18 03 24

(Unit : 2)

Floating point representation:

$512 \Rightarrow 5.12 \times 10^2$ or 0.512×10^3

Magnitude = 3 Magnitude = 3
Exponent = 2 Exponent = 3

$18.50 \Rightarrow 10010.10$

$\Rightarrow .1001010 \times 2^5$

$\Rightarrow 1.001010 \times 2^4$ (Normalized Form)
recommended by IEEE

Magnitude = 001010
Exponent = 4

IEEE floating point representation

(SINGLE PRECISION) 16 bit	(DOUBLE PRECISION) 64 bit
★ 1-bit : Sign	★ 1-bit : Sign
★ 23-bit : Mantissa	★ 52-bit : Mantissa
★ 8-bit : Exponent	★ 11-bit : Exponent

(SINGLE PRECISION)

$(18.50)_{10} \Rightarrow (10010.10)_2$

$\Rightarrow 1.001010 \times 2^4$ (NORMALIZED FORM)

Biased Exponent = Exponent + 127

$B.E = 4 + 127 = (131)_{10} = (10000011)_2$

MAXIMUM POWER UPTO WHICH THIS IS APPLICABLE IS 128

1-bit	8-bit	23-bit
Sign	Exponent	Mantissa

Sign bit to be kept 0 for +ve and 1 for -ve.

Sign	Exponent	Mantissa
0	10000011	001010------
1-bit	8-bit	23-bit

(SINGLE PRECISION)

For (DOUBLE PRECISION)

$B.E = 4 + 1023 = (1027)_{10} = (10000000011)_2$

Sign	Exponent	Mantissa
0	10000000011	001010------
1-bit	11-bit	52-bit

(DOUBLE PRECISION)

-37.125

$(37)_{10} = (100101)_2$ and $0.125 \times 2 = \underline{0}.250 = 0$

$0.25 \times 2 = \underline{0}.50 = 0$

$0.5 \times 2 = \underline{1}.00 = 1$

So, $-(37.125)_{10} = (100101.001)_2$

$= 1.00101001 \times 2^5$ (NORMALIZED FORM)

For Single Precision;

Biased Exponent $= 5 + 127 = (132)_{10} = (10000100)_2$

Sign	Exponent	Mantissa
1	10000100	00101001------
1-bit	8-bit	23 bit

(SINGLE PRECISION)

For Double Precision;

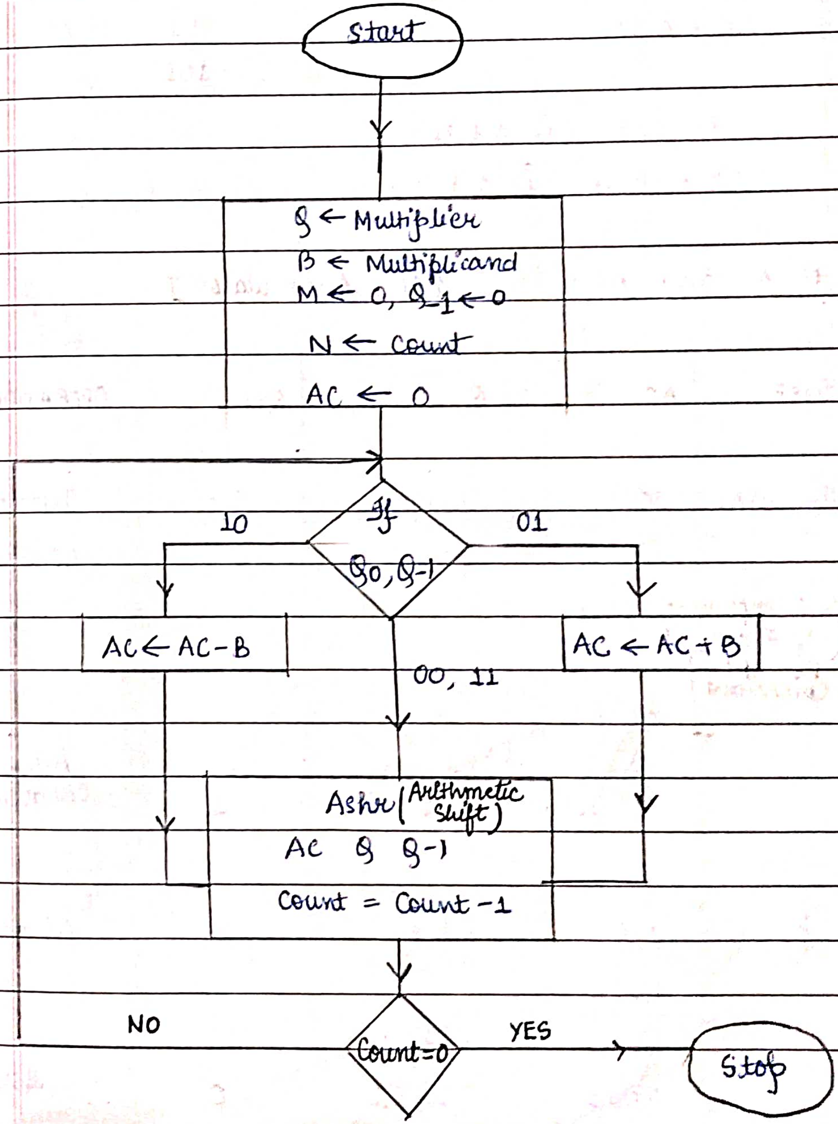
Biased Exponent $= 5 + 1023 = (1028)_{10} = (10000000100)_2$

Sign	Exponent	Mantissa
1	10000000100	00101001-------
1-bit	11-bit	52-bit

(DOUBLE PRECISION)

Signed Number's Multiplication;

Booth's Multiplication Algorithm :



Example: $7 \times (-3) \leftarrow$ Multiplier
↑
Multiplicand

$7 = 111$ 2's Complement of $3 = 100$
$3 = 011$ $\quad +1$
$\quad 101$

$7 = 0111$ (in 4 bits)
$-3 = 1101$ (in 4 bits)

$N = 4$ and $AC \leftarrow 0000$ [AC : Accumulator]

STEP	AC	Q	Q-1	OPERATION
INITIAL	0000	1101	0	INITIAL
	0000	1101	0	AC←AC−B
	(2's Complement of 7 0111) 1001			
	1001			
	1100	1110	1	Ashr (Arithmetic Shift)
3	1100	1110	1	AC←AC+B
	0111			
	0011	1110	1	
	0001	1111	0	Ashr
2	0001	1111	0	AC←AC−B
	1010	1111	0	
	1101	0111	1	Ashr
1	1101	0111	1	
	1110	1011	1	Ashr

[2's complement = 1's complement +1]

Represents −ve Sign. ← 11101011.
↓ 2's complement
$\boxed{00010101}$ ← Represents 21 in Binary Form.

Final Answer: $\boxed{-21}$