

CS 208

Fri: 29 Sep 2023



- How many different integers can you represent?
- Which ones?
- How? (What's your plan?)

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

0  
1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15

Plan #1  
Unsigned  
Binary

0000	+0
0001	+1
0010	
0011	
0100	
0101	
0110	
0111	
1000	← -0
1001	
1010	
1011	-3
1100	
1101	
1110	
1111	-7

Plant #2  
 Left bit  
 is Sign  
 "Signed  
 Magnitude"

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

16  
17  
18  
19  
20

31

Plan #3  
(everybody  
hates  
this)

0	0	0	0
0	0	0	1
0	0	1	0
0	0	1	1
0	1	0	0
0	1	0	1
0	1	1	0
0	1	1	1
1	0	0	0
1	0	0	1
1	0	1	0
1	1	0	0
1	1	0	1
1	1	1	0
1	1	1	1

15

4  
3  
2  
1  
0

Jeff's  
terrible  
plan

0	0	0	0	0
0	0	0	0	1
0	0	0	1	0
0	0	0	1	1
0	0	1	0	0
0	0	1	0	1
1	0	1	1	0
1	0	1	1	1
1	0	0	0	0
1	0	0	0	1
1	1	0	0	0
1	1	0	0	1
1	1	0	1	0
1	1	0	1	1

321

1108

7

Plan #4



0	0	0	0
0	0	0	1
0	0	1	0
0	0	1	1
0	1	0	0
0	1	0	1
0	1	1	0
1	0	1	1
1	0	0	0
1	0	0	1
1	0	1	0
1	1	0	0
1	1	0	1
1	1	1	0
1	1	1	1

1  
1  
1  
1  
1  
1  
1  
1  
1  
1  
1  
1  
1  
1  
1

1  
1  
1  
1  
1  
1  
1  
1  
1  
1  
1  
1  
1  
1  
1

1

Plan #5  
"excess-7"





char ch = 0x c3;  
int z = ch;



c3



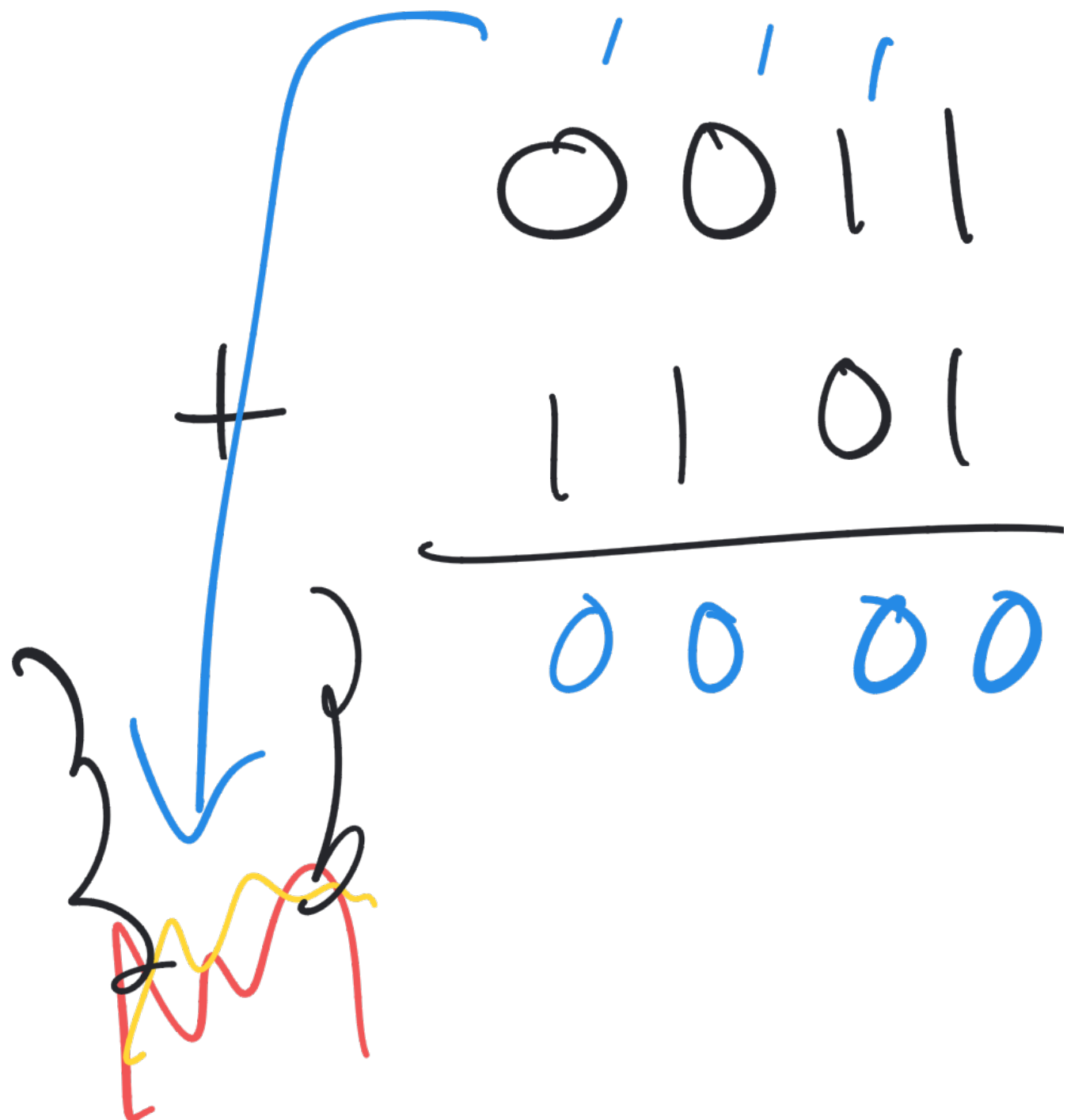
?

"Sign extension"

Why 2's comp?

Answer #1: addition works

$$\begin{array}{r} 0011 \\ 1011 \\ \hline 1110 \end{array} \quad \begin{array}{r} 3 \\ -5 \\ -2 \end{array}$$



0' 0' 1' 1

1 1 0 1

0 0 0 0

3  
-3

To negate a #

0100

4

Complement

1011

1100

+1

+1

1100

-4