1 1111110 = -2

~~11111111~~

~~100000000~~

By definition 11111111 = -1

∴ invert 1101 = -3

plus 1 -8 5

1100

0011

0101 +5

1010 invert

1011 plus

-5

1 10101111 neg ✓ pos

01111111 neg pos

①

in 2's complement

$$\text{pos} \underset{\substack{\text{minus 1}\\ \text{invert}}}{\overset{\substack{\text{invert}\\ \text{plus 1}}}{\rightleftarrows}} \text{neg}$$

$$\begin{array}{rrl} & 1111 & N \\ + & 0001 & P \\ \hline & \boxed{1}0000 & \end{array}$$

carry but ~~no~~ no overflow

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

$$\boxed{-2^{n-1} \leq \text{Range} \leq 2^{n-1}-1}$$

n: the number of bits

② 10-bit

Overflow

Definition: $\begin{cases} P+P=N \\ N+N=P \end{cases}$ ✓ ✓

$0\ldots + 0\ldots \overset{D}{=} 1\ldots$

$P+N = P$ OR N ✗

100111 000111

$-25+7=-18$

N + P   N

A

+ B

= C

$$\begin{array}{lr} & 0001 & P \\ + & 0001 & P \\ \hline & 0010 & P \end{array}$$

Overflow: adopt ~~the~~ 1 more bit in the front

No overflow: Do not do that

① $5+6=11$

$$\begin{array}{rl} 0101 & P \\ +\,0110 & P \\ \hline 01011 & N \end{array}$$

overflow

② $-5+(-6)=-11$

$$\begin{array}{rl} 1011 & N \\ +\,1010 & N \\ \hline 10101 & P \end{array}$$

overflow

③ $-1+2=1$

111 010

$$\begin{array}{rl} 111 & N \\ +\,010 & P \\ \hline \cancel{1}001 & P \end{array}$$

No overflow

④

21 + 11

~~010010~~

P 010101 + 001011

P + 001011

N 100000 X

000000

0000000 100000