January 8, 2026

Base 2, 8, 16

Binary $(\overset{7}{1}\overset{6}{1}\overset{5}{1}\overset{4}{1}\overset{3}{1}\overset{2}{1}\overset{1}{1}\overset{0}{1})_2 \to (\quad)_{10}$

$$1\cdot 2^7 + 1\cdot 2^6 + 1\cdot 2^5 + 1\cdot 2^4 + 1\cdot 2^3 + 1\cdot 2^2 + 1\cdot 2^1 + 1\cdot 2^0$$

$$= 128 + 64 + 32 + 16 + 8 + 4 + 2 + 1 =$$

$$= 255_{10}$$

$$(\overset{2}{3}\overset{1}{7}\overset{0}{7})_8 = 3\cdot 8^2 + 7\cdot 8^1 + 7\cdot 8^0 = 255_{10}$$

$$(\overset{1}{F}\overset{0}{F})_{16} \to (\quad)_{10}$$

base 16:

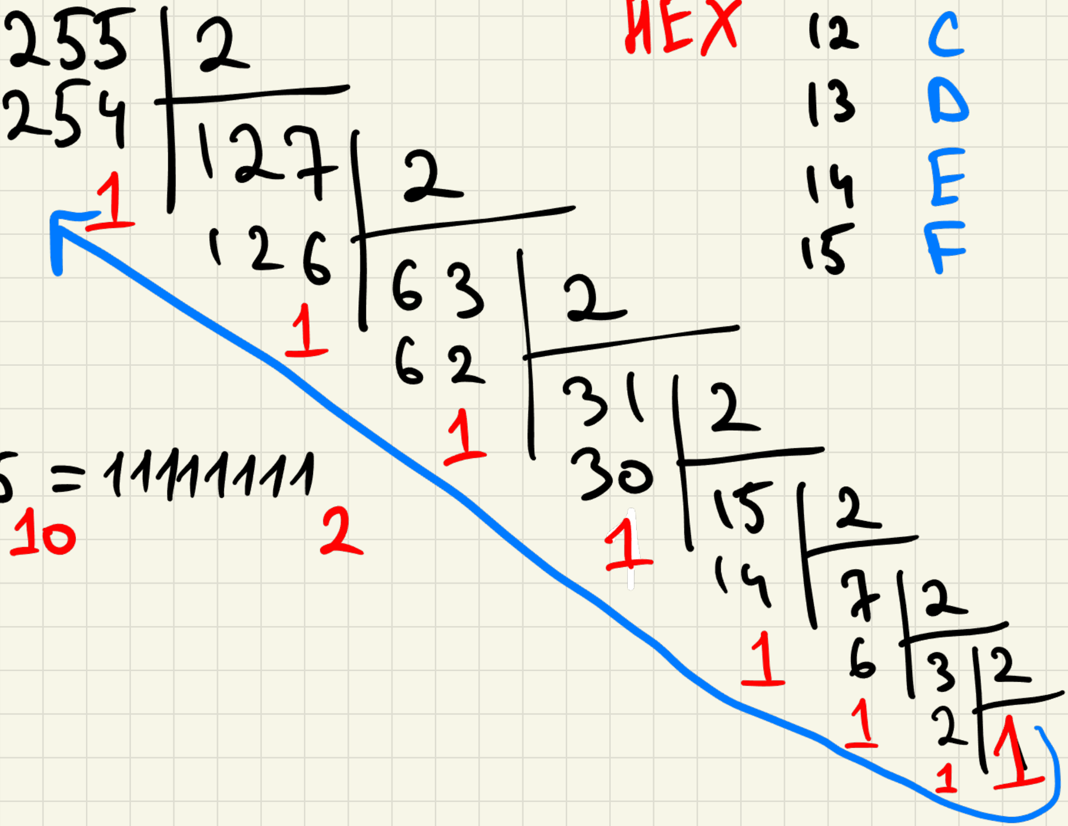
$$16^{1} \cdot F + 16^{0} \cdot F = 16 \cdot 15 + 15 = 255_{10}$$

Decimal

$$\begin{tikzcd}
 & (\quad)_{2} \\
(\qquad)_{10} \arrow[ur] \arrow[r] \arrow[dr] & (\quad)_{8} \\
 & (\quad)_{16}
\end{tikzcd}$$

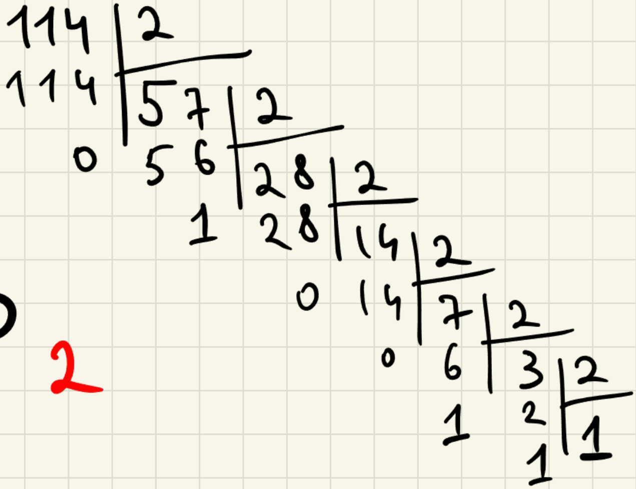
HEX

10	A
11	B
12	C
13	D
14	E
15	F



$255_{10} = 11111111_{2}$

114_{10}



1110010_2

$(0.12)_{10} \rightarrow (\quad)_2 = (.000111)_2$

$0.12 \times 2 = \underbrace{0}.24$	0
$0.24 \times 2 = \underbrace{0}.48$	0
$0.48 \times 2 = \underbrace{0}.96$	0
$0.96 \times 2 = 1.\underbrace{92}$	1
$0.92 \times 2 = 1.\underbrace{84}$	1
$0.84 \times 2 = 1.68$	1

just fraction

Dec.	Binary		Dec.	Binary
1	0001		9	1001
2	0010	A	10	1010
3	0011	B	11	1011
4	0100	C	12	1100
5	0101	D	13	1101
6	0110	E	14	1110
7	0111	F	15	1111
8	1000			
		Hex.		

Binary addition

$$\begin{array}{rr} + & 01100 \\ & \underline{10001} \\ & \boxed{11101} \end{array}$$

$$\begin{array}{cccccc} 1 & & 1 & 1 & & \\ + & 1 & 0 & 1 & 1 & 0 \\ & 1 & 0 & 1 & 1 & 1 \\ \hline \underbrace{1}_{} & [0 & 1 & 1 & 0 & 1] \end{array}$$

$$(1)_2 + (1)_2 = (10)_2$$

$$(10)_2 + (1)_2 = (11)_2$$

It is overflow, machine should know that It is overflow

Binary subtraction

$$\begin{array}{r} 0 \\ -\,0 \\ \hline 0 \end{array} \qquad \begin{array}{r} 1 \\ -\,1 \\ \hline 0 \end{array} \qquad \begin{array}{r} 1 \\ -\,0 \\ \hline 1 \end{array} \qquad \begin{array}{r} 1\leftarrow \quad \\ 0 \\ -\,1 \\ \hline 1 \end{array}$$

$$\begin{array}{r} 10110 \\ -\,10010 \\ \hline 00100 \end{array} \qquad \begin{array}{r} 10110 \\ -\,10011 \\ \hline 00011 \end{array}$$

1's complement

$(10101111)_2$ logic operation

1's compliment is inverse of digits

(01010000) 1's comp.

$+\quad 1$

(01010001) 2's compliment

$(0101)_2 = (5)_{10}$