Number Systems

3789.271

Digits: Each numeral in the number
Radix point: interface between integer portion and real.
Numerals: symbols of each digit.
Order: Weight of the exponent of the base of each digit.
Weight: Magnitude of the numeral (max is base − 1)
Base: Total weight of each moduland.

$$x = \sum_{i=-m}^{n} a_i b^i$$

Binary addition

$$101101.11 + 011.01$$

$$\begin{array}{r} 1\,0\,1\,1\,0\,1.\,1\,1 \\ +\ 0\,0\,0\,0\,1\,1.\,0\,1 \\ \hline 1\,1\,0\,0\,0\,1.\,0\,0 \end{array}$$

$2^5 + 2^3 + 2^2 + 2^0 + 2^{-1} + 2^{-2} = 45.75_{10}$

$2^1 + 2^0 + 2^{-2} = 3.25_{10}$

$2^5 + 2^4 + 2^0 = 49_{10}$

Binary subtraction

$$101101.11 - 011.01$$

$$\begin{array}{r} 1\,0\,1\,1\,0\,1.\,1\,1 \\ -\ 0\,0\,0\,0\,1\,1.\,0\,1 \\ \hline 1\,0\,1\,0\,1\,0.\,1\,0 \end{array}$$

45.75_{10}
3.25_{10}
$2^5 + 2^3 + 2^1 + 2^{-1} = 42.5_{10}$

Decimal to binary conversion:

62_{10}

62	r	0
31	r	1
15	r	1
7	r	1
3	r	1
1	r	1
0		

33.333

111110

33.75 ? (33.333̇)

Q - notation

Q n.m → x

33.75 in Q3.3

100001.11 → Q5.2

0001.110 → 1.75 ≠ 33.75 ∴

unsigned

Range : for Q3.3 is 15.875 → $(max - min) = b^{n+1} - b^{-m}$

Resolution : for Q3.3 is 0.125 → $(smallest\ number) = b^{-m}$

$x = 33.75$

$n =$ ~~$(e1)\ floor(\log_2(x)) - 1 \rightarrow$~~ 5 not valid for b^n numbers.

$= floor(\log_2(x)) \rightarrow 5$

$m \Rightarrow$ You choose it.

Q n.m has $m+n+1$ digits.

8 bits $\therefore$ $m+n+1 = 8$

$\Rightarrow m = 8-n-1$