

CS 208

M 22 Sep 2025

Ideas for conditional(x, y, z)

$$a \& 0xffffffff == a$$

$$a | 0x00000000 == a$$

$$a \& 0 == 0$$

$$a | 0xffffffff == 0xffffffff$$

1. Use x to compute "masks"

2. One of the masks will zero out y or z
One " " " " Preserve z or y

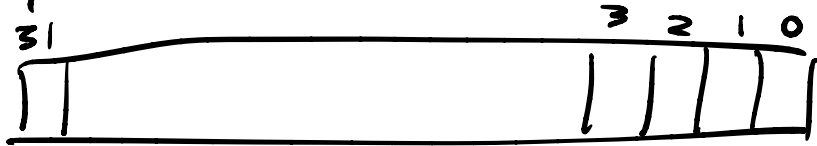
3. combine

Integers — infinite # of them

... -3, -2, -1, 0, 1, 2, 3 ...

int w/ gcc compiler on mantri's

Every int is 32 bits long



Thus there are only 2^{32} int values.

Given any int takes 32 bits
how should we store negative integers?

- Principle: let's make $\frac{1}{2}$ the bit patterns represent negatives

- Let bit 31 be the sign bit

"Signed magnitude representation"
easy for people to get

10000...00101 $\sim$ -5

Nobody uses
this

Two's Complement (temporarily let's say
each int has 4 bits,
not 32)

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

Why do this?

3
+ -5

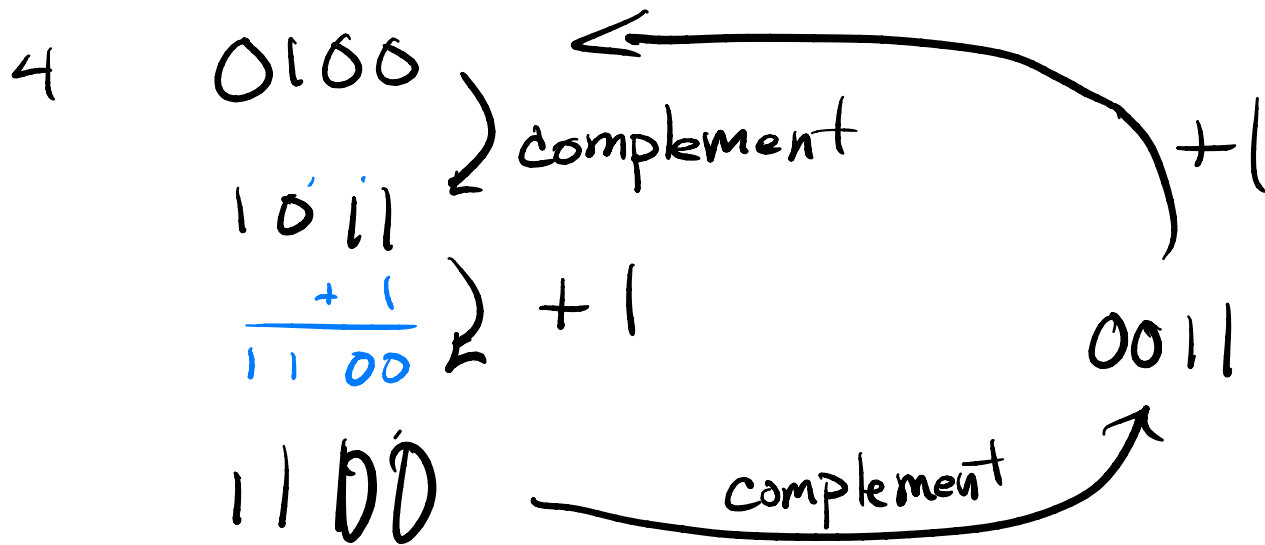
0011
1011

1110

3 0011
-3 1101

~~0000~~
3 3 3
~~0000~~

What does negation look like
(ie. given 3, how to get -3?
given -4, how to get 4?)



Why does "complement and +1" do negation?

We want addition to work.

given N I want

$$N + -N = 0$$

$\begin{array}{r} 1110 \\ + 0001 \text{ comp} \\ \hline 1111 \\ + 1 \\ \hline 0000 \end{array}$	$\begin{array}{r} 1110 \\ + x y z w \\ \hline 0000 \end{array}$
---	---

(Note: The original image has a large '3' written over the bottom of the second column of the addition, which is crossed out with orange and yellow lines.)

32 bits

What integer is represented by

$0_{\text{x}}\text{ffff8fff c}$

?

-4

|||| ||| ||| ||| ||| ||| ||| ||00

compl. (

0000

00000011

+1

0000

00000100

4

Alternative
 $0 \times \text{ffffffffffc}$

4

What do I have to add to this to get 0?

$$0 \times \text{f} \text{ --- } \text{fc} + 3 = 0 \times \text{ff} \text{ --- } \text{ff}$$

$$0 \times \text{f} \text{ --- } \text{fc} + 4 = 0 \times 00 \text{ --- } 00$$

$$\text{So } 0 \times \text{ffffffffffc} \sim -4$$

Techniques

Given a hex or binary description
of a 32-bit int

- ① Tell me what it is in decimal
- ② Negate it
- ③ (Tell me whether it's neg
or pos.)

Examples

- $0x\textcircled{9}8765432 \leftarrow \textcircled{\text{neg}}$ or pos?

$\textcircled{9} \equiv 1001$

- $0x\textcircled{f}fffffe2 \leftarrow \text{what \#?}$

$\textcircled{f} \equiv 1111$

$\sim$
Comp

$000 \text{ --- } 000 \underline{000} 1101$

$+1$

$000 \text{ --- } 0 \underline{1111} 0$

30

neg.
 -30

ASCII - American Standard Code
for Information Interchange
~ 1960

Which 7-bit patterns are going
to mean which characters