

Binary!

$$1209_{[10]} = 1 \times 10^3 + 2 \times 10^2 + 0 \times 10^1 + 9 \times 10^0$$

$$100101_{[2]} = 1 \times 2^5 + 0 \times 2^4 + 0 \times 2^3 + 1 \times 2^2 + 0 \times 2^1 + 1 \times 2^0$$

$$(b_{n-1} b_{n-2} \dots b_1 b_0)_{[2]} = b_{n-1} \times 2^{n-1} + b_{n-2} \times 2^{n-2} + \dots \\ + b_2 \times 2^2 + b_1 \times 2^1 + b_0 \times 2^0$$

$$= 2 \times (b_{n-1} \times 2^{n-2} + b_{n-2} \times 2^{n-3} + \dots + b_2 \times 2^1 + b_1 \times 2^0) + b_0$$

$$= 2 \times (2 \times (b_{n-1} \times 2^{n-3} + b_{n-2} \times 2^{n-4} + \dots + b_2 \times 2^0) + b_1) + b_0$$

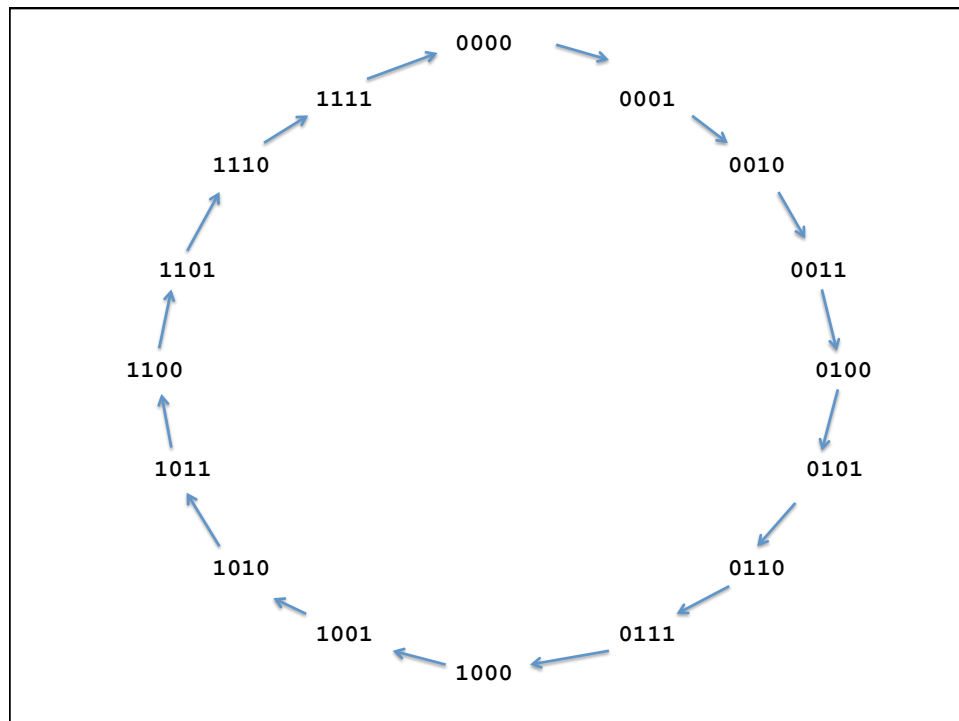
$$= 2 \times (2 \times (2 \times (\dots (2 \times b_{n-1} + b_{n-2}) + \dots) + b_2) + b_1) + b_0$$

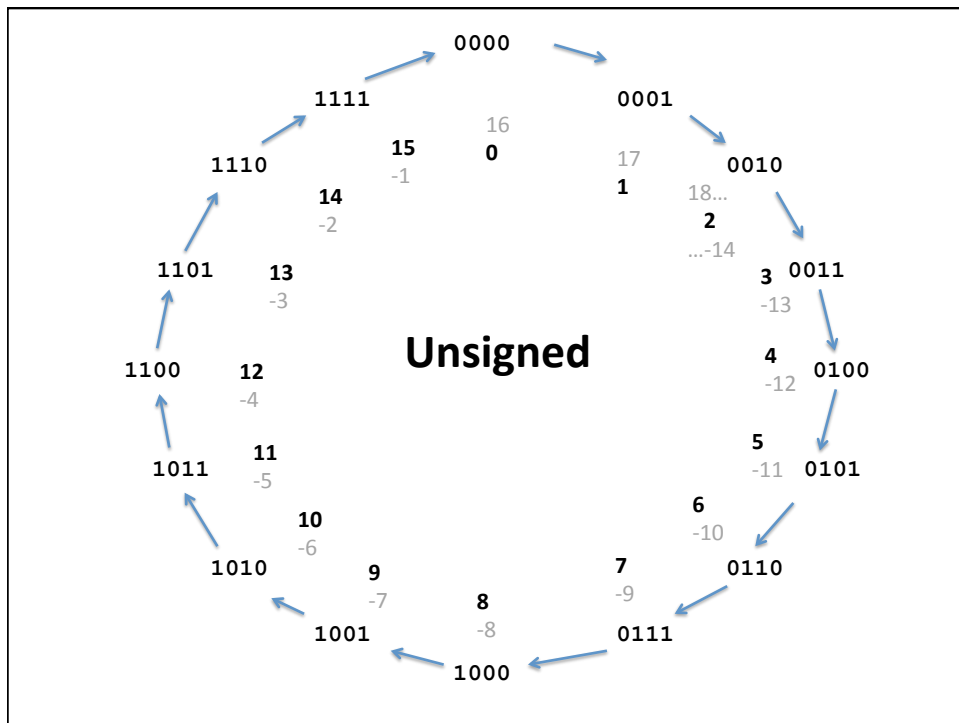
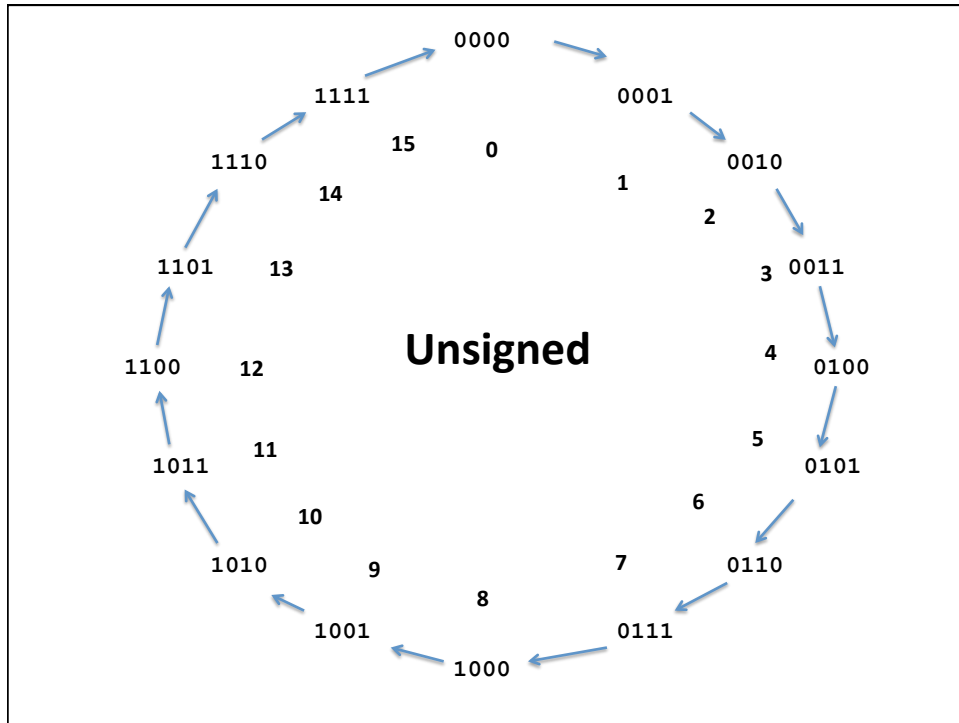
Modular arithmetic

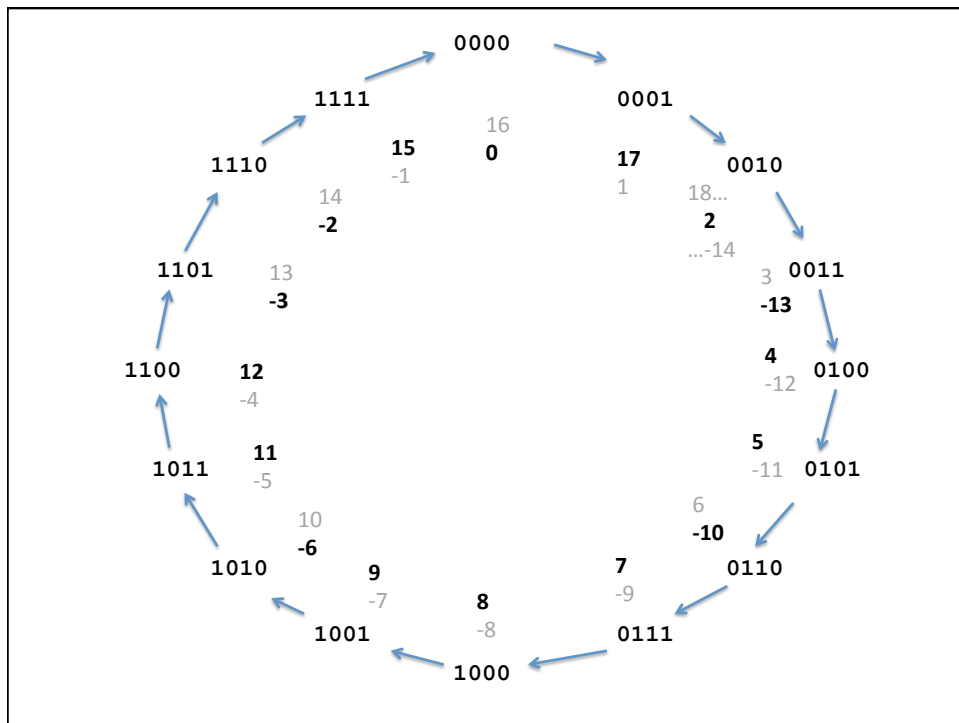
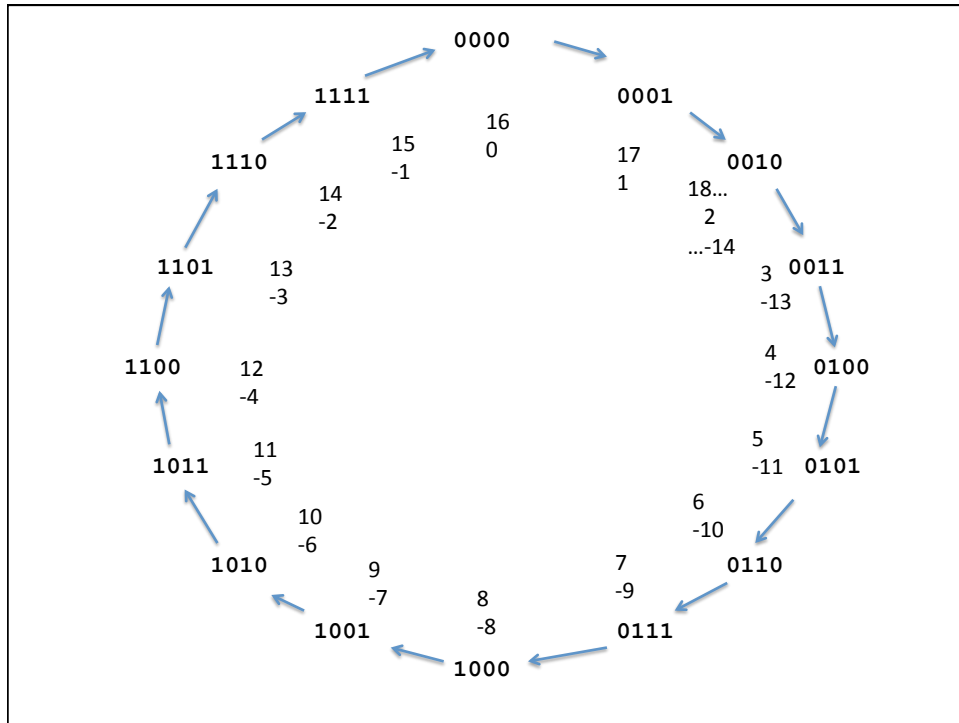
$\begin{array}{r} 1111 \\ 01101010 \quad (106) \\ + 10101010 \quad (170) \\ \hline 100010100 \quad (276) \end{array}$	$\begin{array}{r} 01101010 \quad (106) \\ \times 10101010 \quad (170) \\ \hline 00000000 \\ 01101010 \\ 00000000 \\ 01101010 \\ 00000000 \\ 01101010 \\ 00000000 \\ + 01101010 \\ \hline 100011001100100 \quad (18020) \end{array}$
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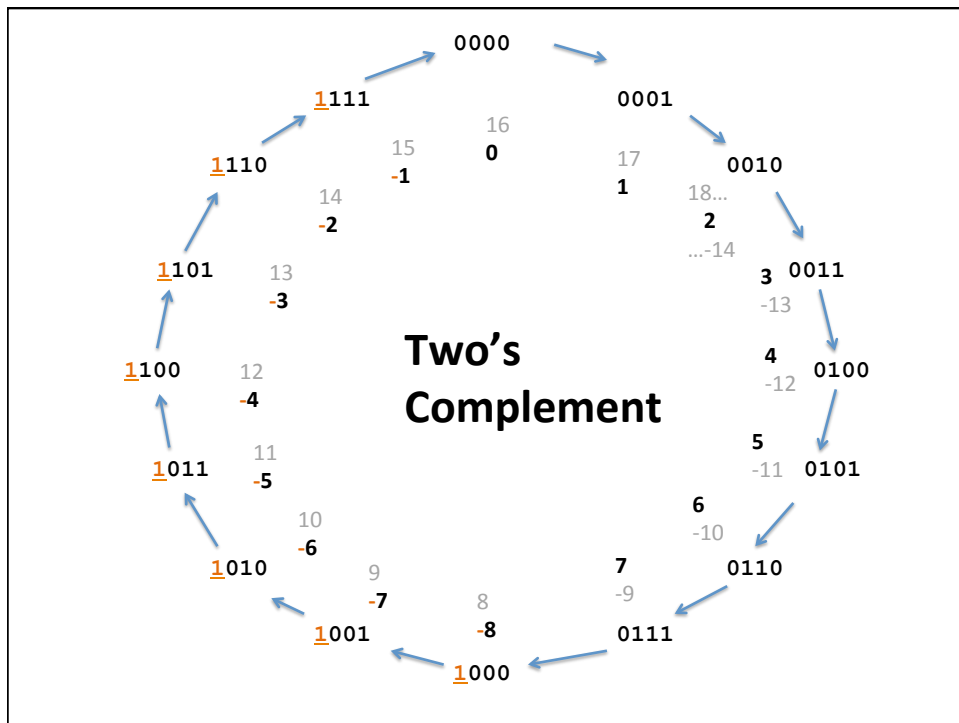
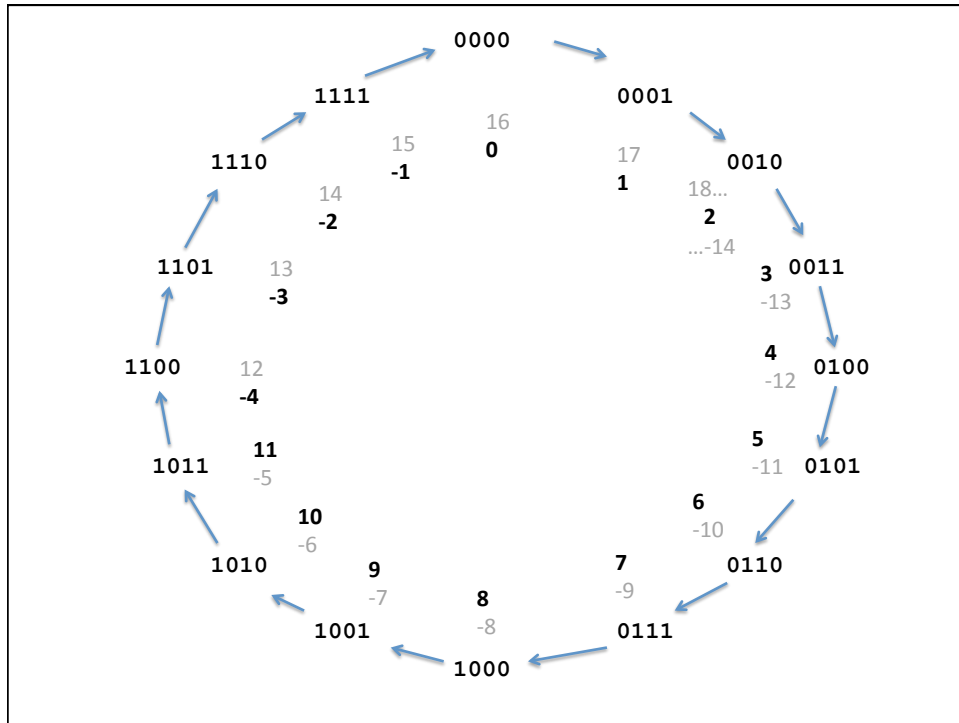
Modular arithmetic

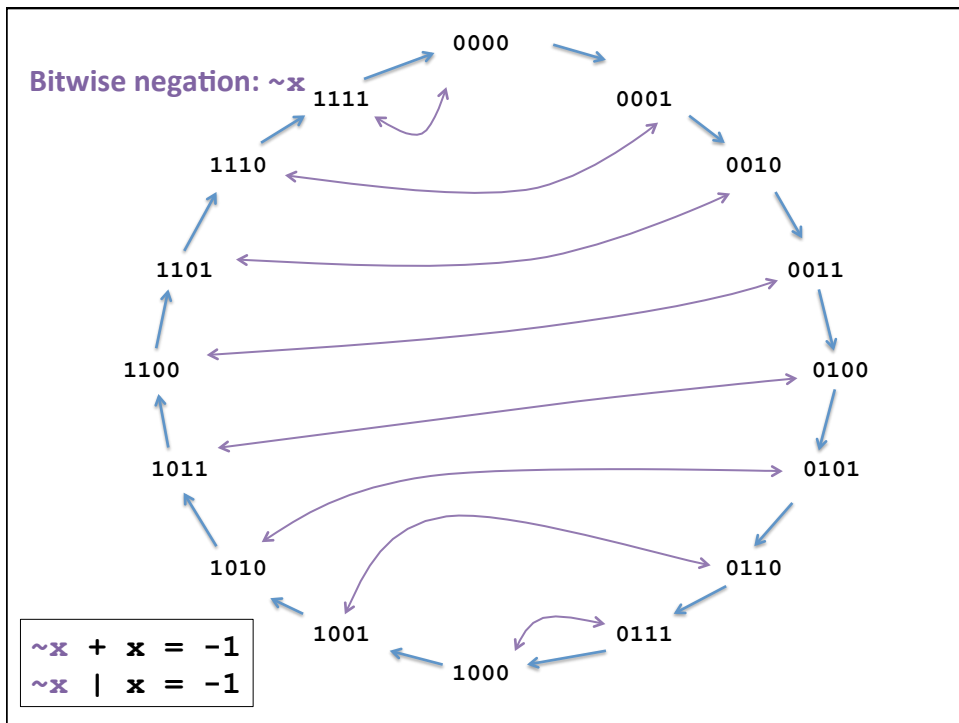
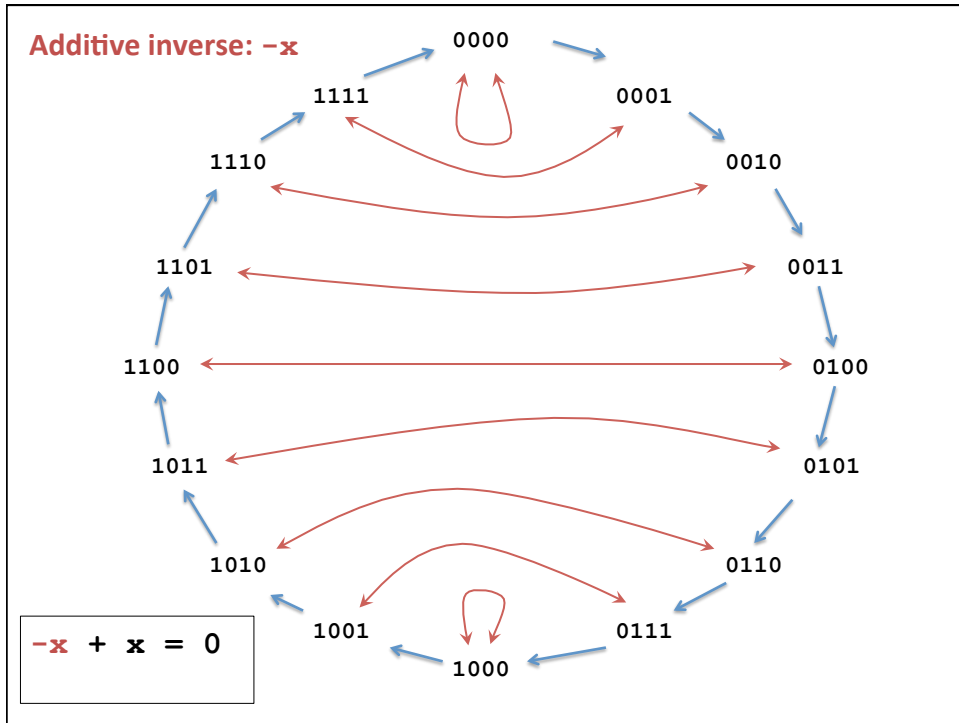
$$\begin{array}{r}
 1111 \\
 01101010 \quad (106) \\
 + 10101010 \quad (170) \\
 \hline
 100010100 \quad (276) \\
 \\
 00010100 \quad (20)
 \end{array}
 \qquad
 \begin{array}{r}
 01101010 \quad (106) \\
 \times 10101010 \quad (170) \\
 \hline
 00000000 \\
 01101010 \\
 00000000 \\
 01101010 \\
 00000000 \\
 01101010 \\
 00000000 \\
 + 01101010 \\
 \hline
 100011001100100 \quad (18020) \\
 \\
 01100100 \quad (100)
 \end{array}$$

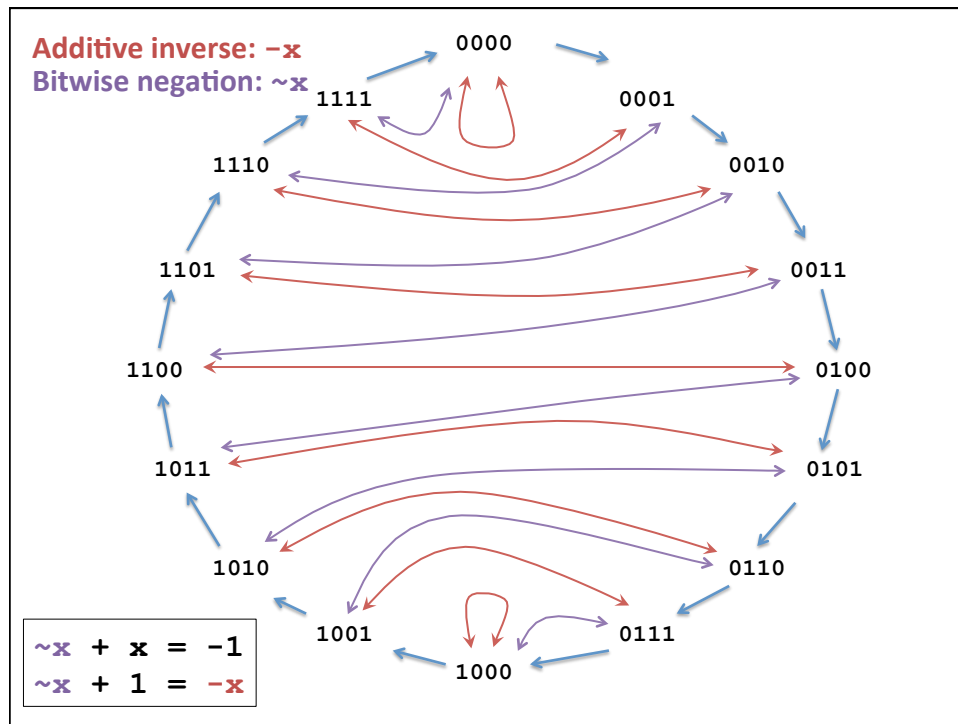












Hexadecimal (base 16)

• $0_{[16]}$	$0000_{[2]}$	$0_{[10]}$	• $8_{[16]}$	$1000_{[2]}$	$8_{[10]}$
• $1_{[16]}$	$0001_{[2]}$	$1_{[10]}$	• $9_{[16]}$	$1001_{[2]}$	$9_{[10]}$
• $2_{[16]}$	$0010_{[2]}$	$2_{[10]}$	• $A_{[16]}$	$1010_{[2]}$	$10_{[10]}$
• $3_{[16]}$	$0011_{[2]}$	$3_{[10]}$	• $B_{[16]}$	$1011_{[2]}$	$11_{[10]}$
• $4_{[16]}$	$0100_{[2]}$	$4_{[10]}$	• $C_{[16]}$	$1100_{[2]}$	$12_{[10]}$
• $5_{[16]}$	$0101_{[2]}$	$5_{[10]}$	• $D_{[16]}$	$1101_{[2]}$	$13_{[10]}$
• $6_{[16]}$	$0110_{[2]}$	$6_{[10]}$	• $E_{[16]}$	$1110_{[2]}$	$14_{[10]}$
• $7_{[16]}$	$0111_{[2]}$	$7_{[10]}$	• $F_{[16]}$	$1111_{[2]}$	$15_{[10]}$

Hexadecimal

$$\begin{aligned}0 * 16 + C &= 12 \\12 * 16 + 0 &= 192 \\192 * 16 + F &= 3087 \\3087 * 16 + A &= 49402 \\49402 * 16 + C &= 790444 \\790444 * 16 + E &= 12647119\end{aligned}$$

Hexadecimal

$$\begin{aligned}0 * 16 + C &= 12 \\12 * 16 + 0 &= 192 \\192 * 16 + F &= 3087 \\3087 * 16 + A &= 49402 \\49402 * 16 + C &= 790444 \\790444 * 16 + E &= 12647119\end{aligned}$$

```
--> 0xC0FACE  
12647118 (int)  
--> int2hex(12647118);  
"00C0FACE" (string)
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