Assignment 3

Method

①
```
  1
  1 1 0 0 0 0   =>   -16.
  0 1 1 1 1 1   =>.   31 +
 ---------------
 |1 0 0 1 1 1 1|  =>   15.
```

No overflow.

$x < 0$ $y > 0$.

No overflow occurs when operands of opposite signs are added.

```
  1 1 1 1 1
  1 1 1 1 1 1   =>   -1
  1 1 1 1 1 1   =>.  -1 +
 ---------------
 |1 1 1 1 1 1 0|  =>   -2
```

No overflow.

$x < 0, y < 0$ $x + (x+y) < 0$.

$000111 << 2 = 011100 \Rightarrow 28$

$000011 \Rightarrow 3 +$

$011111 \Rightarrow 31$

No overflow

$x > 0$ $y > 0$. $(x+y) > 0$.

$111000 >> 3 =$

```
  1 1 1 1 1
  D D D 1 1 1   =>   7
  1 1 1 1 1 1   =>  -1
 ---------------
 |1 0 0 0 1 1 0|  =>   6
```

No overflow.

$x > 0$ $y < 0$

opposite signs don't overflow.

Answer

X	Y	Overflow.	Type	Justification
110000	011111	NO.	–	$x < 0$ $y > 0$. No overflow when operands of opposite signs are added.
111111	111111	NO.	–	$x < 0$ & $y < 0$ & $(x+y) < 0$.
$000111 << 2$	000011	NO.	–	$x > 0$ $y > 0$ & $(x+y) > 0$
000111	$111000 >> 3$	No.	–	$x > 0$ $y < 0$. opposite signs no overflow.

overflow example

```
  1 1 1  1 1
  0 1 1  1 1 1   ⇒ 31
  0 1 1  1 1 1   ⇒ 31
-------------------
  1 1 1  1 1 0   ≠ 62
```

↳ -2

$x > 0$, $y > 0$ but $(x+y) < 0$.

```
  1 0 0 0 0 1   ⇒ -31
  1 0 0 0 1 1   ⇒ -29
-------------------
1 0 0 0 1 0 0     -60
```

↳ 4

$x < 0$, $y < 0$ but $(x+y) > 0$.

1011.101_2.

1 0 1 1 . 1 0 1

$(2^3 \times 1) + (2^2 \times 0) + (2^1 \times 1) + (2^0 \times 1) . (2^{-1} \times 1) + (2^{-2} \times 0) + (2^{-3} \times 1)$

$(8 \times 1) + (4 \times 0) + (2 \times 1) + (1 \times 1) . (\frac{1}{2} \times 1) + (\frac{1}{4} \times 0) + (\frac{1}{8} \times 1)$

$8 + 0 + 2 + 1 + \frac{1}{2} + 0 + \frac{1}{8}$

$= 11.625_{10}$ //.

(3).

Fractional Value.	Binary Representation.	Decimal Representation
1/8	0.001	0.125.
3/4	0.110	0.75.
25/16	1.1001	1.5625.
43/16	10.1011	2.6875.
9/8	1.001	1.125.
47/8	101.111	5.875
51/16.	11.0011	3.1875.

Single Precision

④. $15214.0_{10} = 1.\ 110\ 110\ 110\ 1110.$

Significand

$M = 1.\ 110\ 110\ 110\ 1110_2.$

frac = 110 110 110 1110 000 000 000 000.

Exponent

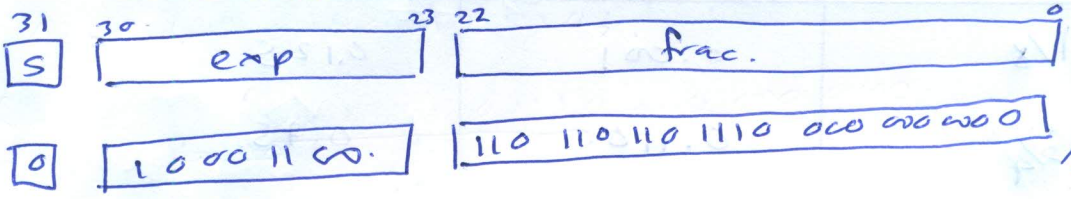
$E = 13.$

$Bias = 127.$

$Exp. = E + bias.$

$= 127 + 13$

$= 140 = 1000\ 1100.$



Double Precision

$15214.0_{10} = 1.\ 110\ 110\ 110\ 1110.$

Significand

$M = 1.\ 110\ 110\ 110\ 1110_2.$

frac = 110 110 110 1110 00000 00000 000000 00000 00000 00000 00000 0000.

Exponent

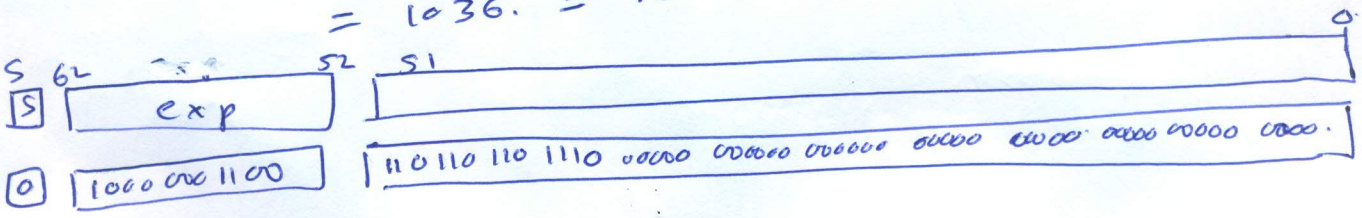
$E = 13$

$Bias = 1023.$

$Exp = E + Bias$

$= 1023 + 13$

$= 1036. = 1000\ 000\ 1100.$



$27.456_{10} = 1000\,00\,1111.0111\,0100\,1011\,1000\,111$.

Single precision.

$1.0000\,0111\,1011\,1010\,0101\,1110\,0011\,11 \times 10^{9}$.

Fraction: 00000 1111 0 111 0100 1011 1000 111

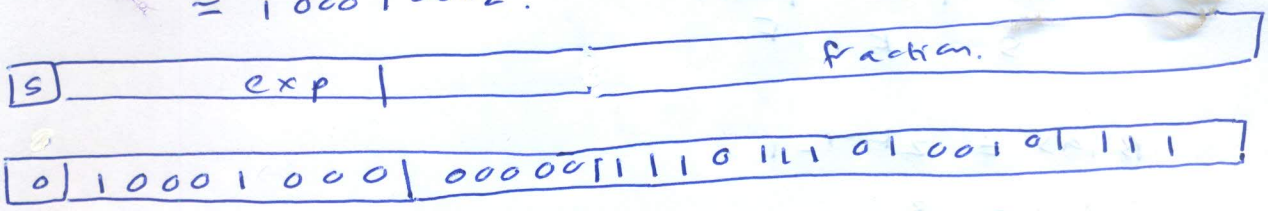
Bias = $2^{8-1} - 1 = 127$.

Exponent = E + Bias.

= 9 + 127.

= 136.

= $1000\,1000_2$.



Double Precision.

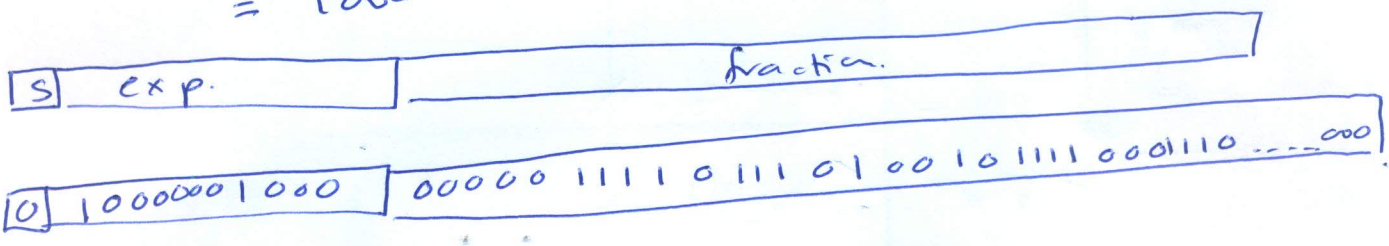
Bias = $2^{11-1} - 1 = 1023$.

Exponent = E + Bias

= 9 + 1023.

= 1023.

= $1000\,0001\,000_2$



(5) i) 0 | 010 | 01.

S K F.

Bias = $2^{K-1} - 1 = 3$.

Expanat = E + bias.

$2 = E + 3$.

$E = -1$.

$1.01 \times 10^{-1} = 0.1012$

$= 0.625_{10}$ //.

ii) 0 | 001 | 00.

S K F.

Bias $= 2^{K-1} - 1$

$= 3$.

Exp = E + Bias

$1 = E + 3$.

$E = -2$.

$1.00 \times 10^{-2} = 0.012$

$= 0.25_{10}$ //.