10's complement.

1 digit 10's complement

0 – 9

7

↓

0 – 4

5 – 9 → $\boxed{-7}$

−4   −1

~~6~~

0 . . . 9

Floating point adder.

3FC000000 ←

40500000 ←

① Extract exponent & mantissa.

sign	exponent	mantissa
0	011 11111	1 000 . . . 0.
0	100 00000	1010 - - - -

First op: $S: 0, \quad E: 127, \quad F = 0.1$

2nd op: $S: 0, \quad E: 128, \quad F: 0.101$

② Prepend 1 to F.

$N_1 = 1.1$

$N_2: 1.101$

3. Compare exponents

$127 - 128 = -1.$

$127 \to 0$ ✓
$128 \to 1$ ✓

First op: $.11 \times 2^1 \longrightarrow$

2nd op: 1.101×2^1

4. Add mantissa

$$
\begin{array}{r}
0.11 \\
1.101 \\
\hline
10.011 \times 2^1
\end{array}
$$

5. Normalize

$10.011 \times 2^1 = 1.0011 \times 2^2$

6. Assemble into IEEE 754 format.

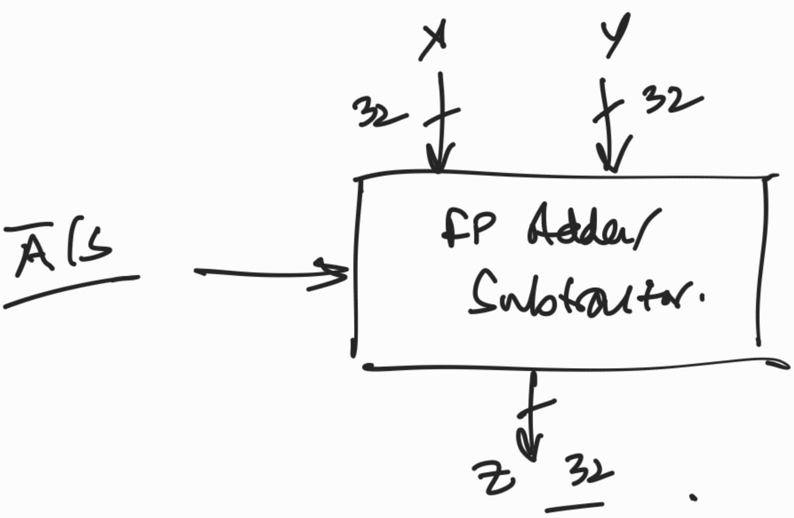
$S = 0$

$E = 2 + 127 = 129 = 1000\ 0001_2$

$F = 00110 \ldots 0$

$0 \quad \xrightarrow[E]{} \quad \xrightarrow[23]{}$

$\boxed{4098\ 0000}$



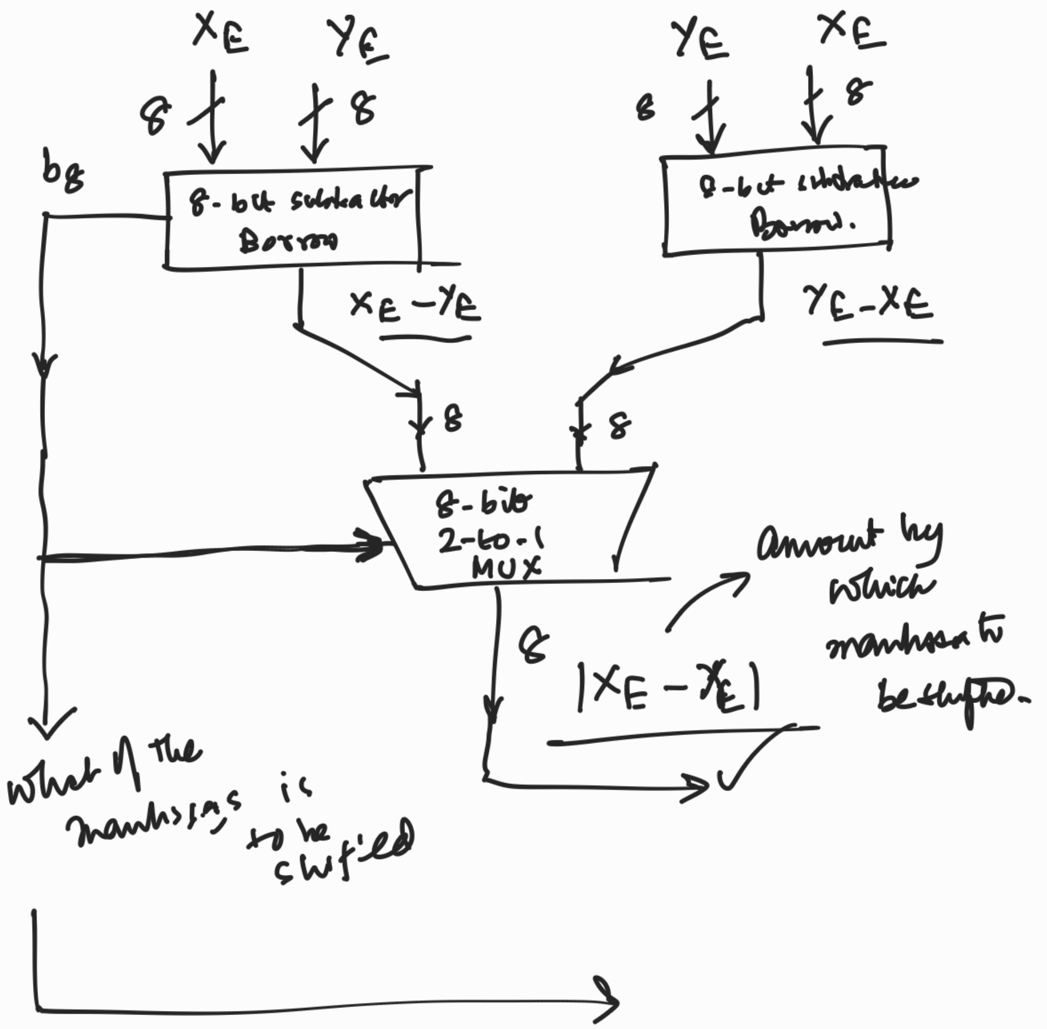
1. Exponent comparison : $X_E > Y_E$
   $Y_E > X_E$.

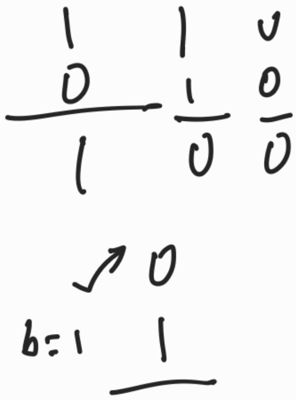
2. Mantissa alignment
   Shift the mantissa with smaller exponent by
   $|X_E - Y_E|$ bits.

3. Mantissa addition

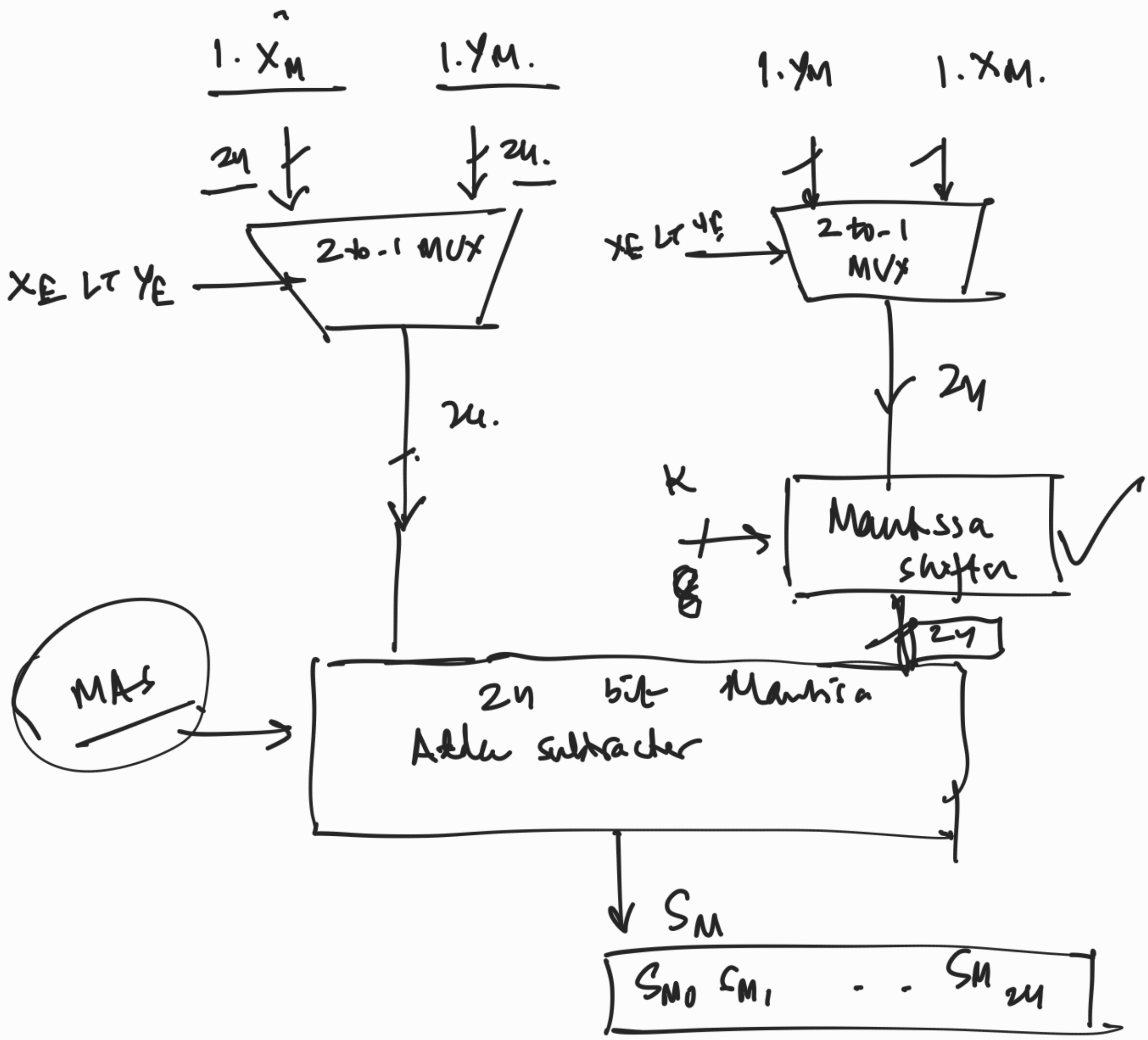
   0 1 1 0 0 1 1 1 1
   − 0 1 1 0 [illegible] 1 1 1 1

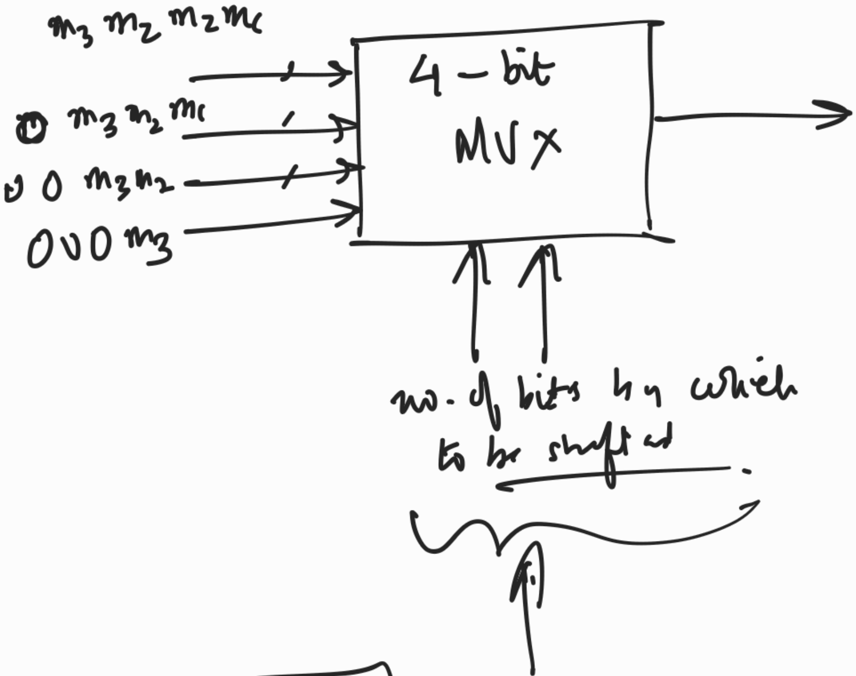
4. Result normalization.

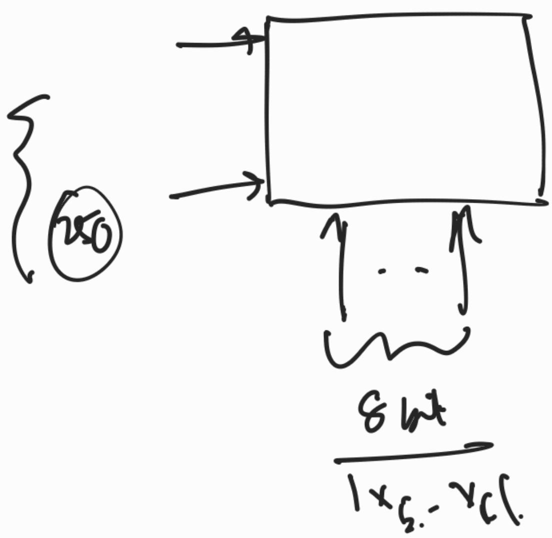




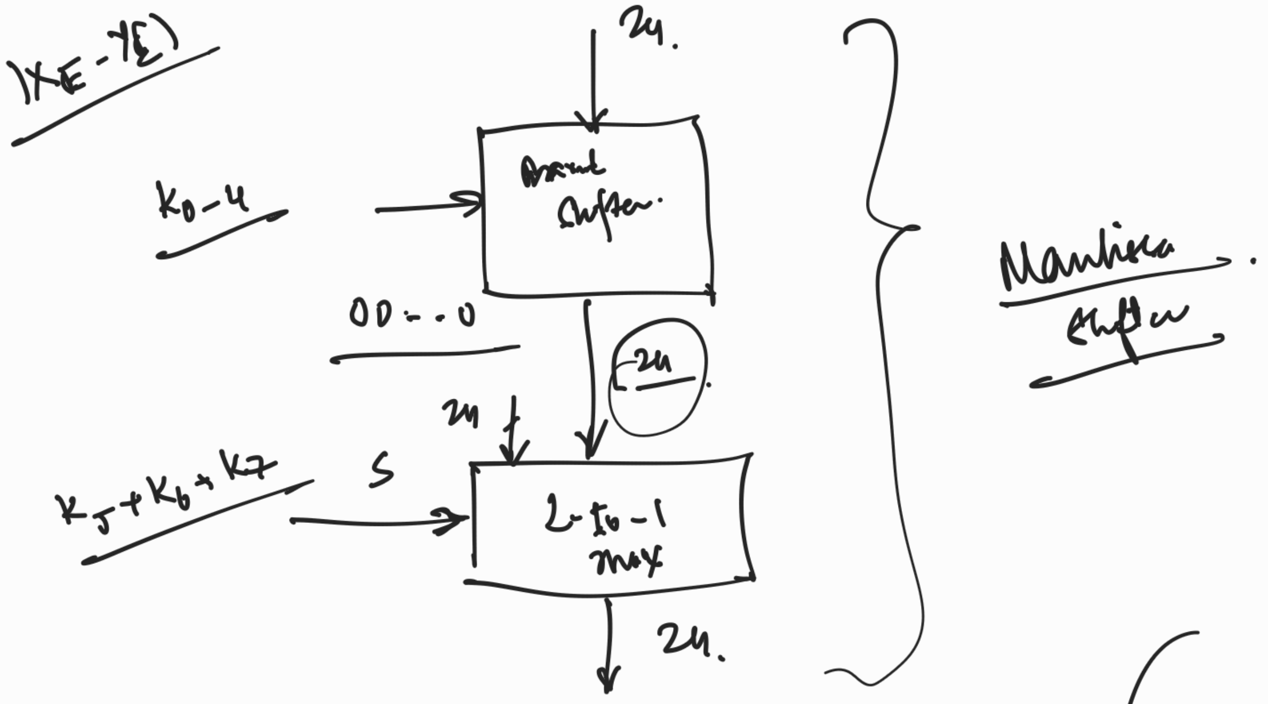
$\underbrace{1.X_M}_{24\text{ bit}}$







$\boxed{\text{Barrel Shifter}}$



0 → add, 1 → SUB

sign

X_E LT Y_E	X_S	Y_S	A_S	Z_S	MAS
0	0	0	0	0	0
0	0	0	1	0	1
0	0	1	0	0	1
0	0	1	1	0	0
0	1	0	0	1	1
0	1	0	1	1	0
0	1	1	0	1	0
0	1	1	1	1	1
1	0	0	0	0	0

.
.
.

$$Z_S(X_E LT Y_E, X_S, Y_S, A_S) = \sum m(4,5,6,7,10,13,14,15)$$

$$MAS(X_E LT Y_E, X_S, Y_S, A_S) =$$

$$Z_S = \overline{X_E \, LT \, Y_E} \cdot X_S + X_E \, LT \, Y_E \cdot \overline{X_S} \cdot A_S + X_E \, LT \, Y_E \cdot Y_S \cdot A_S.$$

$$MAS = X_S \oplus Y_S \oplus A_S.$$

Normalization - $\quad 1.\boxed{\quad \_\ \_\ \_\quad}$

SM_0	SM_1	. . . . . .	SM_{24}

0 0 $\frac{1 \quad 1}{}$

1.1×2^{exp}.

leading Zeros Detector

ZE	SM_0	SM_1 . .	. . .	SM_{24}
$Z_E = G_E + 1$	1	X	X X - -	X
GE $\quad Z = G_E$	0	1	X X	X
$Z_E = G_E - 1$	0	0	1 X	X
⋮		⋮		
$Z_E = G_E - 23$	0	0	0 . .	1

no. of leading zeros

0 ✓

1 ✓

2

24

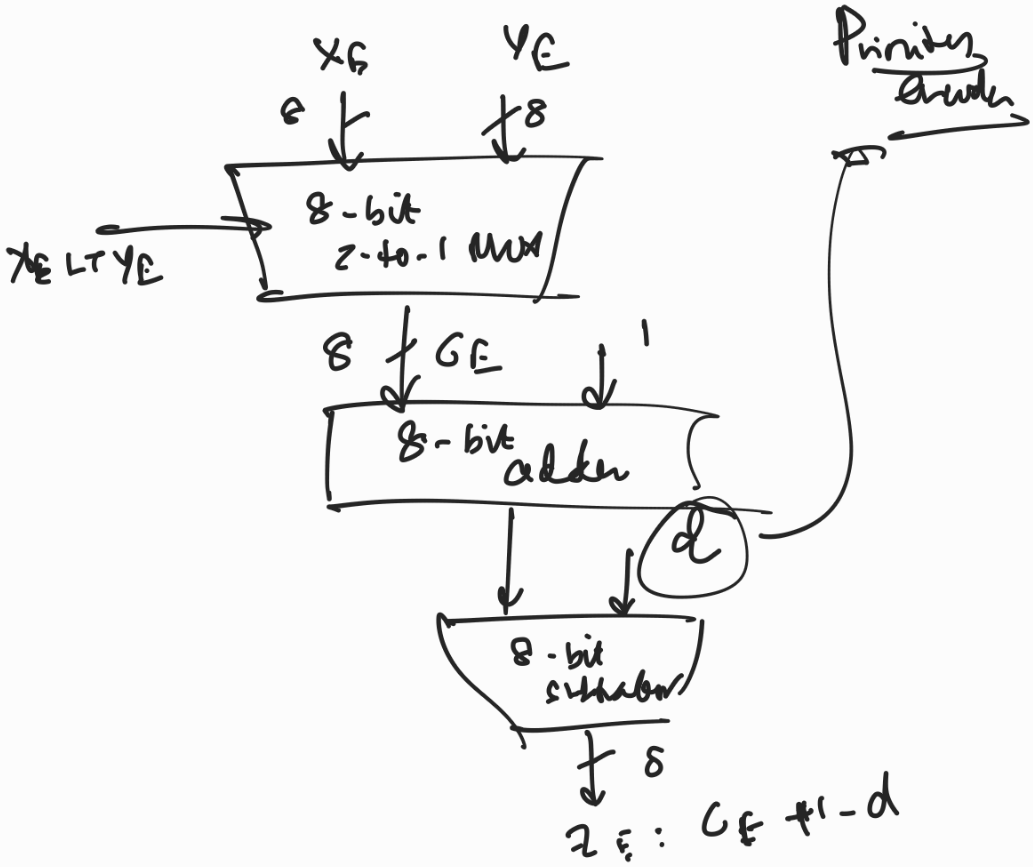
0 0 0 0 0 = 1

0 0 0 D 1

0 0 0 1 0

$$\boxed{Z_E = \underline{G_E + 1} - d}$$

no. of leading zeros.


XE
YE
8
8
8-bit
2-to-1 MUX
XE LT YE
Priority
encoder
8
CE
1
8-bit
adder
d
8-bit
subtractor
8
ZE : CE +1 - d