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Decimal

$\# = d_{n-1} \cdots d_2 d_1 d_0$

computer

$\# = 123$

$\# = 1 \times 10^2 + 2 \times 10^1 + 3 \times 10^0$

Base 10

0, ... , 9

binary $\# = b_{n-1} \cdots b_1 b_0$

2^{n-1} 2^1 2^0

binary (unsigned) = 01101 the decimal equivalent

2^4	2^3	2^2	2^1	2^0
16	8	4	2	1

$= 13$

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$123_{10} \rightarrow$ binary (base 2)

128	64	32	16	8	4	2	1
0	1	1	1	1	0	1	1

11_{10}

123
−64
59
32
27
16
11
8
3

2 | 123		LSB
2 | 61	1	
2 | 30	1	
2 | 15	0	
2 | 7	1	
2 | 3	1	
2 | 1	1	
0	1	MSB

$(1111011)_2$

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$173_{10} \longrightarrow$ binary

256 128 64 32 16 8 4 2 1

0 1 0 1 0 1 1 0 1

6 10

173

-128

45

32

13

8

5

$(01010110 1)_2$

2 | 173

32-bit

01010110 1

hex (group 4 binary values)

fr LSB → msB

$(01010110 1)_2$

$(AD)_{16}$

0 1010 1101

A D

16

0 → 15

0 → 9, A, B, C, D, E, F

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$(AD)_{16}$

$(10101101)_2$

Octal (group 3 bits, from LSB → MSB)

↓

0 → 7

10 101 101

? 2 5 5

$(AD)_{16} \stackrel{?}{=} (10101101)_2 \stackrel{?}{=} (255)_8$

8^2 8^1 8^0

Value of $(173)_8$ in decimal ?

$(173)_8 = 1 \times 8^2 + 7 \times 8^1 + 3 \times 8^0$

$= 64 + 56 + 3 = (123)_{10}$

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Value of $(7B)_{16}$ in decimal?

$$(7B)_{16} = 7 \times 16^1 + B \times 16^0$$

$$= 112 + 11$$

$$= (123)_{10}$$

Determine decimal value of

(a) $(011101111110)_2 = (478)_{10}$

256 128 64 16 8 4 2

80 14

256
128
384
94
478

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decimal addition

$$\begin{array}{r} {\scriptstyle 1}7 \\ +\,8 \\ \hline 15 \end{array}$$

Binary

$$\begin{array}{r} 0 \\ +\,0 \\ \hline 0 \end{array} \qquad \begin{array}{r} 0 \\ +\,1 \\ \hline 1 \end{array} \qquad \begin{array}{r} 1 \\ +\,0 \\ \hline 1 \end{array}$$

$$\begin{array}{r} {\scriptstyle 1} \\ +\,1 \\ \hline 10 \end{array}$$

$2^1 \quad 2^0$

$(10)_2 = 2_{10}$

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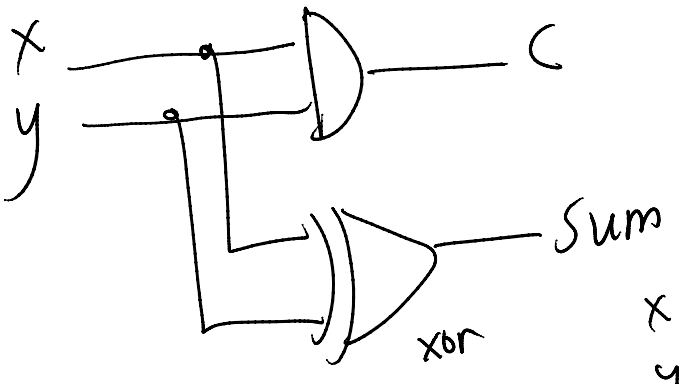
X	y	C	Sum
0	0	0	0
0	1	0	1
1	0	0	1
1	1	1	0

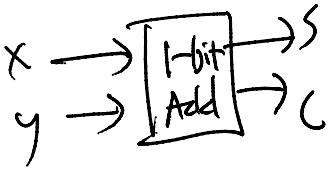
$C = xy$

$Sum = \bar{x}y + x\bar{y}$

$= x \oplus y$



1-bit adder



$A = a_3 a_2 a_1 a_0$

$B = b_3 b_2 b_1 b_0$

A + B