

Number Systems + Conversion

Given system base n

- number digits: n
- number range: $0 \rightarrow n-1$

→ units

n^3	n^2	n^1	n^0
↓	↓	↓	↓
—	—	—	—

base 10 (decimal)

- num digits: 10
- range: 0-9

units

10^2	10^1	10^0
↓	↓	↓
—	—	—

hundreds tens ones

$$376 \rightarrow 3 \times 10^2 + 7 \times 10^1 + 6 \times 10^0 = 376$$

base 2 (binary)

- num digits: 2
- range: 0-1

units

2^4	2^3	2^2	2^1	2^0
↓	↓	↓	↓	↓
—	—	—	—	—

$$1011 \rightarrow 1 \times 2^3 + 0 \times 2^2 + 1 \times 2^1 + 1 \times 2^0$$
$$\rightarrow 1 \times 8 + 0 \times 4 + 1 \times 2 + 1 \times 1 = 8 + 3 = 11_{10}$$

base 16 (hexadecimal)

→ num digits: 16

→ range: 0-9, A → F A=10, B=11, ...

units: $\begin{array}{ccc} 16^2 & 16^1 & 16^0 \\ \downarrow & \downarrow & \downarrow \\ \hline & & \end{array}$

$$62_{16} \rightarrow 6 \times 16^1 + 2 \times 16^0 = 96 + 2 = 98_{10}$$

$$3B_{16} \rightarrow 3 \times 16^1 + 11 \times 16^0 = 48 + 11 = 59_{10}$$

max hex digit → F

$$\text{binary} \rightarrow 1111 \rightarrow 8 + 4 + 2 + 1 = 15_{10}$$