

Signed vs Unsigned

Bits	Signed	Unsigned
0000	0	0
0001	1	1
0010	2	2
0011	3	3
0100	4	4
0101	5	5
0110	6	6
0111	7	7
1000	-8	8
1001	-7	9
1010	-6	10
1011	-5	11
1100	-4	12
1101	-3	13
1110	-2	14
1111	-1	15

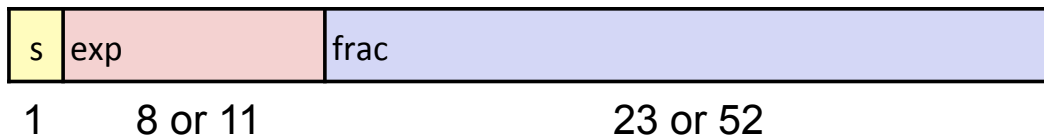
Diagram illustrating the mapping between bit patterns, signed integers, and unsigned integers. The bit patterns are shown in the first column. The signed integers are shown in the second column, ranging from 0 to -1. The unsigned integers are shown in the third column, ranging from 0 to 15. A double-headed arrow with an equals sign (=) connects the Signed and Unsigned columns for bit patterns 0000 through 0111. A double-headed arrow with ± 16 connects the Signed and Unsigned columns for bit patterns 1000 through 1111.

Integer Exercises

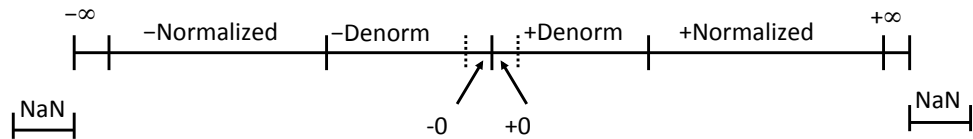
1. $x < 0$ implies $(x * 2) < 0$
2. $ux \geq 0$
3. $ux > -1$
4. $x > y$ implies $-x < -y$
5. $x > 0 \ \&\& \ y > 0$ implies $x + y > 0$
6. $x \geq 0$ implies $-x \leq 0$
7. $x \leq 0$ implies $-x \geq 0$
8. $(x | -x) \gg 31 == -1$
9. $x \ \& \ 7 == 7$ implies $(x \ll 30) < 0$

IEEE Floating Point (IEEE 754)

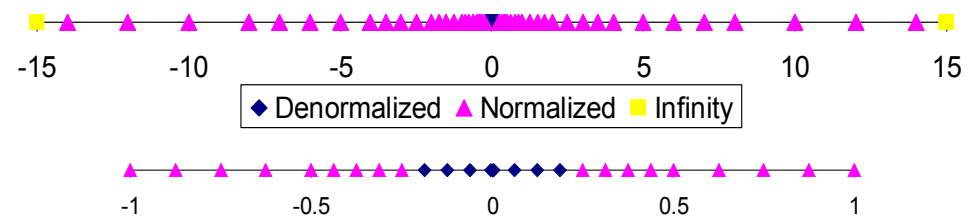
$$\text{value} = (-1)^s M 2^E$$



Floating Point Visualization



6-bit values (3 exp, 2 frac)



Close-up (central values)