

## Positional numbering system

$\mathbb{Z}$  is a set of  $\{-\infty, \dots, 0, \dots, \infty\}$  integers

define an alphabet  $\Sigma$

A string  $X$  of  $n$  elements from  $\Sigma$ :  $X_n \in \Sigma^n$

Apply  $\Vdash$   $X_n$  to a valuation function

For a base-10 system (radix = 10):

$$\begin{aligned} 277_{10} &= \frac{10^2 | 10^1 | 10^0}{2 \quad 7 \quad 7} \\ &= 2(10^2) + 7(10) + 7(1) \end{aligned}$$

How do you choose a representation?

- representation of special values/cases (e.g. 0)
- range of values that can be represented
- efficiency of implementation (common operations?)

Unsigned integer representation:

$$V: X_{n-1} \cdot 2^{n-1} + X_{n-2} \cdot 2^{n-2} + \dots + X_0 \cdot 2^0$$

Range:  $2^n - 1$  (total  $2^n$ , but one is all 0s)  
Representation is good

Can overflow, so have to detect — carry.