

# Elen 2006 — Microprocessors

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## Number systems

37854.25

Base: Order of the numeral.

Numeral: Symbol of the digit

Digit: (see numeral).

$$\text{Max (Numeral)} = \text{Base} - 1$$

Order: weight of the base for a specific numeral.

$$37854.25 = 3 \times 10^4 + 7 \times 10^3 + 8 \times 10^2 + 5 \times 10^1 + 4 \times 10^0 + 2 \times 10^{-1} + 5 \times 10^{-2}$$

$$y = \sum_{i=-m}^n a_i b^i \quad n, m, i \in \mathbb{N}_0$$

Resolution/precision:  $-m$

$$\text{Max}(y) = b^{n+1} - b^{-m}$$

Binary "10" kinds of people...

$$\boxed{10_2 = 1 \times 2^1 + 0 \times 2^0}$$

$$\begin{aligned} 0101101_2 &= 0 \times 2^7 + 1 \times 2^6 + 1 \times 2^5 + 0 \times 2^4 + 1 \times 2^3 \\ &\quad + 1 \times 2^2 + 0 \times 2^1 + 1 \times 2^0 \\ &= 109_{10} \end{aligned}$$

$$72_{10} = 2 \overline{) 72} = 36 \text{ r } 0$$

$$18 \text{ r } 0$$

$$9 \text{ r } 0$$

$$4 \text{ r } 1$$

$$2 \text{ r } 0$$

$$1 \text{ r } 0$$

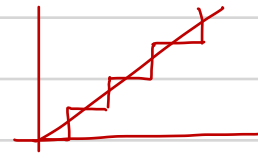
$$0 \text{ r } 1 \Rightarrow 1001000_2$$

$$41.3_{10} = 2^5 + 2^3 + 2^0 +$$

$$11.011 = 1 \times 2^1 + 1 \times 2^0 + 0 \times 2^{-1} + 1 \times 2^{-2} + 1 \times 2^{-3}$$

$$n = 5; m = 4 \quad (n+m+1 \text{ digits})$$

$$41.3 \approx 101001.0101$$



$$\text{Absolute error} = |\text{Converted} - \text{Actual}|$$

$$\text{Relative error} = \text{Absolute} / \text{Actual} \times 100$$

$$\text{Precision error} = \text{Absolute} / b^{-m} \quad (\text{NB: } < 1)$$

## Binary addition

$$11_2 + 10_2 = 101$$

$$\begin{array}{r} 11 \\ +10 \\ \hline 101 \end{array}$$

$$110110_2 + 111_2 = 1000101_2$$

$$\begin{array}{r} 11110110 \\ +001111 \\ \hline 1000101 \end{array}$$

$$1000101$$

$$1000101$$

$$n = 6 \quad m = 0$$

$$\mathbb{Q}_{n,m} = \mathbb{Q}_6$$

$$110.001_2 + 11.1_2$$

NB: Align on radix

$$\begin{array}{r} 110.001 \\ + 11.100 \\ \hline 1001.101 \end{array}$$