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1's and 2's Complement

For n-bit binary numbers: (N)

1's complement $= (2^n - 1) - N$ = "flip bits" of N

2's complement $= 2^n - N = (2^n - 1) - N + 1$

$= (1\text{'s complement}) + 1$

[Can also choose the 2^n with $n >$ number of bits]

Ways to represent positive + negative numbers:

Decimal	Signed-Magnitude ("sign bit")	1's Compl.	2's Compl.
+3			
+2			
+1			
0	000	000	000
−1			
−2			
−3			

Subtraction with 2's compl.: $(M - N)$

① To M add 2's compl. of N.

$(M \geq N)$ ② If "end carry", then discard it.

$(M < N)$ ③ If no end carry, take 2's compl. of sum + insert negative sign.

Subtraction with 1's compl.: $(M - N)$

① To M add 1's compl. of N.

$(M \geq N)$ ② If "end carry", add it to sum.

$(M < N)$ ③ If no end carry, take 1's compl + negative sign.