Data Representation

Friday, October 18, 2024 12:26 PM

- Convert 4.75 to normalized floating point notation
  Use 8 bit for exponent & 8 bit for mantissa.

4.75

16 8 4 2 1 . 0.5 0.25 0.125

100.11 ← ① Convert to binary

0100.11 E

for +ve, we need 0.1.... x 2 So,

0.10011×2^3 ← ②

01001100 00000011 ← ③

M E

In exam:

4.75

$= 4 + 0.5 + 0.25$

$= 100.11$

$= 0.10011 \times 2^3$

So,

M = 0.1001100

E = 00000011

01001100 00000011

M

- Convert -4.75 to binary
  Use 8 bit for mantissa & 10 bit for exponent

4.75 = 100.11

Now, add zeros to make it 8 bits.

0100.1100

↓ take 2's complement

10110011

+1

1011.0100

1.0110100×2^3

for -ve we need, 1.0....

M 10110100 0000000011 E

In exam

4.75

= 0100.1100

So for -ve taking 2's comp

= 1011.0100

$= 1.0110100 \times 2^3$

M = 10110100

E = 0000000011

- You might need -ve exponent too
- Convert 0.125 into binary

0.125 = 0.001

$= 000.1 \times 2^{-2}$

$= 0.1 \times 2^{-2}$

Mantissa = 01000000 (if 8 bit is req)

Exponent = two's complement of 0000010

= 11111110

M = 01000000

E = 11111110

notice padding is different from above

- Convert to decimal

0100 1100 | 00000011

+ve (No need to take 2s comp)

+ve

Exponent is 3

$0.100\ 100 \times 2^{3}$

8 4 2 1 ← 0.100

0100. 1100

4 + 0.5 + 0.25

= 4.75 ∎

In exam:

01001100 00000011

$= 0.1001100 \times 2^{3}$

= 0100.1100

= 4 + 0.5 + 0.25

= 4.75

#

- Convert to decimal

10110100 00000011

-ve (2s comp) +ve

0.1001100×2^{3}

8 4 2 1 ← 0.1001100

$= -0100.1100$

$= -4.75$

In exam

10 110100 00000011

2s comp of mantissa is 01001100

So,

$= -0.1001100 \times 2^{3}$

$= -0100.1100$

$= -4.75$

∎

Normalize

(a) 0.001000 0000101

$= 0.001000 \times 2^{5}$

$= 0.1000 \times 2^{-2} \times 2^{5}$

$= 0.1000 \times 2^{3}$

M = 01000000

E = 00000011

+ve → 0.1...

-ve → 1.0...

(b) 11011110 00000111

$= 1.1011110 \times 2^{7}$

$= 1.0111110 \times 2^{6}$

M = 10111100

E = 00000110