CMPS 10 10-27-08

EX. SUPPOSE 32 BITS ARE USED FOR REP. OF (UNSIGNED) NON-NEGATIVE INTEGERS

$$\#\text{ OF }\#\text{S} = 2^{32} = 4,294,967,296$$

$$\text{smallest} = 0$$

$$\text{largest} = \underbrace{1111\cdots1111}_{32} = \underbrace{1000\cdots00}_{32} - 1 = 2^{32} - 1$$

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SIGNED (i.e. + OR −) INTEGERS:

SIGN/MAGNITUDE REPRESENTATION: leftmost BIT ENCODES SIGN (0 = +, 1 = −), OTHER BITS ENCODE MAGNITUDE.

EX. SUPPOSE 8 BITS ARE USED FOR SIGN/MAG REP.

$$-27 = \underbrace{1}_{\ominus},\ \underbrace{0011011}_{27}$$

$$+27 = \underbrace{0}_{\oplus},\ 0011011$$

$$0 = \begin{cases} 1\ 0000000 \\ 0\ 0000000 \end{cases}$$

Bit strings of length 8 | $= 2^8 = 256$

of #s $= 255$

smallest $= 1\ 1111111 = -(2^7 - 1) = -127$

largest $= 0\ 1111111 = +(2^7 - 1) = +127$

Two's complement representation:

Also use leftmost bit for sign

$1 = -$

$0 = +$

EX. Suppose 4 BITS ARE USED FOR 2's COMP. REP.

BIN	DEC
0000	0
0001	1
0010	2
0011	3
0100	4
0101	5
0110	6
0111	7
1000	-8
1001	-7
1010	-6
1011	-5
1100	-4
1101	-3
1110	-2
1111	-1

$$\begin{array}{rcl} 2 & = & 0010 \\ -6 & = & 1010 \\ \hline -4 & = & 1100 \end{array}$$

$$\#\text{OF}\#\text{S} = 2^4 = 16$$

REAL NUMBERS (APPROX.)

FLOATING POINT REPRESENTATION:

CONVERT TO SCIENTIFIC NOTATION:

$$\pm M \cdot 2^{\pm E}$$

MANTISSA — EXPONENT

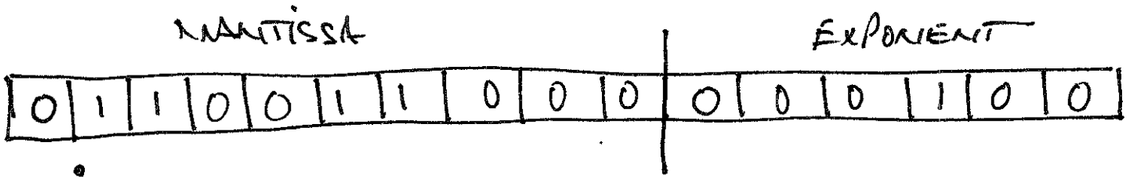
Ex. Suppose 16 bits are used for F.P. rep. 10 bits to mantissa, 6 bits for exp. (both sign magnitude.)

$$12.75 = 8 + 4 + \frac{1}{2} + \frac{1}{4} = 2^3 + 2^2 + 2^{-1} + 2^{-2}$$

$$= (1100.11)_2$$

$$= (.110011)_2 \cdot 2^4$$

$$= (.110011)_2 \cdot 2^{(100.)_2}$$



mantissa ↙ exponent

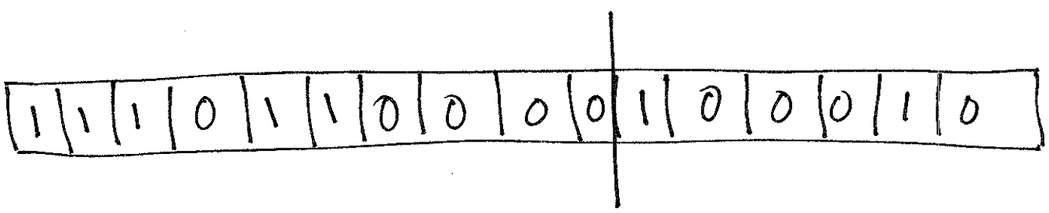
EX. SAME $16 = \overset{\downarrow}{10} + 6$

$$-.2109375 = -\left(\frac{1}{8} + \frac{1}{16} + \frac{1}{64} + \frac{1}{128}\right)$$

$$= -(.0011011)_2$$

$$= -(.11011)_2 \cdot 2^{-2}$$

$$= -(.11011)_2 \cdot 2^{-(10)_2}$$



TEXT DATA:

ENCODINGS:

ASCII: 8 BITS, $2^8 = 256$ CHARACTERS

CODES 32-126 ASSIGNED TO PRINTABLE CHARACTERS.

UNICODE: 16 BITS, $2^{16} = 65,536$ CHARACTERS.