Assignment -1

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Question 1

1. Given, $\beta = 2$, $m = 4$, $e = -2 \leq e \leq 5$

we know that,

$$f = \pm (0.1 d_1 d_2 d_3 \ldots d_m)_\beta \cdot \beta^e$$

so here, $\pm (0.11111)_2 \times 2^e$

∴ Maximum number: $+(0.11111)_2 \times 2^5$

$$= +\left(0\times2^{0}+1\times2^{-1}+1\times2^{-2}+1\times2^{-3}+1\times2^{-4}+1\times2^{-5}\right) \times 2^5$$

$$= +\left(\frac{1}{2}+\frac{1}{4}+\frac{1}{8}+\frac{1}{16}+\frac{1}{32}\right) \times 2^5$$

$$= +(31)_{10} \quad \text{(Ans)}$$

2 So Now the

Minimum number,

$$= -(0.11111) \times 2^5$$

$$= -(31)_{10} \quad [\text{from "a"}]$$

(Ans)

3 Given Limit = e = $(-2, -1, 0, 1, 2, 3, 4, 5)$

$= 8$

for each exponent we can have 2^4 combination or 16 combination, Again we can get $(8 \times 2) = 16$ positive and negative values,

So, 16 different sets of numbers we can store in this system

Ans: 16

4

F_{max} for non negative numbers,

$$= +(0.11111) \times 2^5$$

$$= +\left(\frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \frac{1}{16} + \frac{1}{32}\right) \times 2^5$$

$$= +(31)_2$$

(Ans)

5 min number for the non negative numbers,

$$= +(0.10000) \times 2^{-2}$$

$$= +\left(0 \times 2^0 + 1 \times 2^{-1} + 0 + 0 + 0 + 0\right) \times \frac{1}{4}$$

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

$$= +(0.125)_{10}$$

(Ans)

6. For $e = 5$

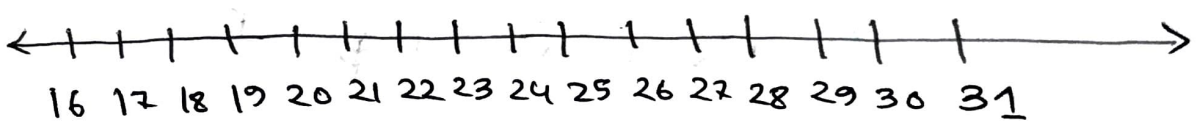
1. $(0.10000) \times 2^5 = (1 \times 2^{-1}) \times 2^5 = (16)_{10}$
2. $(0.10001) \times 2^5 = (1 \times 2^{-1} + 1 \times 2^{-5}) \times 2^5 = (17)_{10}$
3. $(0.10010) \times 2^5 = (1 \times 2^{-1} + 1 \times 2^{-4}) \times 2^5 = (18)_{10}$
4. $(0.10011) \times 2^5 = (2^{-1} + 2^{-4} + 2^{-5}) \times 2^5 = (19)_{10}$
5. $(0.10100) \times 2^5 = (20)_{10}$ [As it maintain same distance for a particular e]
6. $(0.10101) \times 2^5 = (21)_{10}$
7. $(0.10110) \times 2^5 = (22)_{10}$
8. $(0.10111) \times 2^5 = (23)_{10}$
9. $(0.11000) \times 2^5 = (24)_{10}$
10. $(0.11001) \times 2^5 = (25)_{10}$
11. $(0.11010) \times 2^5 = (26)_{10}$
12. $(0.11011) \times 2^5 = (27)_{10}$
13. $(0.11100) \times 2^5 = (28)_{10}$
14. $(0.11101) \times 2^5 = (29)_{10}$

15. $(0.11110) \times 2^5 = (30)_{10}$

15. $(0.11111) \times 2^5 = (31)_{10}$

Plotted Line :

for, e = 5



Question 2

1

Given,

$\beta = 2$

$m = 4$

$e_{min} = -1$, $e_{max} = 2$

Minimum of |x| for denormalized form:

$$= (0.1\, d_1\, d_2\, d_3\, d_4)_\beta \times \beta^{e_{min}}$$

$$= (0.10000)_2 \times 2^{-1}$$

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

$$= \frac{1}{2} \times \frac{1}{2} \Rightarrow \frac{1}{4} \quad \text{(Ans)}$$

2

We know,

the machine epsilon for the denormalised form is, $\varepsilon_m = \frac{1}{2}\beta^{-m}$

$$= \frac{1}{2}(2)^{-4}$$

$$= \frac{1}{2} \times \frac{1}{16}$$

$$= \frac{1}{32} \quad \text{(Ans)}$$

3

As there is no epsilon in the machine epsilon formula

So, there is no connection between ~~of~~ expotent and machine epsilon.

4

know that Machine epsilon value for normalized form is $\varepsilon_m = \frac{1}{2}\beta^{-m}$

$$= \frac{1}{2} \times 2^{-4} \Rightarrow \frac{1}{2} \times \frac{1}{16}$$

$$= \frac{1}{32} \quad \text{(Ans)}$$