_{16}$  to Binary:

Part 1: Each of the hex symbols is replaced with its 4 bit binary equivalent.

**$1B.A_{16}$**   
 **$(0001)(1011).(1010)_2$**

Part 2: Leading and trailing zeros can be removed.

**$11011.101_2$**