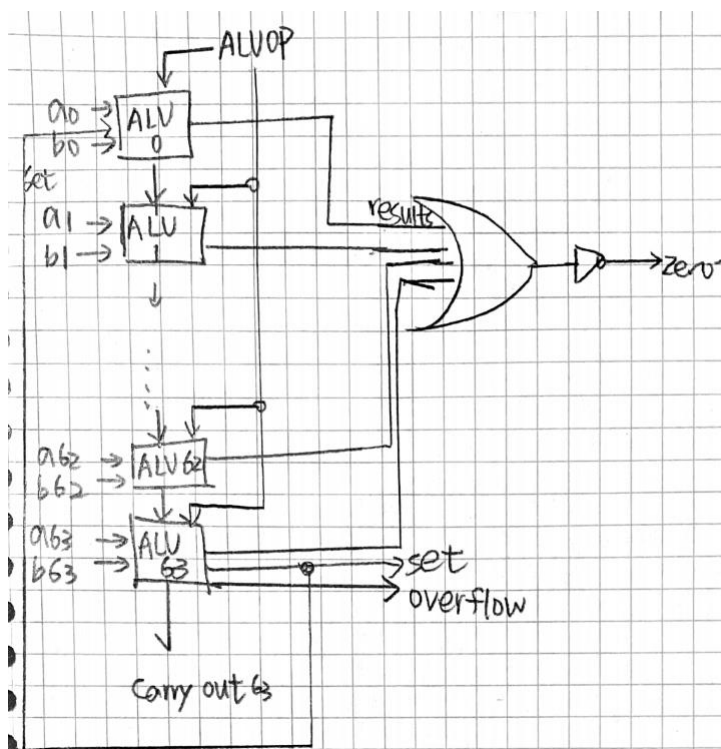
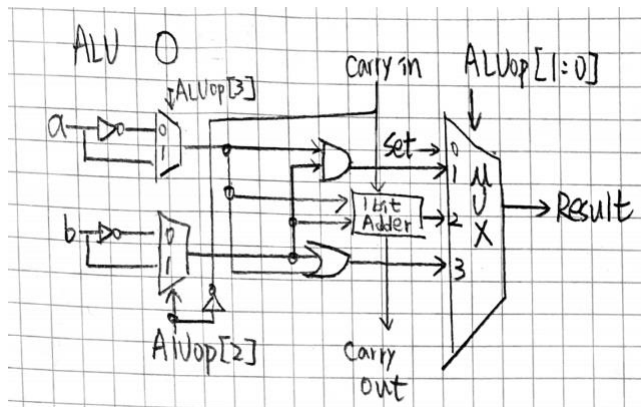
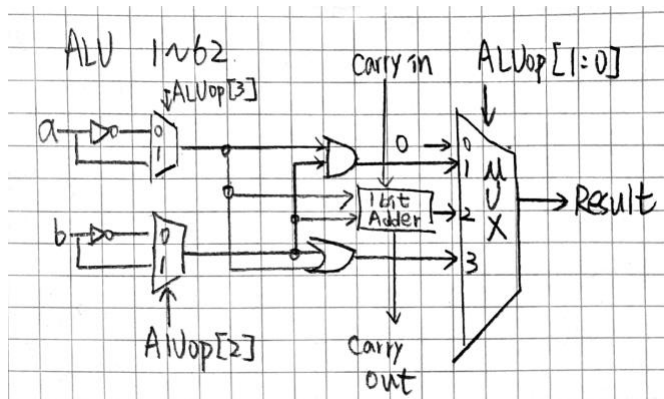


1.



2.(abcd)

(a)

$$M = 1010 \quad N = 0101$$

$$M \times N$$

produce	multiplier	multiplicand
0000 0000	0101	00001010
0000 1010	0010	0001 0100
0000 1010	0001	0010 1000
0011 0010	0000	0101 0000
0011 0010	0000	1010 0000

$$\text{Ans} = 0011 0010$$

(b)

Multiplicand	produce
1010	0000 0101 1010 0101
1010	0101 0010
1010	0010 1001 1100 1001
1010	0110 0100
1010	0011 0010

$$\text{Ans: } 0011 0010$$

(c) $M=1010$ $N=0101$

Quot.	Divisor	Remainder
0000	0101 0000	0000 1010 1011 1010
0000	0010 1000	0000 1010 1110 0010
0000	0001 0100	0000 1010 1111 0110
0000	0000 1010	0000 1010 0000 0000
0001	0000 0101	0000 0000

(d)

Remainder	Divisor
0000 1010	0101
0001 0100	
1100 0100	
0001 0100	
0010 1000	
1101 1000	
0010 1000	
0101 0000	
0000 0000	
0000 0001	
1011 0001	
0000 0001	
0000 0010	

3.(a)

$2 \overline{) 1785}$
 $\rightarrow \overline{) 392}$
 $2 \overline{) 1196}$
 $2 \overline{) 1780}$
 $2 \overline{) 490}$
 $2 \overline{) 241}$
 $\geq \overline{) 120}$
 $2 \overline{) 160}$
 $2 \overline{) 30}$
 $\rightarrow \overline{) 11}$
 $\overline{) 0} \quad 1$

exponent = 10001000

sign = 0 (+)

	$0.125 \times 2 = 0.25$	0
$2 \overline{) 13}$	$0.25 \times 2 = 0.5$	0
$2 \overline{) 6} 1$	$0.5 \times 2 = 1.0$	1
$2 \overline{) 3} 0$		0
$2 \overline{) 1} 1$		1
$\underline{10} 1$		0

$$0.175 = 001$$

$$|101.001| = 1.101001 \times 2^3$$

$$\text{exponent} = 3 = 130 - 127$$

exponent = 10000010

exponent = 10000010
fraction = 101001000000000000000000

Y = 1 10000010 101001000000000000000000

STEP1 $X = 1.1000100010101 \times 2^9$

STEP2 $Y = -1.101001 \times 2^3 = -0.000001101001 \times 2^9$ (負)

STEP3 $X+Y = 1.1000001000011 \times 2^9 = 0\ 10001000\ 100000100001100000000000 = -772.1875$

3.(c)

STEP1 $(1.1000100010101 \times 1.101001) \times 2^{(9+3)}$

STEP2 $10.10000100001101 \times 2^{(12)}$

STEP3 $-1.010000100001101 \times 2^{(13)}$ (put the sign)
 $= 1\ 10001100\ 01000010000110011101000$

4.(a)

Convert W into 32 bit binary : 1111 1111 1000 1110 0000 1110 0001 0011

2 補數為: 0000 0000 0111 0001 1111 0001 1110 1101 = 7467501

加上負號 = ANS = -7467501

4.(b)

Convert W into 32 bit binary : 1111 1111 1000 1110 0000 1110 0001 0011

Sign(1Bit)	Exponent(8 bits) Bias = 127 = 2^7-1	Fraction 23 bits
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Sign = 1

Exponent = 1111 1111

Fraction = 0000 1110 0000 1110 0001 0011

They are called Not a Number (NaN) à (Exponent = 111...1), (Fraction \neq 000...0)

NaN

4.(c)

Convert W into 32 bit binary : 1111 1111 1000 1110 0000 1110 0001 0011

Last 7 codes are opcode = 001 0011

[14:12] = funct3 = 000

Rd = 1110 0

Rs1 = 1110 0

Imm = 1111 1111 1000

So the corresponding assembly instruction is `addi rd, rs1, imm = addi x28, x28, -8`

5.(a)

0(sign) 00001(exponent) 0000000000(fraction)

1.0×2^{-14} is smallest positive normalized number = a0

5.(b)

0(sign) 00000(exponent) 1111111111(fraction)

$= 0.1111111111 \times 2^{-14}$

$= 1.111111111 \times 2^{-15}$ = largest positive denormalized number = a1

0(sign) 00000(exponent) 1111111110(fraction)

$0.1111111111 \times 2^{-14}$

$= 1.11111111 \times 2^{-15}$ = second largest positive denormalized number = a2

5.(c)

$A0 - a1 = 0.0000000001 \times 2^{-14}$

$A1 - a2 = 0.0000000001 \times 2^{-15}$

$A0 - a1 = a1 - a2$ so the minimize difference between denormalized numbers are same as the difference between normalized numbers.

5.(d)

1(sign) 01111(exponent) 0110100111(fraction)

$= -1.0110100111 \times 2^0 = -1.4130859375$

5.(e)

$\frac{21}{10} = 2.1$	0.24×2	0.48	0
	0.48×2	0.96	0
$1 = 1$	0.96×2	1.92	1
$0.24 = \Rightarrow$	0.92×2	1.84	1
	0.84×2	1.68	1
	0.68×2	1.36	1
	0.36×2	0.72	0
	0.72×2	1.44	1
	0.44×2	0.88	0
	0.88×2	1.76	1
	0.76×2	1.52	1

所以可能 $1.0011110101 = 1.2392578125$ 和 1.24 差 0.0007421

或 $1.0011110110 = 1.240234375$ 和 1.24 差 0.000234

因為 $0.000234 < 0.0007421$ 所以 $U = 1.240234375 (1.0011110110)$