

# Integers in different bases

decimal  
base 10

$$(1234)_{10} = 1 \cdot 10^3 + 2 \cdot 10^2 + 3 \cdot 10^1 + 4 \cdot 10^0$$

base b

$$(1234)_b = 1 \cdot b^3 + 2 \cdot b^2 + 3 \cdot b^1 + 4 \cdot b^0$$

$b \geq 5$       digits:  $0, 1, 2, \dots, b-1$

number  $\equiv$  its least significant digit in base b (mod b)

EG 25 in base 2

$$[25 = 16 + 8 + 1 = (11001)_2]$$

$$\begin{aligned} 25 &= 12 \cdot 2 + 1 \\ 12 &= 6 \cdot 2 + 0 \\ 6 &= 3 \cdot 2 + 0 \\ 3 &= 1 \cdot 2 + 1 \\ 1 &= 1 \end{aligned}$$

$$25 = (11001)_2$$

EG 49 in base 2

$$\begin{aligned} 49 &= 24 \cdot 2 + 1 \\ 24 &= 12 \cdot 2 + 0 \\ 12 &= 6 \cdot 2 + 0 \\ 6 &= 3 \cdot 2 + 0 \\ 3 &= 1 \cdot 2 + 1 \\ 1 &= 1 \end{aligned}$$

$$49 = (110001)_2$$

EG 49 in base 3

$$\begin{aligned} 49 &= 16 \cdot 3 + 1 \\ 16 &= 5 \cdot 3 + 1 \\ 5 &= 1 \cdot 3 + 2 \\ 1 &= 1 \end{aligned}$$

$$49 = (1211)_3$$