

# **INTEGERS**

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# Integers

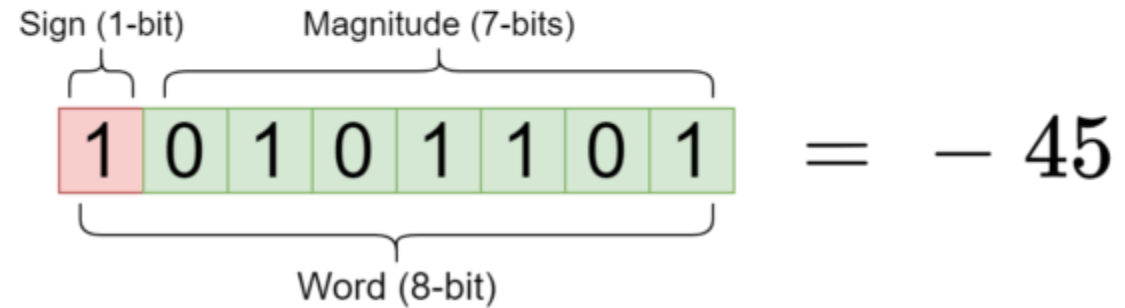
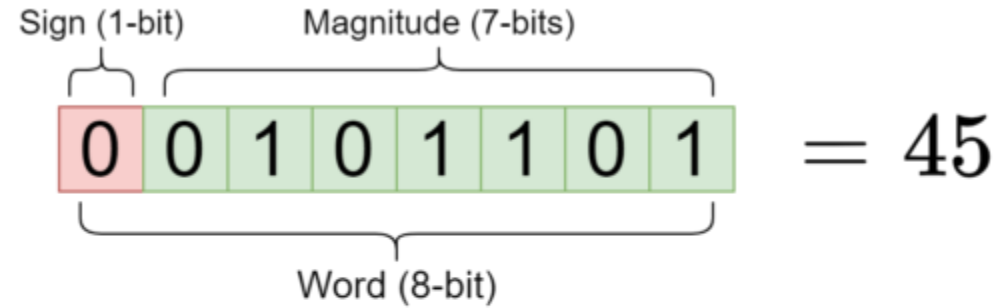
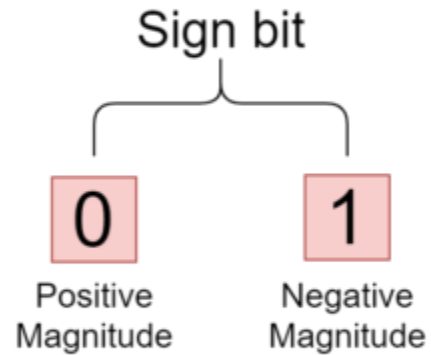
- Fixed number of bits in memory
  - Short: usually 16 bits
  - Int: 16 or 32 bits
  - Long: 32 bits
- Unsigned integer
  - No sign bit
  - Shows a positive number or 0
- Signed integer
  - Most left bit is for sign
  - Shows a positive, negative or 0

# Unsigned Integer

- 00000001 → 1
- 00001111 → 15
- 00010000 → 16
- 00100001 → 33
- 11111111 → 255

# Signed Integer

- SIGN-AND-MAGNITUDE



# Signed Integer

- SIGN-AND-MAGNITUDE

$-7_{10}$  converted to 4-bit Signed Binary Number  $\rightarrow$   $1111_2$

$13_{10}$  converted to 5-bit Signed Binary Number  $\rightarrow$   $01101_2$

$-30_{10}$  converted to 6-bit Signed Binary Number  $\rightarrow$   $111110_2$

$-59_{10}$  converted to 7-bit Signed Binary Number  $\rightarrow$   $1111011_2$

$100_{10}$  converted to 8-bit Signed Binary Number  $\rightarrow$   $01100100_2$

# Signed Integer

- SIGN-AND-MAGNITUDE

*for Unsigned Binary Number:*

$0 \text{ to } (2^n - 1) \rightarrow 0 \text{ to } (2^4 - 1) \rightarrow 0 \text{ to } 15$

*for Signed Binary Number:*

$-(2^{(n-1)} - 1) \text{ to } (2^{(n-1)} - 1)$

$-(2^3 - 1) \text{ to } (2^3 - 1) \rightarrow (-7) \text{ to } 0 \text{ to } (+7)$

# Signed Integer

- ONE'S COMPLEMENT
  - flip every bit

0 1 1 0 1 1 1 0

Original binary value

1 0 0 1 0 0 0 1

1's complement

# Signed Integer

- The positive values remain unchanged
- The negative values are one's complement

+10 = 0 1 0 1 0

-10 = 1 0 1 0 1

1's Complement of  
0100

1's Complement of 1010