

279

Power of 2 subtract

$$279 - 256 = 23 \quad (2^8)$$

$$23 - 16 = 7 \quad (2^4)$$

$$7 - 4 = 3 \quad (2^2)$$

$$3 - 2 = 1 \quad (2^1)$$

$$1 - 1 = 0 \quad (2^0)$$

0000000100010111

$2^8 \quad 2^4 \quad 2^2 2^1 2^0$

Divide by 16 to hex

$$279 / 16 = 17 \text{ R } 7$$

$$17 / 16 = 1 \text{ R } 1$$

$$1 / 16 = 0 \text{ R } 1$$

0x0117

0000 0001 0001 0111

Divide by 2 to binary

$$279 / 2 = 139 \text{ R } 1$$

$$139 / 2 = 69 \text{ R } 1$$

$$69 / 2 = 34 \text{ R } 1$$

$$34 / 2 = 17 \text{ R } 0$$

$$17 / 2 = 8 \text{ R } 1$$

$$8 / 2 = 4 \text{ R } 0$$

$$4 / 2 = 2 \text{ R } 0$$

$$2 / 2 = 1 \text{ R } 0$$

$$1 / 2 = 0 \text{ R } 1$$

0000000100010111

- 150 (The number is negative, so there are two ways to convert it to binary)

1. Convert the positive value to binary, then take the 2's complement.

| <u>Power of 2 subtract</u> | <u>Divide by 2 to binary</u> |
|----------------------------|------------------------------|
| $150 - 128 = 22 \ (2^7)$ | $150 / 2 = 75 \text{ R } 0$ |
| $22 - 16 = 6 \ (2^4)$ | $75 / 2 = 37 \text{ R } 1$ |
| $6 - 4 = 2 \ (2^2)$ | $37 / 2 = 18 \text{ R } 1$ |
| $2 - 2 = 0 \ (2^1)$ | $18 / 2 = 9 \text{ R } 0$ |
| | $9 / 2 = 4 \text{ R } 1$ |
| | $4 / 2 = 2 \text{ R } 0$ |
| | $2 / 2 = 1 \text{ R } 0$ |
| | $1 / 2 = 0 \text{ R } 1$ |

| | |
|---------------------------------------|-------------------------------|
| 00000000 | 10010110 |
| Add leading zeros for positive number | $2^7 \quad 2^4 \quad 2^2 2^1$ |

Calculate 2's complement

Complement: 1111111101101001

Add 1: $\begin{array}{r} 1111111101101001 \\ + \\ \hline \end{array}$

-150 = 1111111101101010

0xff6a

2. Start with negative power of 2 more negative than -150 and add positive powers of 2 until you reach the desired value.

$$\begin{aligned} -2^8 &= -256 \\ +2^6 &= +64 = -192 \\ +2^5 &= +32 = -160 \\ +2^3 &= +8 = -152 \\ +2^1 &= +2 = -150 \end{aligned}$$

101101010

$2^8 \quad 2^6 \quad 2^5 \quad 2^3 \quad 2^1$

| REF | |
|-------------|---------------|
| $2^0 = 1$ | $-2^0 = -1$ |
| $2^1 = 2$ | $-2^1 = -2$ |
| $2^2 = 4$ | $-2^2 = -4$ |
| $2^3 = 8$ | $-2^3 = -8$ |
| $2^4 = 16$ | $-2^4 = -16$ |
| $2^5 = 32$ | $-2^5 = -32$ |
| $2^6 = 64$ | $-2^6 = -64$ |
| $2^7 = 128$ | $-2^7 = -128$ |
| $2^8 = 256$ | $-2^8 = -256$ |

Only 9 bits – extend sign bit to 16 bits

PEMDAS

1111111101101010

sign
extension

0xff6a