Assignment-01

Answer to the question no-1.

a) Largest:

i) Standard $= (0.111)_2 \times 2^4$

$= 1\times2^{-1} + 1\times2^{-2} + 1\times2^{-3} \times 2^4$

$= (14)_{10}$

ii) Normalized $= (1.111)_2 \times 2^4$

$= 1\times2^0 + 1\times2^{-1} + 1\times2^{-2} + 1\times2^{-3} \times 2^4$

$= (30)_{10}$

iii) Denormalized $= (0.1111)_2 \times 2^4$

$= 1\times2^{-1} + 1\times2^{-2} + 1\times2^{-3} + 1\times2^{-4} \times 2^4$

$= (15)_{10}$

b) Non-Negative smallest.

i) Standard

$= (0.100)_2 \times 2^{-2}$

$= (0.125)_{10}$

ii) Normalized

$= (1.000)_2 \times 2^{-2}$

$= (0.25)_{10}$

iii) Denormalized

$= (0.1000)_2 \times 2^{-2}$

$= (0.125)_{10}$

c) Negative support:

Maximum will be the same.

i) Standard $= (14)_{10}$

ii) Normalized $= (30)_{10}$

iii) Denormalized $= (15)_{10}$

Minimum:

i) Standard $= -(0.111)_2 \times 2^4$

$= -(14)_{10}$

ii) Normalized $= -(1.111)_2 \times 2^4$

$= -(30)_{10}$

iii) Denormalized $= -(0.1111)_2 \times 2^4$

$= -(15)_{10}$

(Ans)

Answer to the question no-2

a) $X = (6.235)_{10}$

$$
\begin{array}{r|l}
2 & 6 \\
2 & 3 - 0 \\
2 & 1 - 1 \\
 & 0 - 1
\end{array}
\uparrow
$$

$$
\begin{aligned}
0.235 \times 2 &= 0.47 && 0 \\
0.47 \times 2 &= 0.94 && 0 \\
0.94 \times 2 &= 1.88 && 1 \\
0.88 \times 2 &= 1.76 && 1 \\
0.76 \times 2 &= 1.52 && 1 \\
0.52 \times 2 &= 1.04 && 1 \\
0.04 \times 2 &= 0.08 && 0
\end{aligned}
\downarrow
$$

$\therefore (6.235)_{16} = (110.0011110)_2$

(Ans)

b) if $m = 5$

$$x_1 = (6.235)_{10} = (110.0011110)_2 \quad [\text{from 'a'}]$$

$$= (0.11000)_2 \times 2^3$$

$$fl(x_1) = 0.75 \times 2^3 = (6)_{10}$$

if $m = 6$

$$x_2 = (0.110001)_2 \times 2^3$$

$$fl(x_2) = 0.765625 \times 2^3 = (6.125)_{10}$$

c) if $m = 5$

$$fl(x_1) = (0.11000)_2 \times 2^3$$

$$= 0.75 \times 2^3$$

$$= (6)_{10}$$

if $m = 6$

$$fl(x_2) = (6.125)_{10}$$

$\therefore$ Rounding error, $E_1 = |fl(x_1) - x_1|$

$$= |6 - 6.235|$$

$$= 0.235$$

and, $E_2 = |fl(x_2) - x_2| = |6.125 - 6.235| = 0.11$

(Ans)

Answer to the question no-3

a) $2x^2 - 60x + 3 = 0$ $\qquad$ SF = 6

$$\frac{-(-60) \pm \sqrt{(-60)^2 - 4 \cdot 2 \cdot 3}}{2 \cdot 2}$$

$$= \frac{60 \pm \sqrt{3600 - 24}}{4}$$

$$= 15 \pm \frac{\sqrt{894}}{2}$$

$\therefore x_1 = 29.9499$

$x_2 = 0.050075$

$\therefore$ SF 6 $= \frac{\sqrt{894}}{2} = 14.9499$

$\therefore x_1' = fl(15) + fl\left(\frac{\sqrt{834}}{2}\right)$

$= 29.9499$

and $x_2' = fl(15) - fl\left(\frac{\sqrt{894}}{2}\right)$

$= 0.0501$

$\therefore x_2 \neq x_2'$

Hence, after round up the root $x_2 \neq x_2'$ due to substraction.

b) we know,

in polynomial

$$\alpha_1 \alpha_2 = c/a$$

from "a" $\frac{c}{a} = \frac{3}{2} = 1.5$

and,

$$\alpha_1 \cdot \alpha_2 = 29.9499 \times 0.050075$$

$$= 1.499975$$

$$\neq 1.5$$

So, it doesn't satisfy the claim.

(Ans)

c) if we ignore the substaction part then we can overcome the loss.

So,

$$\alpha_1 \alpha_2 = c/a$$

$$\therefore \alpha_2 = \frac{c}{\alpha_1 a} = \frac{3}{29.9499 \times 2}$$

$$= 0.0500836$$

This is the actual value of x_2

(Ans)