

# Section 1.2: Binary and Hexadecimal

Wednesday, January 8, 2020 12:10 PM

binary = base 2, so only two digits (0, 1)

decimal	binary
0	0
1	1
2	$10_2$
3	$11_2$
4	$100_2$
5	$101_2$
6	$110_2$
7	$111_2$
8	$1000_2$
9	$1001_2$
10	$1010_2$

example: convert the following binary numbers into decimal:

$$\begin{aligned} \text{a) } 1010_2 &= 1 \times 2^3 + 0 \times 2^2 + 1 \times 2^1 + 0 \times 2^0 \\ &= 8 + 0 + 2 + 0 \\ &= 10 \end{aligned}$$

← could omit →

$$\begin{aligned} \text{b) } 101110_2 &= 1 \times 2^5 + 0 \times 2^4 + 1 \times 2^3 + 1 \times 2^2 + 1 \times 2^1 + 0 \times 2^0 \\ &= 32 + 0 + 8 + 4 + 2 + 0 \\ &= 46 \end{aligned}$$

---

2020/01/09

hexadecimal = base 16

decimal	hexadecimal
0	0
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
10	$A_{16}$
11	$B_{16}$
12	$C_{16}$
13	$D_{16}$
14	$E_{16}$
15	$F_{16}$
16	$10_{16}$
17	$11_{16}$
18	$12_{16}$
19	$13_{16}$
20	$14_{16}$

So, in hexadecimal:

$$A_{16} = 10$$

$$B_{16} = 11$$

$$C_{16} = 12$$

$$D_{16} = 13$$

$$E_{16} = 14$$

$$F_{16} = 15$$

so  $DEAD_{16}$  is a number! what is it in decimal?

$$\begin{aligned} DEAD_{16} &= D \times 16^3 + E \times 16^2 + A \times 16^1 + D \times 16^0 \quad \leftarrow \text{can skip this step} \\ &= 13 \times 16^3 + 14 \times 16^2 + 10 \times 16^1 + 13 \times 16^0 \\ &= 57005 \end{aligned}$$

example: convert the following numbers to decimal:

$$\begin{aligned} \text{a) } 15_{16} &= 1 \times 16^1 + 5 \times 16^0 \\ &= 21 \end{aligned}$$

$$\begin{aligned} \text{b) } 2B_{16} &= 2 \times 16^1 + B \times 16^0 \\ &= 2 \times 16^1 + 11 \times 16^0 = 43 \end{aligned}$$

$$\begin{aligned} \text{c) } C3_{16} &= C \times 16^1 + 3 \times 16^0 \\ &= 12 \times 16 + 3 \\ &= 195 \end{aligned}$$

$$\begin{aligned} \text{d) } 98003_{16} &= 9 \times 16^4 + 8 \times 16^3 + 0 + 0 + 3 \\ &= 622\ 595 \end{aligned}$$

$$\begin{aligned} \text{e) } 8055_{16} &= 8 \times 16^3 + 0 + 5 \times 16^1 + 5 \times 16^0 \\ &= 11 \times 16^3 + 0 + 5 \times 16 + 5 \\ &= 45\ 141 \end{aligned}$$

*(Note: In the original image, arrows point from the digits 8, 0, 5, 5 in 8055 to the powers 3, 2, 1, 0 respectively.)*