# Question 1

(a) Lecture note form : $\pm(0.1111)_2 \times 2^2$

$= 15/4$

Normalized form : $\pm(1.1111)_2 \times 2^2$

$= 31/4$

De-normalized form : $\pm(0.11111)_2 \times 2^2$

$= 31/8$.

(b) Minimum number —

Lecture note form : $\pm(0.1000)_2 \times 2^{-4}$

$= 1/32$

Normalized form : $\pm(\cancel{0}\ 1.0000)_2 \times 2^{-4}$

$= 1/16$

De-normalized form $= \pm(0.10000)_2 \times 2^{-4}$

$= 1/32$

(c)

$(0.1000)_2 \times 2^{-3} = 1/16$

$(0.1001)_2 \times 2^{-3} = 9/128$

$(0.1010)_2 \times 2^{-3} = 5/64$

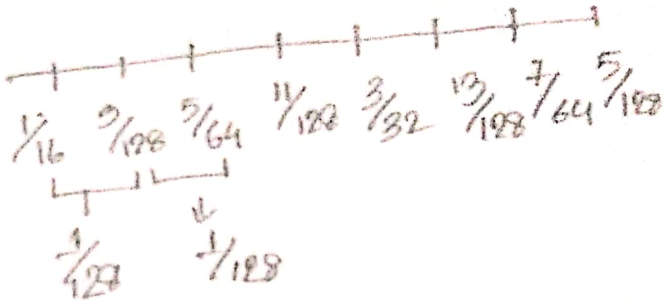
$(0.1011)_2 \times 2^{-3} = 11/128$

$(0.1100)_2 \times 2^{-3} = 3/32$

$(0.1101)_2 \times 2^{-3} = 13/128$

$(0.1110)_2 \times 2^{-3} = 7/64$

$(0.1111)_2 \times 2^{-3} = 15/128$




Here, from one point to another point's difference is 1/128. So the number line is equally spaced.

9) Question 2 :-

(a) |a| minimum

- Normalized : $(1.00000)_2 \times 2^{-2} = \boxed{1/4}$

- De-normalized : $(0.100000)_2 \times 2^{-2} = \boxed{1/8}$.

(b) Machine epsilon for -

- Normalized $\epsilon = 1/2 \times \beta^{-m}$

$= 1/2 \times 2^{-5}$

$= \boxed{1/64}$

- De-normalized $\epsilon = 1/2 \times \beta^{-m}$

$= 1/2 \times 2^{-5}$

$= \boxed{1/64}$.

(c) Maximum delta value -

$\epsilon = 1/2 \, \beta^{-m}$

$= 1/2 \cdot 2^{-5}$

$= \boxed{1/64}$

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Question : 3

(a) $(2.20)_{10} = (10.00111\ldots)_2$

$= (1.0001)_2 \times 2^1$ [Normalized form]

$= (1.001)_2 \times 2^1$ [Rounded form]

$(2.2018)_{10} = (10.00110\ldots)_2$

$= (1.0001)_2 \times 2^1$ [Normalized]

$= (1.001)_2 \times 2^1$ [Rounded form]

(b) Here $fl(x) = (1.001)_2 \times 2^1$

$= (2.25)_{10}$.

$\therefore$ Rounding error $= |2.25 - 2.20|$

$= (0.02)_{10}$.

$\therefore$ Rounding error $= |2.25 - 2.2018|$

$= (0.0482)_{10}$.

(8) $(2.23)_{10} = (10.00111\cdots)_2 \times 2^0$

$= (0.10001\cdots)_2 \times 2^2$ [De-normalized]

$= (0.1001)_2 \times 2^2$ [Rounded]

$= (2.25)_{10}$.

$(2.2018)_{10} = (10.001100\cdots)_2 \times 2^0$

$= (0.10001\cdots)_2 \times 2^2$ [De-normalized]

$= (0.1001)_2 \times 2^2$ [Rounded]

$= (2.25)_{10}$

As we can see that after rounding ~~see~~ ~~can~~ the de-normalized form of both ~~2.3~~ $(2.23)_{10}$ and $(2.2018)_{10}$ the number becomes $(2.25)_{10}$. So we can not represent them in de-normalized form.