Data Representation & Number Systems

Base-X Conversion

Integers (repeated ÷ by 2)

2	x
2	y R 1
2	z R 0
	⋮
2	1 R 0
	0 R 1

LSB ↑ MSB

Fractions (repeated x by 2)

	Carry
2(0.abc) = 0.xyz	0
2(0.xyz) = 1.def	1
2(0.def) = 1.hjk	1
⋮	
2(0.5) = 1.00	1

MSB ↓ LSB

Binary → Octal / Hexadecimal

← from right

$(x)_8$: 010 | 000 | 011 | 000 = 20140_8

$(x)_{16}$: 010 | 0000 | 0110 | 0000 = 2060_{16}

Data

bit (b): 0, 1

byte (B): 8b

word: 32b / 4B

N bits: 2^N values

M values: $\lceil \log_2 M \rceil$ bits

Integers

Rep	+ → −	Range	Zeros
S-M.	Flip MSB	$-(2^{n-1}-1)$, $2^{n-1}-1$	+/−
1s	Flip ALL	$-(2^{n-1}-1)$, $2^{n-1}-1$	+/−
2s	← till first 1, flip rest	-2^{n-1}, $2^{n-1}-1$	+

Overflow A + B : $(MSB_A == MSB_B)$!= MSB_{A+B}

1s : Add carry to LSB_{A+B}, check for overflow

2s : Ignore carry, check for overflow

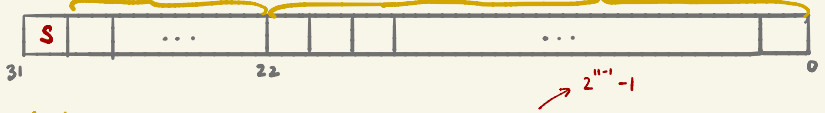
IEEE-754

$(S) \times (1.M) \times 2^{E-127}$

$2^{8-1}-1$

exponent E : 2^{x+127}

mantissa M : 1.M



$2^{11-1}-1$

64b : M : 0 to 51, E : 52 to 62, Bias : 1023

C: Functions, Pointers, Arrays, Structures