EECS 281, 1/13/15

CH2 Number systems

$$1734 = 1 \times 1000 + 7 \times 100 + 3 \times 10 + 4 \times 1$$

$$\text{SI } 8.68 = 5 \times 10^{2} + 1 \times 10^{1} + 8 \times 10^{0} + 6 \times 10^{-1} + 8 \times 10^{-2}$$

In general : $d_1 d_0 . d_{-1} d_{-2}$

$$D = d_1 \times 10^{1} + d_0 10^{0} + d_{-1} 10^{-1} + d_{-2} 10^{-2}$$

Base or radix of the number system = 10.

Radix r may be any integer

$$r \geq 2$$

$$d_{p-1} \; d_{p-2} \; \cdots \; d_1 \; d_0 \; . \; d_{-1} \; d_{-2} \; \cdots \; d_{-n}$$

↑ radix point

Value of the number

$$D = \sum_{i=-n}^{p-1} d_i r^i = d_{p-1} \cdot r^{p-1} + \dots + d_1 r^1 + d_0 r^0$$

left most digit : high-order / most significant digit

right most digit : low-order / least significant digit.

Signals have two conditions!

low / high, charged / discharged, off / on

⇒ represent using binary digits / bits with two values:

0 and 1.

Binary radix ($r = 2$) is used to represent numbers in a digital system.

$$b_{p-1}\, b_{p-2} \dots b_0 . b_{-1}\, b_{-2} \dots b_{-n}$$

↑ binary point

$$B = \sum_{i=-n}^{p-1} b_i \, 2^i$$

$$10011_2 = 1 \times 2^4 + 0 \times 2^3 + 0 \times 2^2 + 1 \times 2^1 + 1 \times 2^0 = 19_{10}$$

MSB LSB

$$101.001_2 = 1 \times 4 + 0 \times 2 + 1 \times 1 + 0 \times 2^{-1} + 0 \times 2^{-2} + 1 \times 2^{-3} = 5.125_{10}$$

$2^{-3} = 0,125$