Q1: A= 14, B= 6 in 6-Bit representation:

(1) A-B => A+(-B)

$A = 14 = 001110_2$

$B = 6 = 000110_2$, $-B = 111010_2$

A	001110_2
(-B)	111010_2
$\boxed{1}$	001000_2

overflow

$A-B = 001000_2$

$= 8_{10}$

CHECK

$$\begin{array}{r} 14 \\ -8 \\ \hline 8 \end{array}$$

So our calculations are correct.

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(2) -A /-B

It	Qoot	div	Rem	
0	000000	000000-000000	000000-001110	Init:
1	000000	000110-000000	000000-001110	Rem = Rem-D Shift 0→Q
	000000	000011-000000	"	Shift D right
2	000000	000011-000000	000000-001110	"
	000000	000001-100000	"	
3	000000	000001-100000	000000-001110	"
	000000	000000-110000	"	
4	000000	000000-110000	000000-001110	"
	000000	000000-011000	"	
5	000000	000000-01100	000000-001110	"
	000000	000000-001100	"	
6	000000	000000-001100	000000-000010	Rem-=Div Shift 1→Q
	000001	000000-000110	"	Shift div right
7	000001	000000-000110	000000-000010	Rem-= Div Shift 0→Q
	000010	000000-000110	000000-000010	~~dont~~ Shift div
	2	3	2	

1 000000-001110
111010-000000
dont update $\boxed{1}$11010-001110

2 111101-000000
000000-001110
dont update $\boxed{1}$11101-001110

3 000000-001110
111110-100000
dont update $\boxed{1}$11110-101110.

4 000000-001110
111111-010000
$\boxed{1}$11111-011110

5 000000-001110
111111-101000
$\boxed{1}$11111-110100

6 000000-001110
111111-110100
1 $\boxed{0}$00000-000010
update

7 000000-000010
111111-111010
1 $\boxed{1}$11111-111100
dont update

- div
- divd } → Quot
- Rem

So we need to complement the remainder and quotient unchanged

Quotient = $000010_2 \approx 2_{10}$

Rem = $00010_2 \xrightarrow{2's\ C} 111110_2 \approx -(00010) \approx -2_{10}$

So $-6\overline{)-14}$ → 2, ± 12, -2 — our calculations are right after rechecking it.

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(3) - A X B

It	Muld	Prod_Reg	CB	PB	Step
0	000110	000000-110010	0	-	Init.
1	000110	000000-011001	0	0	RHS
2	000110	111101-001100	1	0	Prod-Muld → RHS
3	000110	000001-100110	0	1	Prod+Muld → RHS
4	000110	000000-110011	0	0	RHS
5	000110	111101-011001	1	0	Prod-Muld
6	000110	111110-101100	1	1	

000110
111010

000000-011001
111010
1111010-011001

111101-001100
000110
0000011-001100

000000-110011
111010
1111010-110011

$\underbrace{111110-101100}$

- (2's comp)
- $(000001-010100)_2$
- $(64 + 16 + 4)_{10}$
- $(84)_{10}$

CHECK:

-14
$\times 6$
-84

So our calculations for prod of -14×6 is correct and verified.

Q2: Single precision floting point to solve:

$A = 16.35 = 10000.010110_2$

$B = 7.3741 = 111.0101111_2$

$\xrightarrow{\text{normalize}}$

$= 1.0000010110 \times 2^4$

$= 1.110101111 \times 2^2$

$\xrightarrow{\text{add biase}}$

1.000001×2^{131}

1.110101×2^{129}

$\xrightarrow{\text{IEEE form}}$

$0\_10000100\_0000\,0100\,0000\ldots_2$

$0\_10000010\_1101\,0100\,0000\ldots_2$

$\xrightarrow{\text{Hexa}}$

$4\,2\,0\,2\,0\,0\,0\,0_{16}$

$4\,1\,6\,C\,0\,0\,0\,0_{16}$

(a) A+B

A: $1.000001\cancel{0110} \times 2^{131}$

B: 1.110101×2^{129} $\xrightarrow{\text{shift}}$

$$\begin{array}{r} 1.000001 \times 2^{131} \\ +\ 0.011101 \times 2^{131} \\ \hline 1.011110_2 \times 2^{131} \end{array}$$

biase from exp

$1.011110 \times 2^{131-127} = 1.011110_2 \times 2^4 = 10111.10_2 \times 2^0$

binary-to-decimal

$16 + 0 + 4 + 2 + 1.\left(\tfrac{1}{2}\right) = \boxed{23.5 \approx 16.35 + 7.3741}$

IEEE form:

$0\_10000100\_0111\,1000\,0000\ldots$

$4\,2\,3\,C\,0.0\,0\,0_{16}$

Note: Hexa representation for IEEE number are not preicise because we just take 3 to 4 digit after decimal.

$$\begin{array}{r} 16.35 \\ +\ 7.3741 \\ \hline \boxed{23.7241} \end{array}$$

The exact answer is 23.7241 but our less précise addition answer is 23.5 which is ≈ approx. equal.

(b) A-B

I am not converting A & B again I just copied from previous questions:

$A = 1.000001 \times 2^{131} = 1.000001 \times 2^{131}$

$B = 111.0101 \times 2^{129} = 0.011101 \times 2^{131}$

+A

-B

$0 \; 1.000001 \times 2^{131}$

$+ 1 \; 0.011101 \times 2^{131}$

1.011110×2^{131}

11 00010

$-B = +(-B) =$

$1 \; 0.001101 \times 2^{131}$

1 (1101)

$B = \underline{1} \; 0.011101 \times 2^{131}$

$-B = \underline{1} \; 1.100011 \cdot 2^{131}$

Now A-B

1

$\underline{0} \; 1.000001 \times 2^{131}$

$\underline{1} \; 1.100011 \times 2^{131}$

discard ← $\boxed{1}$ $\underline{0}.0.100011 \times 2^{131}$

means answer is +ive.

$+ 0.100011 \times 2^{131}$ $\xrightarrow{\text{IEEE}}$ 0-10000100-100011000000

42470000_{16}

↑Hex

remove biase (127) from exponent

$+0.100011 \times 2^4 = 01000.11 \times 2^0$

01000.11_2

$8 \cdot (\frac{1}{2}+\frac{1}{4})$

$= 8.75_{10}$

CHECK:

16.3500
- 7.3741
8.9759

$\frac{1}{2} + \frac{1}{4}$

$\frac{2+1}{4} = \frac{3}{4}$

0.75
4)30
28
20
20

8.75 ≈ 8.9759 ∴ hence after checking our results are less precise then orignal but aproximately equal.