

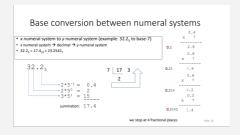
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by wayneswu via cheatography.com/193768/cs/40338/

# Positional Number System

- Radix number of unique symbols in a number system
- usually 0-9, then A-Z

# Number System Base conversion



#### 2x vs 10v



- Binary prefix are mainly use in memory capacity
- SI prefix are usually use in data transfer rate or storage space
- abbreviation \* value = number of bits

# Binary Data Organization

Organization	Number of bits	Usage	
Bit (binary digit)	2 cells - 0 or 1	Basic unit	
Crumb	2 bits	*largely defunct term. rarely used	
Nibble	4 bits	Hex digit, BCD digit	
Byte	8 bits	Smallest addressable data unit	
Half word	16 bits	Definition of word is architecture-dependent	
Word	32 bits	A 32-bit architecture considers 1 word as 32-bit	
Double word	64 bits		
Quad word	128 bits		

- a bit has 2 cells
- most significant (left) ----- least significant (right)
- bit(b), byte(B)
- little endian top address to bottom
- big endian bottom address to top

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magar representation	
UNSIGNED	0 to (2 <sup>n</sup> )-1
normal	fill the rest with 0 (MSb)
SIGNED	$-(2^{n-1})$ to $+(2^{n-1})-1$
sign and magnitude	sign bit   positive int
1's complement (n-1's)	flip for negative int
2's complement (n's)	flip then + 1, for negative int

- unsigned integers use zero extension
- signed integers use sign extension

in short, extend the MSb until you have reached the sufficient num of bits

SHOULD \_\_\_; otherwise, overflow

**ADDITION** 

UNSIGNED SHOULD NOT have carry

SIGNED [same sign] SHOULD remain the same sign

SIGNED [different sign] add using 2's complement representation (never overflow)

SUBTRACTION

**UNSIGNED** SHOULD HAVE carry

**SIGNED** A-B = A+B' (2's complement B)

addition of signed integers [same sign]

1. first bit should never change

2. ignore carry if there is



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# IEEE 754 Floating point for single precision

1 - sign bit 8 - exponent 23 - mantissa

0 for positive e' = e + 127 f in 1. f notation

#### Example:

Given: 3.5<sub>10</sub>

1. 3.5<sub>10</sub> = 11.1<sub>2</sub>

2. 1.11 x 2<sup>1</sup>

3. e' = 128<sub>10</sub> == 1000\_0000<sub>2</sub>

Answer: 1\_1000000\_110 0000...00000

# IEEE 754 Floating point for single precision

1 - sign bit 8 - exponent 23 - mantissa

0 for positive

#### test

1 - sign bit 8 - exponent 23 - mantissa

0 for positive e' = e + 127 f in 1. f notation

### Example:

Given: 3.5<sub>10</sub>

 $1. \ 3.5_{10} = 11.1_{2}$ 

2. 1.11 x 21

3.  $e' = 128_{10} == 1000_0000_2$ 

Answer: 1\_1000000\_110 0000...00000

# Special cases floating single precision

Sign Bit	E'	Significand	Value
0	0000 0000	000 0000 0000 0000 0000 0000	+0 (Positive Zero)
1	0000 0000	000 0000 0000 0000 0000 0000	-0 (Negative Zero)
0/1	0000 0000	≠ 0	Denomalized
0	1111 1111	000 0000 0000 0000 0000 0000	+ Infinity
1	1111 1111	000 0000 0000 0000 0000 0000	- Infinity
x	1111 1111	01x xxxx xxxx xxxx xxxx xxxx	sNaN
x	1111 1111	1xx xxxx xxxx xxxx xxxx xxxx	qNaN



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