Tutorial 7

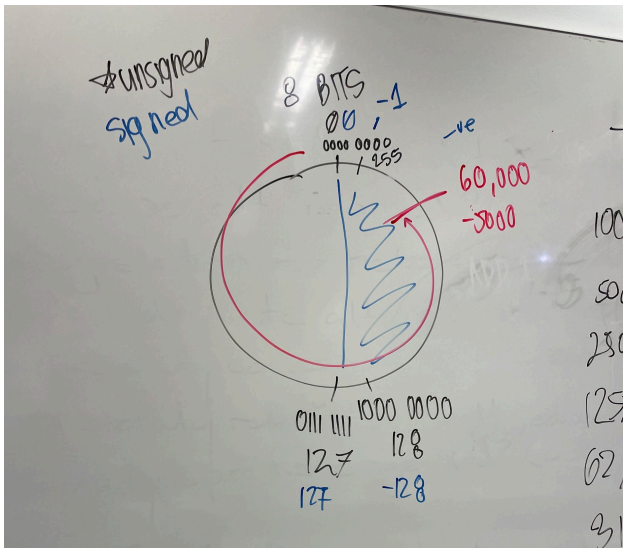
Useful links

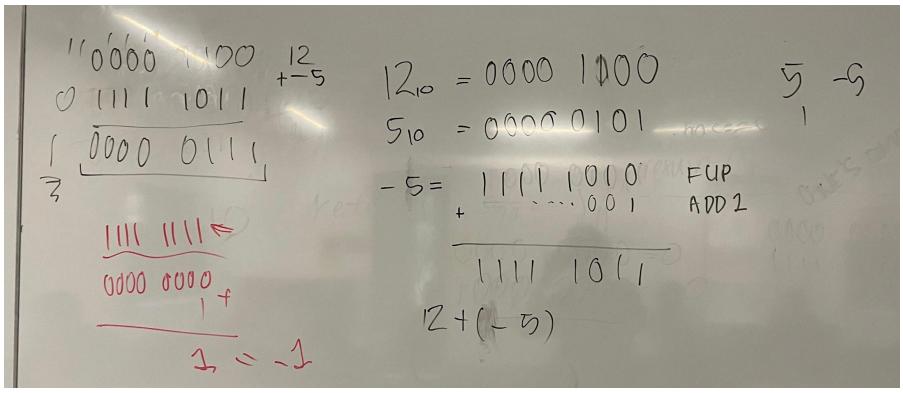
- Two's complement explanation: https://www.ralismark.xyz/posts/twos-complement
- Floating point numbers wiki: https://en.wikipedia.org/wiki/Single-precision_floating-point_format
- Floating point nums converter: https://www.h-schmidt.net/FloatConverter/IEEE754.html

Negative Numbers - two's complement

- To convert from decimal ->two's complement: decimal-> binary IF negative flip and add 1
- To convert from twos complement->decimal:
    - If positive, (if MSB or left most bit is 0) convert to decimal
    - If negative (MSB/left most bit is 1), FLIP AND ADD 1 to get positive number, then convert to decimal (don't forget that it's negative)

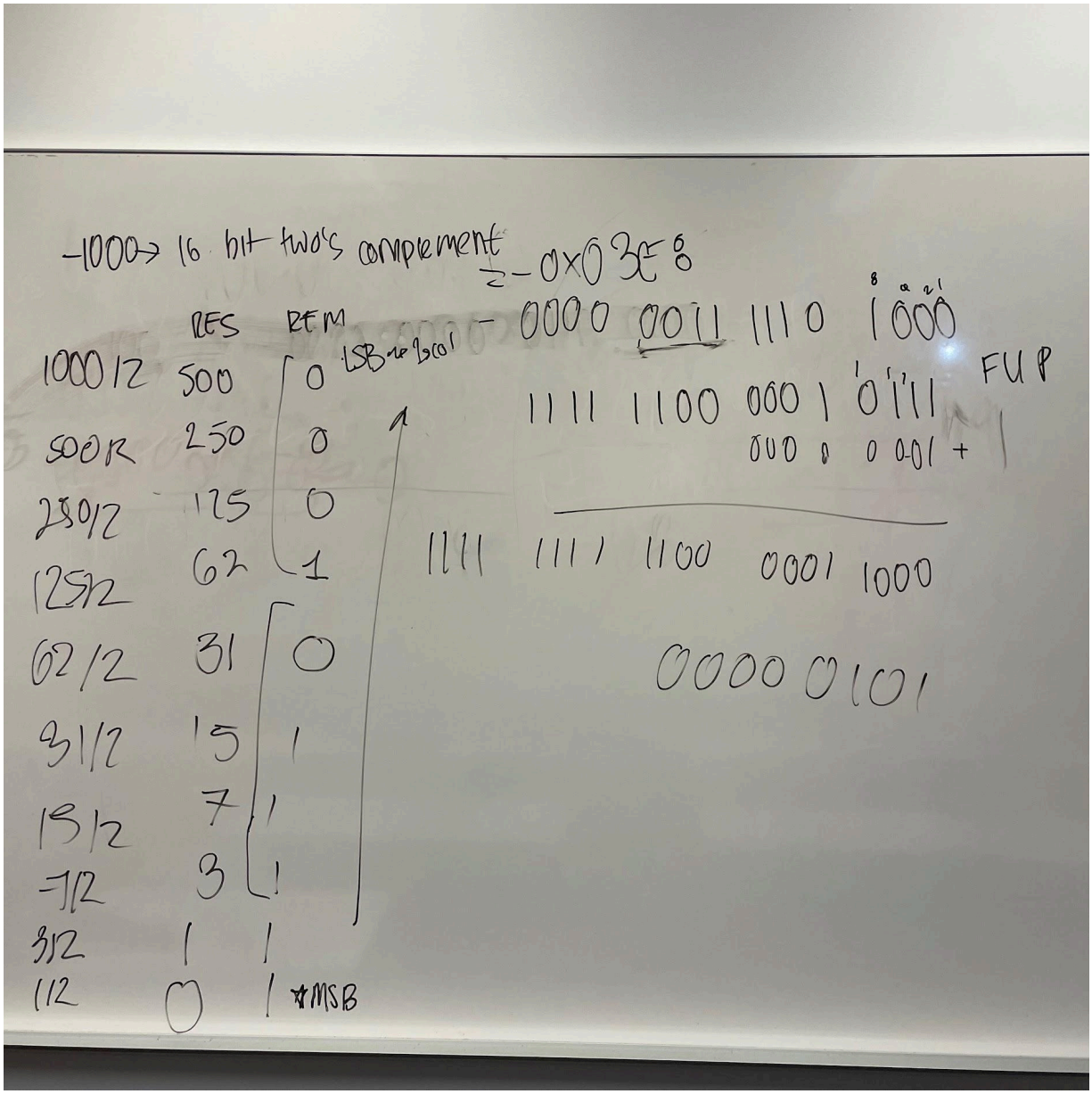
Range of signed and unsigned 8 bit integer





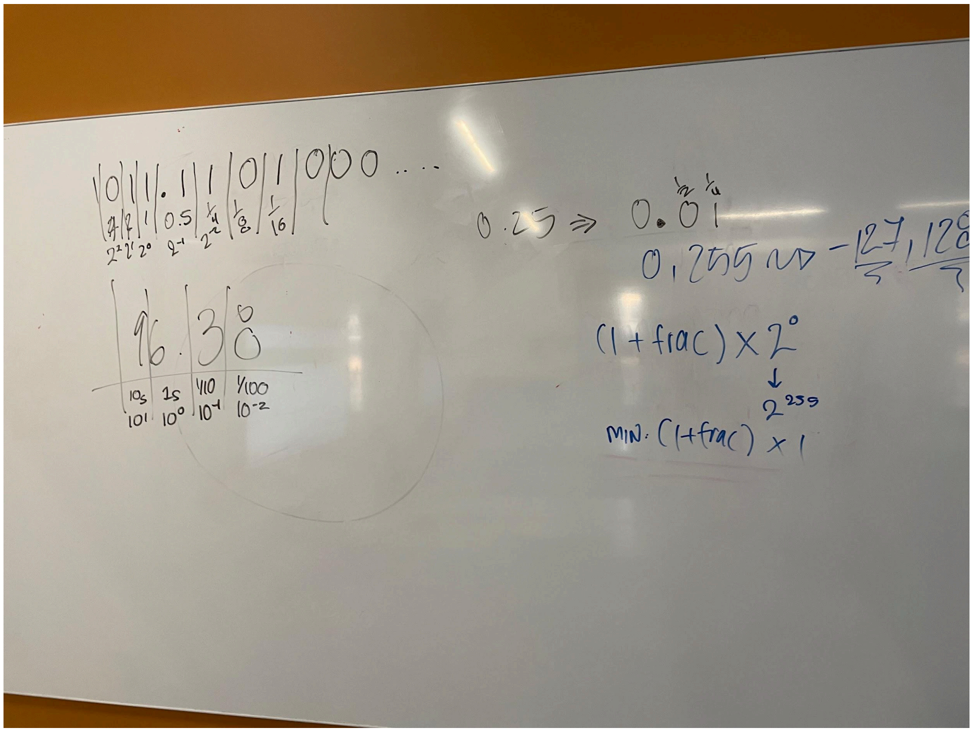
two's complement - flip and add one

Example: -1000 to 16 bit two's complement



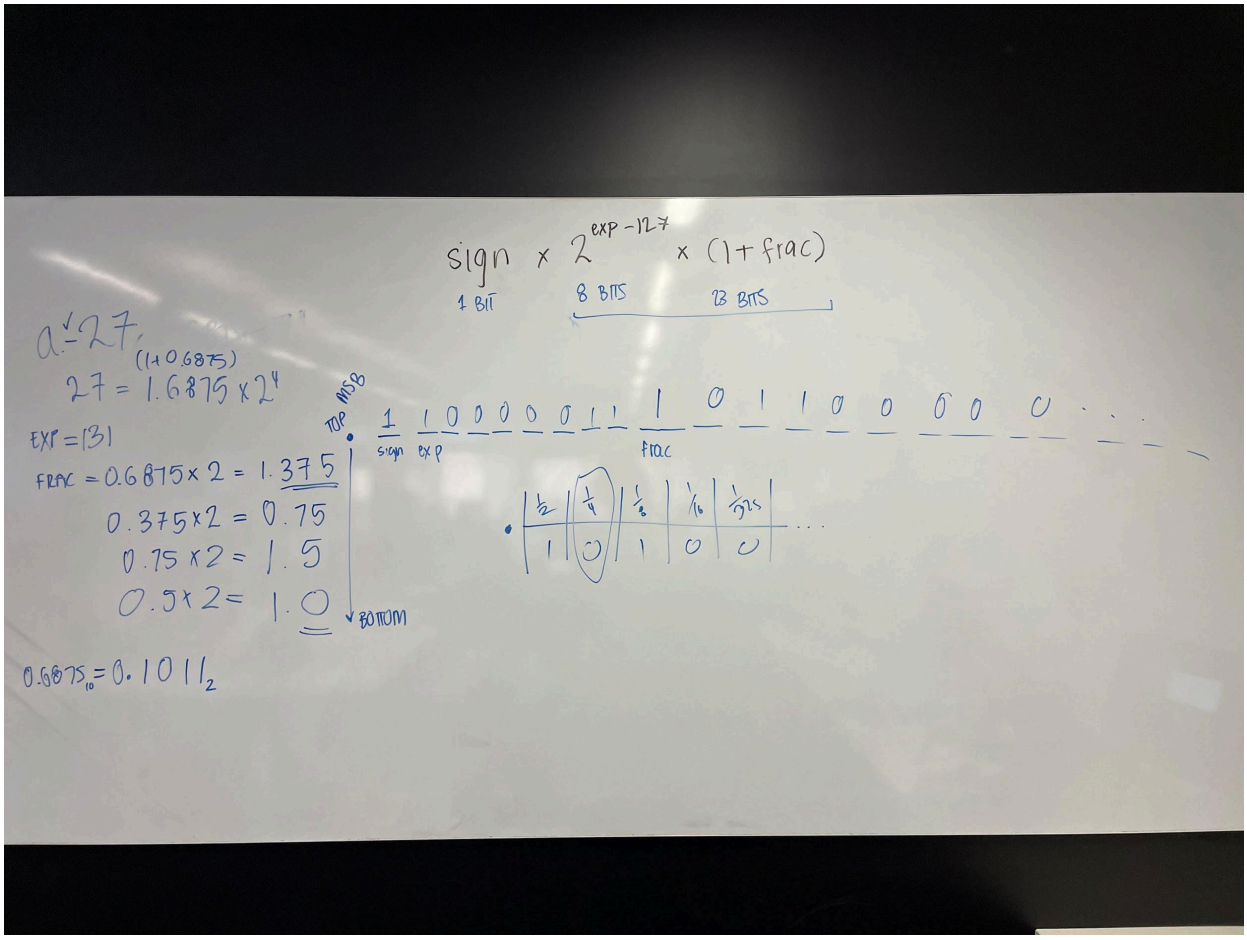
Floats

Binary fractions

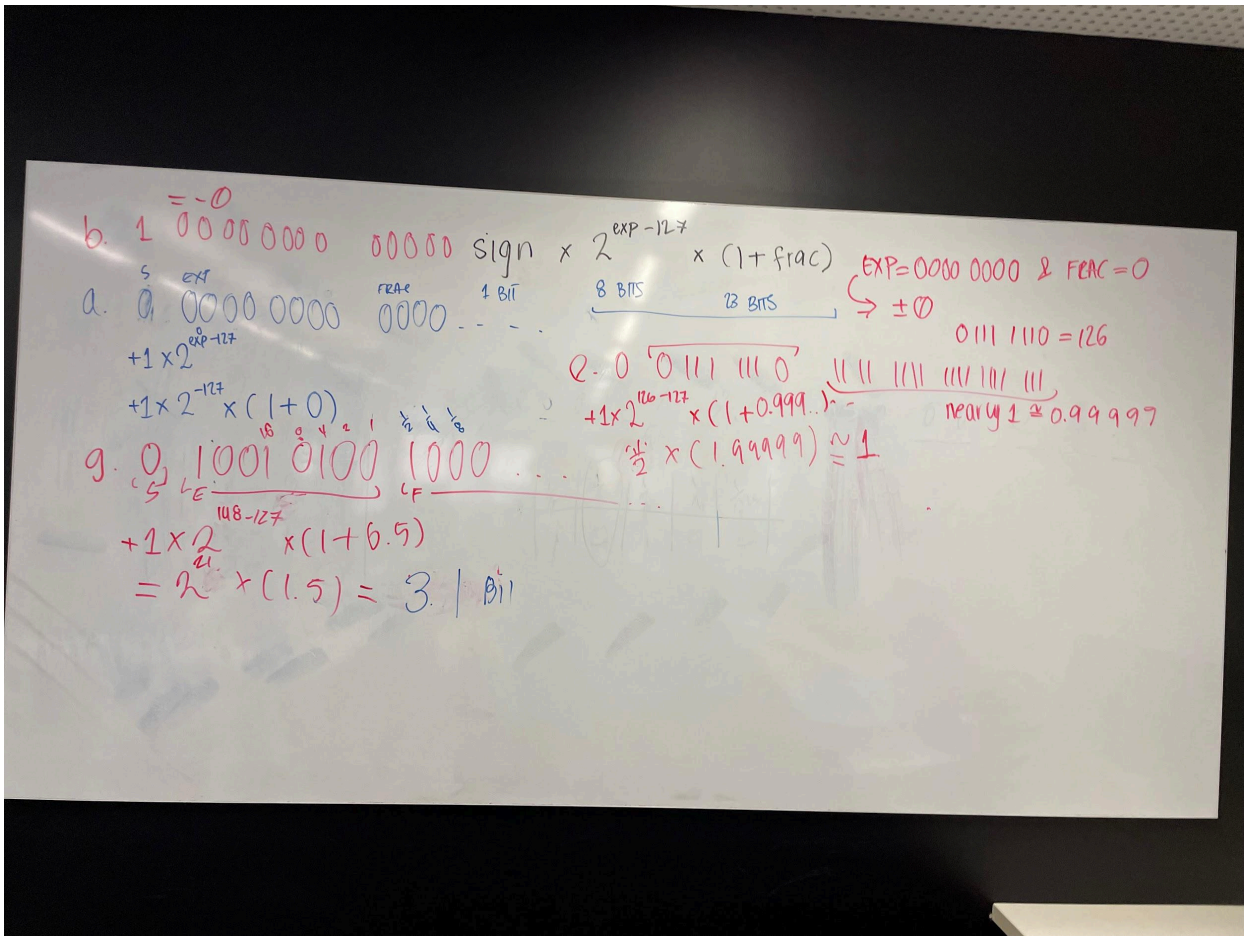


0.25 ⇒ 0.01
(1 + frac) x 2°
MIN. (1+frac) x 1
96.38

Example decimal to float string



Example float strings - dec


= -0
b. 1 00000000 00000 sign x 2^(exp-127) x (1+frac)
EXP=0000 0000 & FRAC=0
⇒ ±0
a. 0 0000 0000 0000 ...
S EXP FRAC
1 BIT
8 BITS
23 BITS
+1 x 2^(exp-127)
+1 x 2^-127 x (1+0)
0111 1110 = 126
2. 0 0111 1110 1111 1111 1111 1111 111
+1 x 2^(126-127) x (1+0.999..)
nearly 1 ≅ 0.99999
1/2 x (1.99999) ≅ 1
g. 0 1001 0100 1000 ...
S E F
18 0 4 2 1 1/2 1/4 1/8
148-127
+1 x 2^21 x (1+0.5)
= 2^21 x (1.5) = 3.1 Bil

Six_middle_bits (masking and shifting)