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"

173

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

$$1\,0\,1\,1\,0\,1\,1$$

$2^6\ 2^5\ 2^4\ 2^3\ 2^2\ 2^1\ 2^0$

64 32 16 8 4 2 1

$$1\times2^6 + 0\times2^5 + 1\times2^4 + 1\times2^3 + 0\times2^2 + 1\times2^1 + 1\times2^0$$

$$64 + 16 + 8 + 2 + 1$$

Symbols: 0 1 $= 91_{ten}$

$10110_{two} = ?_{ten}$

16 + 4 + 2

22_{ten}

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

Strategy: start w/ highest power of 2 ≤ 173

$173 = 2^7 + ?$

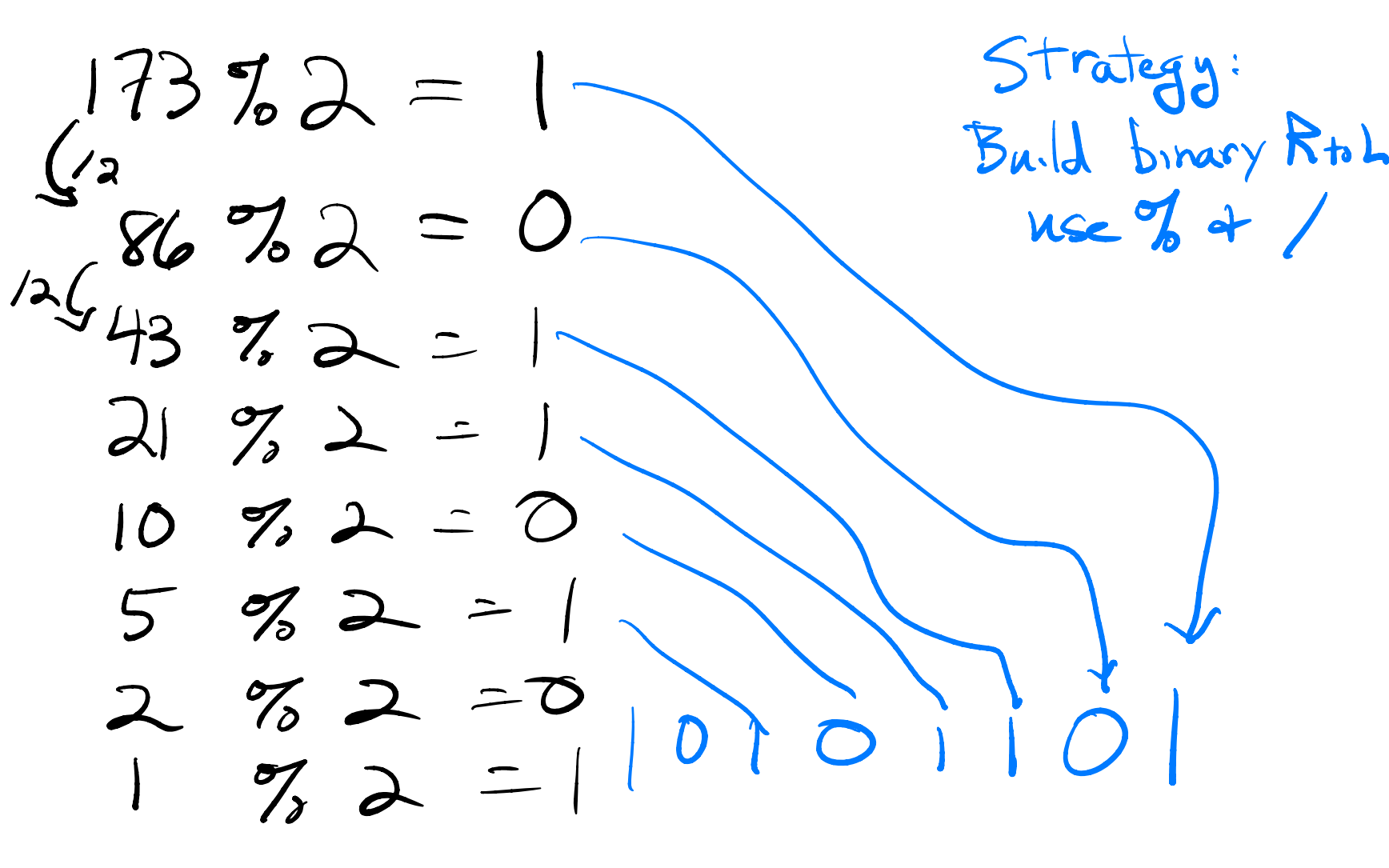
$= 128 + 45$

$= 128 + 32 + 13$

$= 128 + 32 + 8 + 5$

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

2^7 2^5


173 % 2 = 1
/2
86 % 2 = 0
/2
43 % 2 = 1
21 % 2 = 1
10 % 2 = 0
5 % 2 = 1
2 % 2 = 0
1 % 2 = 1
Strategy:
Build binary R to L
use % & /
1 0 1 0 1 1 0 1

Hexadecimal
Base 16

$$1010\,|\,1101_{two} \rightarrow AD_{sixteen}$$

A D

4-bit chunks
each gets one hexadecimal digit.

10 11 12 13 14 15

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

Octal (base 8)

$= 255_{eight}$

Symbols: 0 1 2 3 4 5 6 7

C language

```
int x = 173;
int x = 0b10101101;
int x = 0255;
int x = 0xAD;
int x = 0xad;
```

same data gets stored in x.