Base-10

Decimal!

Base-10 A Familiar Number System

- You've grown up with the **Decimal**, or Base10, number system
- Digits Set $\{0, 1, 2, \ldots, 9\}$
  - How many digits total?
- High-order place values come before low-order
  - 500_{10} is 5×10^2 - Five hundred
  - 050_{10} is 5×10^1 - Fifty
  - 005_{10} is 5×10^0 - Five
- Incrementing a place value beyond 9 causes a **carry**
  - 09 + 01 is 10
    - the next higher-order place value increases by one
    - the lower-order place value resets back to zero

$Base_{10}$
00
01
02
03
04
05
06
07
08
09
10
11
12
13
14
15

Formalization of Base-10

Suppose we define a Base10 number d, with w place values, (w *stands for width*) as a vector of **decimal digits**:

$$\vec{d} = [d_{w-1}, d_{w-2}, \ldots, d_0]$$

We can determine the value of $\vec{d}$ with the following summation:

$$DecimalValue_w\left(\vec{d}\right) = \sum_{i=0}^{w-1} d_i 10^i$$

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A concrete example:

$$w = 3$$

$$\vec{d} = [2, 1, 1] \quad \textit{thus} \quad d_2 = 2,\ d_1 = 1,\ d_0 = 1$$

$$DecimalValue_3([2, 1, 1])$$

$$= \sum_{i=0}^{2} d_i 10^i$$

$$= d_0 \times 10^0 + d_1 \times 10^1 + d_2 \times 10^2$$

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

$$= 1 + 10 + 200$$

$$= 211$$