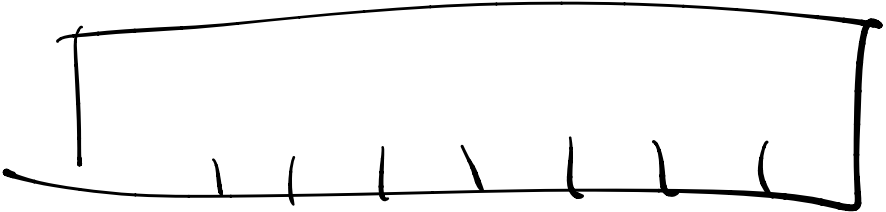


CS 208

M, 30 March 2026

bit — "binary digit"
a box that contains
either a 0 or a 1

byte — 
8 bits

Bases

Base ten
"decimal"

1 7 3
 10^2 10^1 10^0

$$1 \times 100 + 7 \times 10 + 3 \times 1$$

Symbols : 0 1 2 3 4 5 6 7 8 9

Binary ~

$$\begin{array}{ccccccc} 1 & 0 & 1 & 1 & 0 & 1 & 1 \\ 2^6 & 2^5 & 2^4 & 2^3 & 2^2 & 2^1 & 2^0 \\ 64 & 32 & 16 & 8 & 4 & 2 & 1 \end{array}$$

$$1 \times 2^6 + 0 \times 2^5 + 1 \times 2^4 + 1 \times 2^3 + 0 \times 2^2 + 1 \times 2^1 + 1 \times 2^0$$
$$64 + \quad \quad \quad 16 \quad + \quad 8 \quad + \quad 2 + 1$$

Symbols: 0 1 = 91_{ten}

10110_{two}
16 + 4 + 2

=

?
22_{ten}

$$173_{\text{ten}} = ?_{\text{two}}$$

Strategy:
start w/ highest
power of 2
 ≤ 173

$$173 = 2^7 + ?$$

$$= 128 + 45$$

$$= 128 + 32 + 13$$

$$= 128 + 32 + 8 + 5$$

$$= 128 + 32 + 8 + 4 + 1 \rightsquigarrow 10101101$$

$2^7 \quad 2^5$

Strategy:
Build binary R to L
use % + /

	173	% 2	=	1
↙ ₁₂	86	% 2	=	0
↙ ₁₂	43	% 2	=	1
	21	% 2	=	1
	10	% 2	=	0
	5	% 2	=	1
	2	% 2	=	0
	1	% 2	=	1

10101101



Hexadecimal Base 16

1010 | 1101 $\xrightarrow{\text{two}}$ AD $\xrightarrow{\text{sixteen}}$

A D

4-bit chunks
each gets one hexadecimal digit.

Symbols: 0 1 2 3 4 5 6 7 8 9 A B C D E F

10 11 12 13 14 15

Octal (base 8)

$$\begin{array}{|c|c|c|c|} \hline 1 & 0 & 1 & 1 \\ \hline \end{array} = 255_{\text{eight}}$$

The binary sequence 1011 is grouped into three octal digits: 10 (2), 01 (1), and 11 (3). The octal digits are 2, 5, and 5, which together form the octal number 255.

Symbols: 0 1 2 3 4 5 6 7

C language

```
int x = 173;
```

```
int x = 010101101;
```

```
int x = 0255;
```

```
int x = 0xAD;
```

```
int x = 0xad;
```

same data gets stored in x.