CS208

M, 6 Apr 2026

Integers

- represent in binary

  0b10110

- hex

  0x16

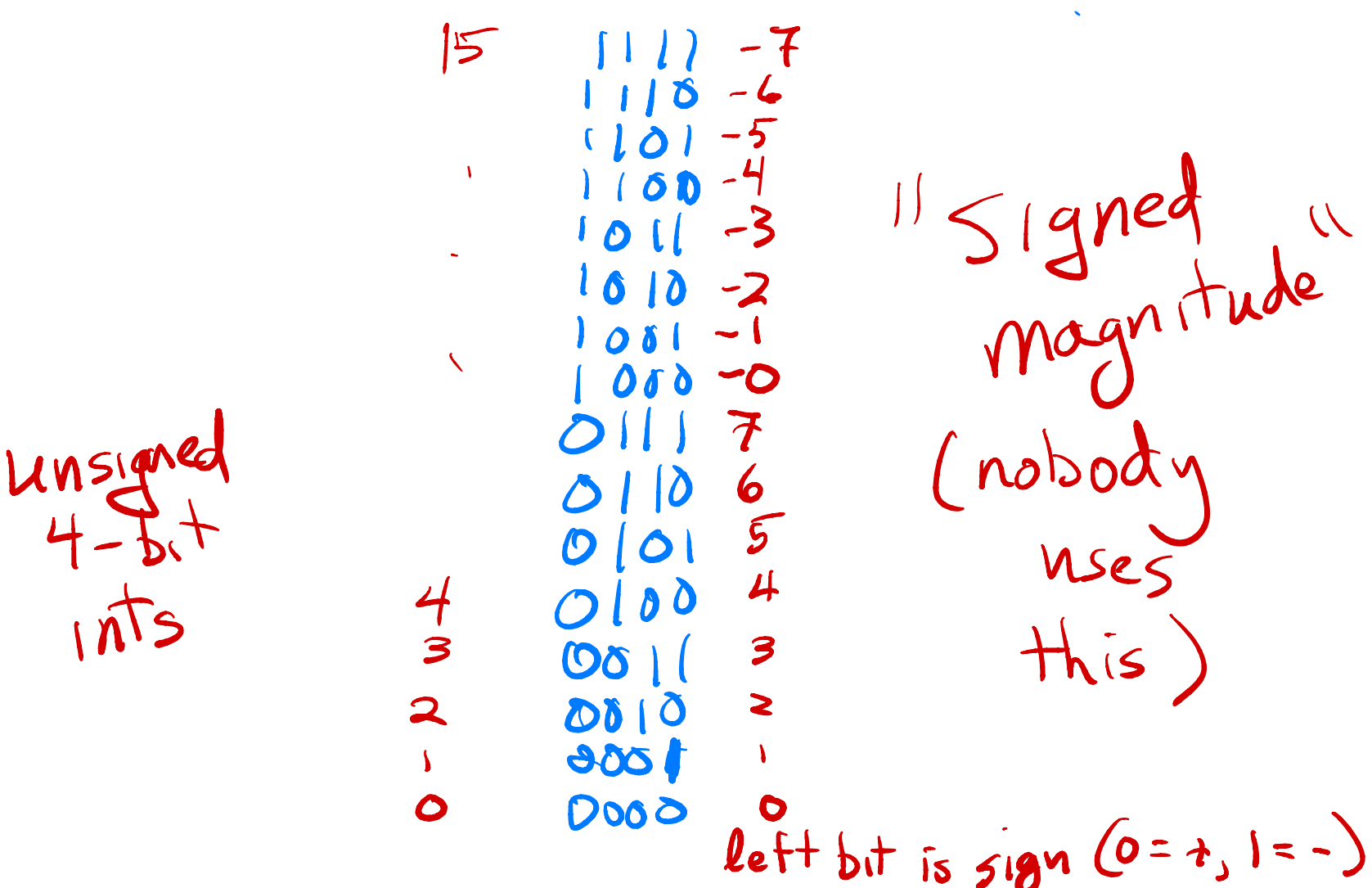
What about negative ints?

Let's pretend each int is 4 bits long.

$\rightsquigarrow 2^4 = 16$ possible integers we can represent

Hope for a system $\sim 8 > 0$, $\sim 8 < 0$

1111
1110
1101
1100
1011
1010
1001
1000
0111
0110
0101
0100
0011
0010
0001
0000


15
1111 -7
1110 -6
1101 -5
1100 -4
1011 -3
1010 -2
1001 -1
1000 -0
0111 7
0110 6
0101 5
4 0100 4
3 0011 3
2 0010 2
1 0001 1
0 0000 0
unsigned 4-bit ints
"signed magnitude" (nobody uses this)
left bit is sign (0=+, 1=-)

0111	7
0110	6
0101	5
0100	4
0011	3
0010	2
0001	1
0000	0
1111	-1
1110	-2
1101	-3
1100	-4
1011	-5
1010	-6
1001	-7
1000	-8

"4-bit two's Complement" representation of integers

2's Complement

1. How do you tell if a bit pattern represents a negative integer?

   Leftmost bit is 1

2. How do you negate a number?

   Complement + 1

4-bit 2's comp

1101 ~ -3

Complement

0010

+1

0011 ~ 3 which means that the original was -3

≥ 0

$$\begin{array}{r} 1101 \\ +\ 0011 \\ \hline 0000 \end{array}$$

-3

$+3$

In general

$$\begin{array}{r} \text{bit pattern} \\ +\ \sim(\text{bit pattern}) \\ \hline 1111\ \ldots\ 1 \\ +\ 1 \\ \hline 00\ \ldots\ 0 \end{array}$$

① What's a negative? 1 leftmost bit

② How to negate (~n) + 1

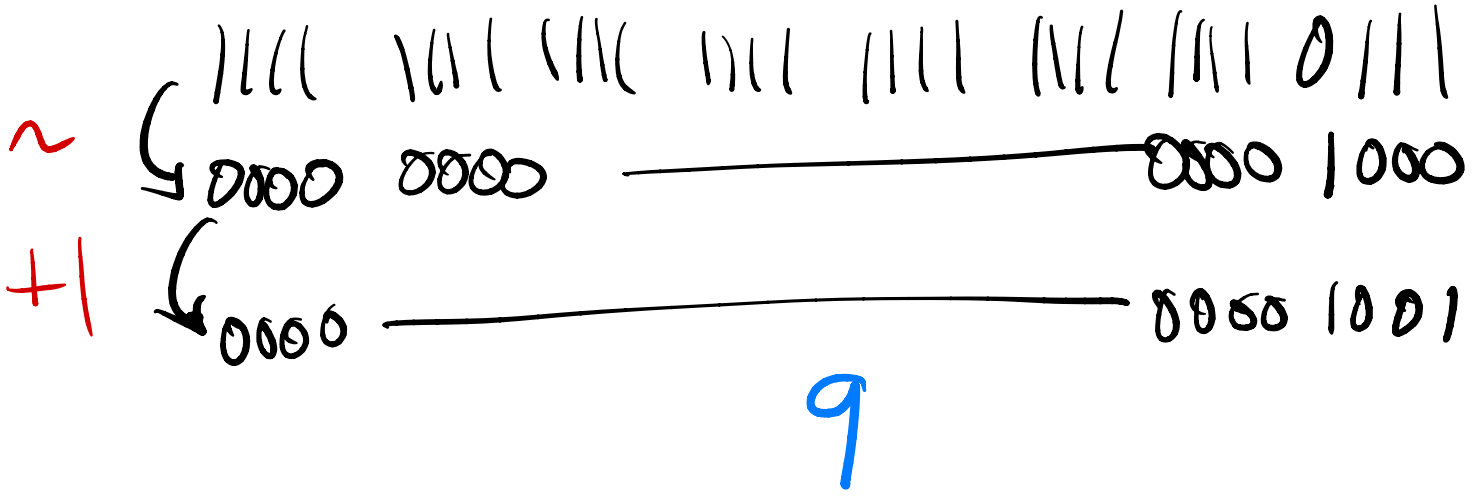
③ Why? addition works

2b "Find the bit pattern that when added to orginal gives me 0"

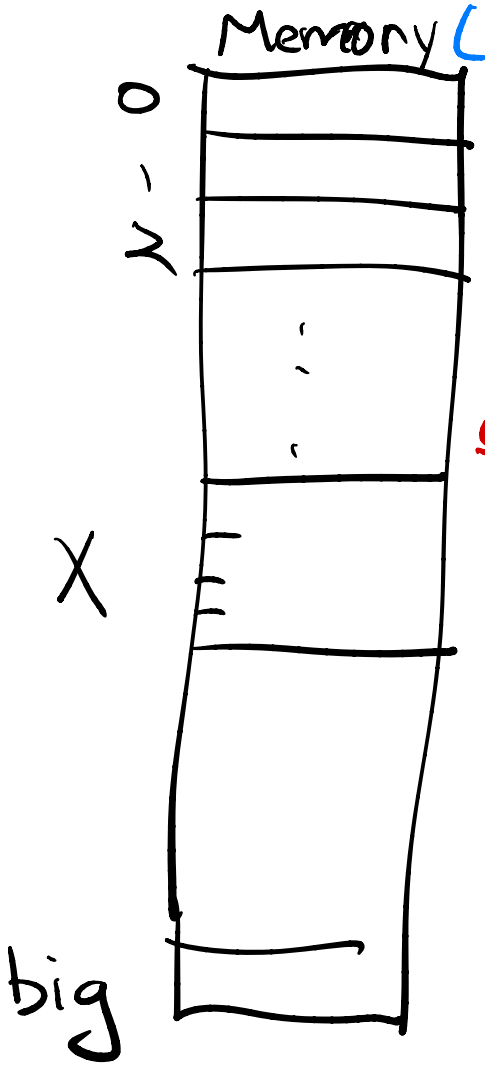
What integer does the int

0xFFFFFFF7 -9

represent?



0xFFFFFFE5



"byte order problem"

int x = -9;

(0xFFFFFFF7)

Option1

F7
FF
FF
FF

Option2

FF
FF
FF
F7

"little endian"

Intel's choice (so also our choice)

"big endian"