

Signed magnitude

+0	0 0 0 0 0	-0 1 0 0 0 0
+1	0 0 0 0 1	-1 1 0 0 0 1
+2	0 0 0 1 0	-2 1 0 0 1 0
+3	0 0 0 1 1	-3 1 0 0 1 1
	:	:
+15	0 1 1 1 1	-15 1 1 1 1

$$+12 = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$-12 = \sqrt{1100}$$

~~1~~ 0 1 0 0 0

1's complement

+0 0 0000

+1 0 0001

+2 0 0010

+3 0 0011

+4 0 0100

+5 0 0101

+6 0 0110

+7 0 0111

+8 0 1000

+9 0 1001

⋮

+15 0 1111

-0 1 1111

-1 1 1110

-2 1 1101

-3 1 1100

-4 1 1011

-5 1 1010

-6 1 1001

-7 1 1000

-8 1 0111

-9 1 0110

⋮

-15 1 0000

+25

6-bit

2's comp
011001

signed magnitude

0 11001

1's complement

0 11001

-25

signed magnitude

1 11001

1's complement

100110

2's complement

011001

↓

100110

+1

100111

Given: 0 1 1 0 1

signed magnitude: +13

1's comp: +13

Given: 1 1 1 1 1
signed mag = -15

1's comp = 1

negative
1 1 1 1 1
↓
0 0 0 0 0

1s wrap

+12

=

0 1 1 0 0

-12

=

1 0 0 1 1

-0

=

1 1 1 1 1

+12

=

0 1 1 0 0

-1

=

1 1 1 1 0

+10

=

~~1 0 1 0 1 0~~

pas

wrong answer

2's complement

$$+12 = 01100$$

$$\begin{array}{c} \downarrow \text{flip} \\ 10011 \quad (\text{1's comp}) \\ +1 \end{array}$$

$$\overline{-12} = 10100 \quad (2's \text{ comp})$$

$$\begin{array}{rcl} -1 \Rightarrow +1 & = & 00001 \\ & & \downarrow \\ & & 11110 \\ & & +1 \\ \hline & & 11111 \end{array}$$

$$\begin{array}{r}
 +12 \quad \begin{array}{cccccc} 1 & 1 & & & & \\ 0 & 1 & 1 & 0 & 0 & \end{array} \\
 -12 \quad \begin{array}{cccccc} 1 & 0 & 1 & 0 & 0 & \end{array} \\
 \hline
 \end{array}$$

$$0 = \cancel{1} \quad 0 \quad 0 \quad 0 \quad 0 \quad 0$$

$$\begin{array}{r}
 +12 \quad \begin{array}{cccccc} 1 & 1 & & & & \\ 0 & 1 & 1 & 0 & 0 & \\ 1 & 1 & 1 & 1 & 1 & \end{array} \\
 -1 \quad \begin{array}{cccccc} 1 & 1 & 1 & 1 & 1 & \end{array} \\
 \hline
 \end{array}$$

$$+11 = \cancel{1} \quad 0 \quad 1 \quad 0 \quad 1 \quad 1$$

Given:

10 111

signed mag = -7

1's comp = -8

10111

↓

01000

2's comp = -9

(1)0111

↓

01000

+1

01001

Given: $\overbrace{100111} = -25$

2s comp

011000

11

011001 -25

Excess Notation

$\overline{32}$ $\overline{16}$ $\overline{8}$ $\overline{4}$ $\overline{2}$ $\overline{1}$

Excess 8

$$+3 \rightarrow +3 + 8 = 11$$

1011

↑ sign - positive

$$-3 \rightarrow -3 + 8 = 5$$

0101

↑ negative