Lecture 08

Reminder

Exercises 1, 2, 3 / Lab 8

(1) 11011.0101 → $(16+8+2+1).\left(2^{-2}+2^{-4}\right) = 27.3125$

$\frac{1}{4} \times \frac{1}{16} = \frac{5}{16} =$

unsigned value : 055i4F

073.200000...

(2) 273.21875 → 1S10i6F

0 0 1 0 0 0 1 0 0 0 1 . 0 0 1 1 1 0 0000....

$2^8 \quad 2^0 \quad 2^{-1} \quad 2^{-2}$

$273 = 256 + 16 + 1$

$2^8 \quad 2^4 \quad 2^0$

0.21875 x 2 = 0.43750

0.4375 x 2 = 0.8750

0.875 x 2 = 1.750

0.75 x 2 = 1.5

0.5 x 2 = 1.0

0 x 2 = 0

0

(3) -22 → 1S6i6F

$22 = 16 + 4 + 2$

$2^4 \quad 2^2 \quad 2^1$

0 0 1 0 1 1 0 . 0 0 0 0 0 0 (22)

-22 ? => Sign-value : 1 0 1 0 1 1 0 . 0 0 0 0 0 0 (-22)

1C : 1 1 0 1 0 0 1 . 1 1 1 1 1 1 (-22)

2C : 1 1 0 1 0 0 1 . 1 1 1 1 1 1 + (carry-bit)

1

1 1 0 1 0 1 0 . 0 0 0 0 0 0

-22.21875 is

22.21875 : 0 0 1 0 1 1 0 . 0 0 1 1 1 0

-22.21875 (S.V) : 1 ——— // ———

-22.21875 (1C) : 1 1 0 1 0 0 1 . 1 1 0 0 0 1

-22.21875 (2C) : 1 1 0 1 0 0 1 . 1 1 0 0 0 1 +

1

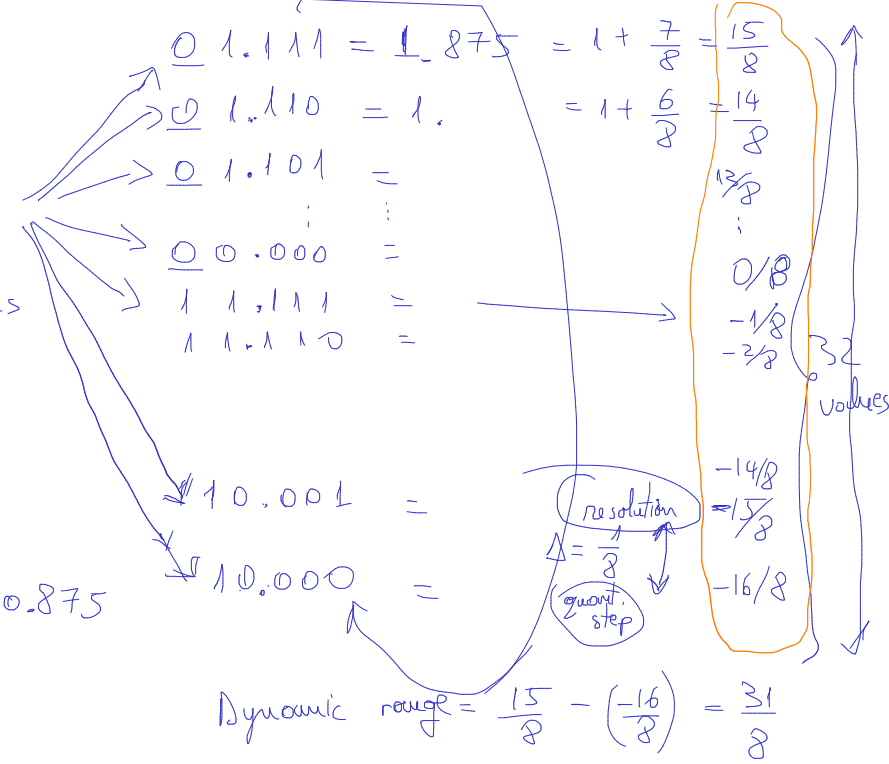
1 1 0 1 0 0 1 . 1 1 0 0 1 0

Dynamic range : (2C)

15 1 3 F

S i . F F F

$2^5 = 32$ values



$0.111 = 2^{-1} + 2^{-2} + 2^{-3}$

$= \frac{1}{2} + \frac{1}{4} + \frac{1}{8} = \frac{7}{8} = 0.875$

$0.110 = 14/8$

Dynamic range $= \frac{15}{8} - \left(\frac{-16}{8}\right) = \frac{31}{8}$

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0 1.1 1 0 = 14/8

0 1 1.1 0 = 14/4

0 1 1 1.0 = 14/2

0 1 1 1 0 = 14

2^3 2^2 2^1 2^0

8 + 4 + 2

11.1 = 7/2

7.8255

7 8.255 ×10

7 82.55 ×10

7 825.5 ×10

7 8255. ×10

$\frac{15}{8} + \frac{3}{8} = \frac{18}{8}$

$\frac{15}{8} + \frac{3}{8} = \frac{15}{8} + 3 \text{ steps} =$

=

01.111 +

00.011

(1)0.010 $= -\frac{14}{8}$

(2C)

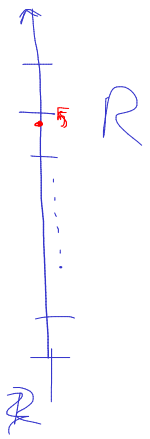
5 negative

subtract 1 $\Rightarrow$ 10.001 $\overset{\text{invert}}{\Rightarrow}$ 01.110 $= \frac{14}{8}$

$\underbrace{\frac{15}{8} + \frac{3}{8}}_{\text{overflow}} - \frac{5}{8} = \text{good} = \frac{13}{8}$

underflow

Quant. methods:



1. Rounding

$8.75 \rightarrow 9$

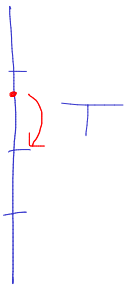
$8.33 \rightarrow 8$

2. Truncation

$8.75 \rightarrow 8$

$8.33 \rightarrow 8$

$-8.75 \rightarrow -9$

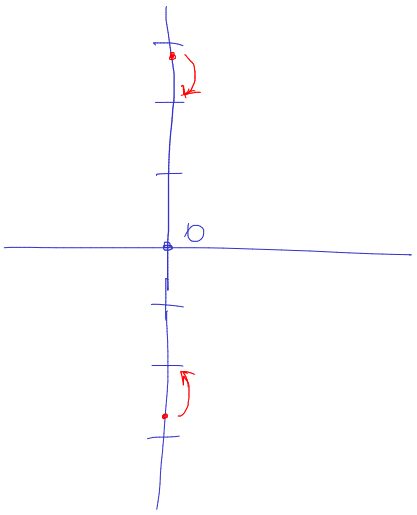


3. Sign-mag. Trunc. = "truncation in absolute value"

= "go towards 0"

$[8.75]_Q = 8$

$[-8.75] = -8$

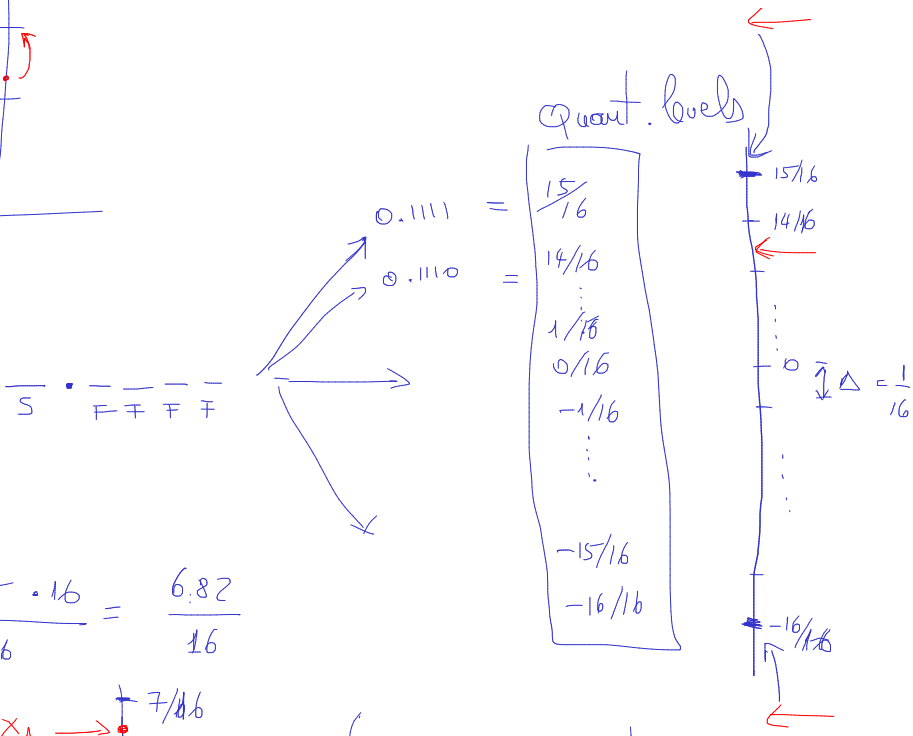


Exercise 4 / Lab 8

$X_1 = 0.42625$

$X_2 = -0.4333$

format: fixed-point 1S0I4F



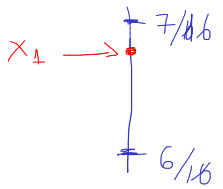
$X_1 = 0.42625 = \frac{0.42625 \cdot 16}{16} = \frac{6.82}{16}$

$[X_1]_R = 7/16 = 0.4375$

$[X_1]_T = 6/16 = 0.375$

$[X_1]_{SMT} = 6/16 = 0.375$

TAV T. obs.



$[\text{100}]_R$ = outside the scale => => go to nearest end of scale

(0.1011 ~~XXXX~~)

÷0

$X_2 = -0.4333 = \frac{-6.5578}{16}$

$[X_2]_R = -7/16 = -0.4375$

$[X_2]_T = -7/16 = -0.4375$

$[X_2]_{S.M.T.} = -6/16 = -0.375$