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Course : CSE330

Section : 10

Assignment no : 01

Ans: to the que no: 01

(1) Given, $\beta = 2$,

$e_{max} = 5$

$e_{min} = -2$

$m = 4$

The maximum number that can be stored in this system -

$$F_{maximum} = +(0.11111)_2 \times 2^5$$

$$= (2^{-1} + 2^{-2} + 2^{-3} + 2^{-4} + 2^{-5}) \times 32$$

$$= \left(\frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \frac{1}{16} + \frac{1}{32}\right) \times 32$$

$$= \frac{31}{32} \times 32$$

$$= 31$$

$\therefore F_{maximum} = 31$. Ans.

(2) The minimum number that can be stored in the system

$$F_{minimum} = -(0.11111) \times 2^5$$

$$= -\left(\frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \frac{1}{16} + \frac{1}{32}\right) \times 32$$

$$= -\frac{31}{32} \times 32$$

$$= -31$$

$\therefore$ The minimum number is the number which has the same value as the maximum number for this system but with (-ve) sign. Ans

(3) According to the question,

$m = 4,$

sign bit $= 2$

$e = -2, -1, 0, 1, 2, 3, 4, 5$

Firstly

For each exponent value we can get 2^m number of different combinations $(m = 4)$.

So, for this case the number of different sets of numbers in this system that can be stored $= 2^m$

$= 2^4$

$= 16.$ (Ans)

Secondly,

If we consider the eight (8) values of e, we can can store different sets in this system are $= 2^4 \times 8 \times 2$

$= 256.$ (Ans)

Now

for each exponent,

there can be stored $= 2^4 \times 2$

$= 16 \times 2$

$= 32$ combinations

(Ans)

(4)

Without considering negative numbers support the maximum number of the system =

$$F_{maximum} = (0\cdot 11111)_2 \times 2^5$$

$$= 31$$

Ans.

(5)

Minimum number of the system if there is no negative support =

$$F_{minimum} = (0\cdot 10000)_2 \times 2^{-2}$$

$$= \frac{1}{2} \times \frac{1}{4}$$

$$= \frac{1}{8}$$

Ans

(6) For e=5, decimal numbers are:-

$F = \pm (0{\cdot}10000)_2 \times 2^5 = \pm(\frac{1}{2} \times 32) = \pm 16$

$F = \pm (0{\cdot}10001)_2 \times 2^5 = \pm 17$

$F = \pm (0{\cdot}10010)_2 \times 2^5 = \pm 18$

$F = \pm (0{\cdot}10011)_2 \times 2^5 = \pm 19$

$F = \pm (0{\cdot}10100)_2 \times 2^5 = \pm 20$

$F = \pm (0{\cdot}10101)_2 \times 2^5 = \pm 21$

$F = \pm (0{\cdot}10110)_2 \times 2^5 = \pm 22$

$F = \pm (0{\cdot}10111)_2 \times 2^5 = \pm 23$

$F = \pm (0{\cdot}11000)_2 \times 2^5 = \pm 24$

$F = \pm (0{\cdot}11001)_2 \times 2^5 = \pm 25$

$F = \pm (0{\cdot}11010)_2 \times 2^5 = \pm 26$

$F = \pm (0{\cdot}11011)_2 \times 2^5 = \pm 27$

$$F = \pm(0.11100)_2 \times 2^5 = \pm 28$$

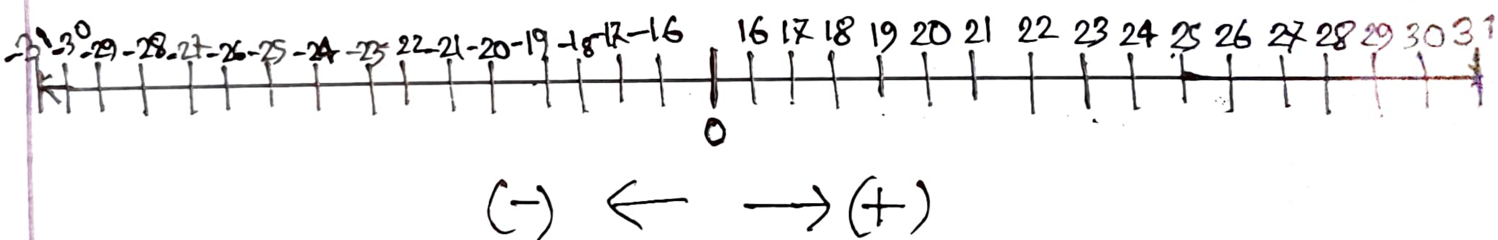
$$F = \pm(0.11101)_2 \times 2^5 = \pm 29$$

$$F = \pm(0.11110)_2 \times 2^5 = \pm 30$$

$$F = \pm(0.11111)_2 \times 2^5 = \pm 31$$

$\therefore$ Total 32 decimal numbers

Real Line Plotting:



Ans: to the que no:02

Given,

$m = 4$

$e_{max} = 2$

$e_{min} = -1$

$\beta = 2$

(1) For denormalized form

$|x|_{minimum} = \beta^{-1} \beta^{e_{min}}$

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

$= \frac{1}{4}$ Ans

(2) Machine Epsilon Value for denormalized form

$$\epsilon_M = \frac{1}{2} \beta^{-m}$$

$$= \frac{1}{2} \beta^{-4}$$

$$= \frac{1}{2} \times 2^{-4}$$

$$= \frac{1}{32} \quad \text{An}$$

(3) In order to see the relation properly, it will be better if I write the formula or equations first.

For the convention:

$$\epsilon_M = \frac{1}{2} \beta^{1-m}$$

Both for Normalized and Denormalized.

$$\epsilon_M = \frac{1}{2}\beta^{-m}$$

Now, from the formulas and equations it can be seen that there is no relation between machine ~~epl~~ epsilon and exponent. It is clearly visible that we did not require exponent to calculate machine epsilon. So, if something has no use in something then it can't have any influence. It can not ~~chan~~ have any effect on the results so, Machine Epsilon Value does not require exponent thus they have no direct relation between them.

(4) Machine Epsilon Value for Normalized form,

$$\epsilon_M = \frac{1}{2}\beta^{-m}$$

$$= \frac{1}{2} \times 2^{-4}$$

$$= \frac{1}{32} \quad \underline{\text{Ans}}$$