

Assignment
Sub: 2

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CSE 390

Section: 09

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1. $mflo \rightarrow \$f2$

$add \$f1, \$f0, \$f2$

2. $div \$s0, \$s1$

$mflo \$f2$

$add \$f3, \$f2, \$f2$

3. $X = (A[4] + B[2]) + (B[3] - 5X); \quad A[0] \rightarrow \$s0 \text{ float}$

$B[0] \rightarrow \$s1 \text{ int}$

for $A[4] + B[2]$:

$A[4]: \text{lw } \$f0, 16(\$s0)$

$x \rightarrow \$s2$

$B[2]: \text{lw } \$f2, 8(\$s1)$

As B gives integer values; converting it to float:

cvt.s.w $\$f2, \$f1$

$A[4] + B[2] \Rightarrow add.s \$f2, \$f1, \$f0$

Now $B[3] - 5X$:

$B[3]: \text{lw } \$f0, 12(\$s1)$

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$5x \Rightarrow$ sub $\$t1, \$s2, 2 [4x]$

add $\$t1, \$t1, \$s2 [5x]$

$B[3] - 5x \Rightarrow$ sub $\$t0, \$t0, \$t1$

value stored in $\$t0$ to $c1$:

$mf<1 \ \$t0, \$f4$

$\$f4$ value to floating point:

cvt, ~~s.w~~ $\$f4, \$f4$

Now $(A[4] + B[2]) + (B[3] - 5x) \Rightarrow$

add. s $\$f5, \$f2, \$f4$

converting value in $\$f5$ to 'integer':

cvt, w.s $\$f5, \$f5$

finally using $mf<1$:

$mf<1 \ \$s2, \$f5$ (Ans)

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$$4. (-72.3456)_{10}$$

$$3456 \times 2 = 0.6912 = 0$$

$$= (-1001000.0101100001)_2$$

$$6912 \times 2 = 1.3824 = 1$$

Normalized =

$$-1.0010000101100001 \times 2^6$$

$$3824 \times 2 = 0.7648 = 0$$

a. for single precision: (32 bit)

$$7648 \times 2 = 1.5296 = 1$$

Exponent 6-bit = 8

$$5296 \times 2 = 1.0592 = 1$$

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

$$0592 \times 2 = 0.1184 = 0$$

bias exponent = $6 + 127 = 133$

$$1184 \times 2 = 0.2368 = 0$$

$$b. Bias = 2^{6-1} - 1$$

(6 bit for exponent)

$$= 31$$

65536

bias exponent = $6 + 31 = 37$

$$c. Bias = 2^{7-1} - 1$$

(7 bit for exponent)

$$= 63$$

bias exponent = $6 + 63 = 69$

(Ans)

$$5. \text{ multiplicand} = 1000, \text{ multiplier} = 101 = 0101(\text{4bit})$$

number of iteration = number of bits of multiplier = 4

numbers of steps	Multiplicand 0000 1000	Multiplicers 0101	Multiplicand 0000 0000
1	0000 1000	0101	0000 1000
2	0001 0000	0101	0000 1000
3	0010 0000	0010	0000 1000
4	0010 0000	0001	0000 1000
	0010 0000	0001	0000 1000
	0010 0000	0001	0000 1000
	0010 0000	0000	0010 1000
	1000 0000	0000	0010 1000
	1000 0000	0000	0010 1000

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6.

	multipli cand	Product
1	0110	0000 0110
2	0110	0110 0011
3	0110	1001 0001
4	0110	0100 1000 0000
		0010 0100 = result

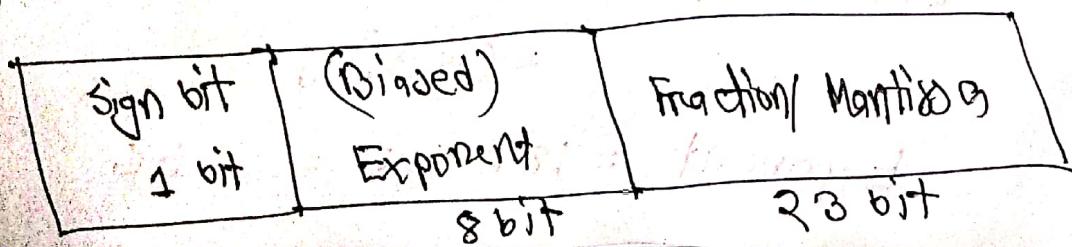
$$7. X = 18ACD0000 \text{ and } Y = 5BCA0000$$

$$X(\text{binary}) = \begin{matrix} \bar{X} & A & C & D & 0 & 0 & 0 & 0 \\ 0111 & 1010 & 1100 & 1101 & 0000 & 0000 & 0000 & 0000 \end{matrix}$$

$$Y(\text{binary}) = \begin{matrix} 5 & B & C & A & 0 & 0 & 0 & 0 \\ 00101001011111001010 & 0000 & 0000 & 0000 & 0000 & 0000 & 0000 & 0000 \end{matrix}$$

As both X and Y 32 bits, can use 32 bit representation

format: (32 bits) for single precision



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$$X = 0 \quad \begin{array}{c} \text{sign bit} \\ \downarrow \\ 11110101 \end{array} \quad \begin{array}{c} \text{Exponent} \\ \downarrow \\ 100 \end{array}$$

$$100 \quad 1101 \quad \underbrace{0000 \quad 0000 \quad 0000 \quad 0000}_\text{fraction = 23 bits}$$

$$Y = 0 \quad \begin{array}{c} \text{sign bit} \\ \downarrow \\ 10110111 \end{array} \quad \begin{array}{c} \text{Exponent} \\ \downarrow \\ 101 \end{array}$$

$$100 \quad 1010 \quad \underbrace{0000 \quad 0000 \quad 0000 \quad 0000}_\text{fraction/mantissa}$$

Ans = Exponent bit = 8 bit, bias = 127

For X \Rightarrow
 \therefore Biased Exponent (X) = $(11110101)_2$
 $= (245)_{10}$

Exponent (X) in Decimal = $245 - 127 = 118$

X (Binary normalized) = 1' fraction $\times 2^{\text{Exponent}}$
As sign bit = 0 = positive \Rightarrow
 $= 1' 10011010000000000000000000000000 \times 2^{118}$

For Y \Rightarrow

Biased Exponent = $(10110111)_2$
 $= (183)_{10}$

Exponent = $183 - 127 = 56$

$$Y(\text{Binary Normalized}) = 1 \cdot \text{Fraction} \times 2^{\text{Exponent}}$$

to sign bit = 0 \Rightarrow

== 1. 100 1010 0000 0000 0000 0000 X 2

Now, for $x+y=$

$A \propto \rho^{1.220}$ exponent $1.220 > 5.6$ of $\gamma \Rightarrow$

we have to match 56 to 118. For that, $118 - 56 = 62$

$$0 \cdot [61 \ 05] \ 1100 \ 1010 \ 0000 \ 0000 \cdot 0000 \ 0000 \times 2^{18}$$

$$\therefore x+y = \left(1 \cdot 1001101 [5405] 11001010 [1605] \right) \times 2^{118}$$

$$= 1'6015625 \times 2 \quad 118$$

$$= 5 \cdot 32210428 \times 10^{25}$$

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8. $X = 19.454$ and $Y = 3.0124$

$X = 10011.01110100$

$X(\text{Normalized}) = 1.001101110100 \times 2^9$

$Y = 11.000000011$

$Y(\text{Normalized}) = 1.1000000011 \times 2^9$

$1954 \times 2 = 0.908 = 0$

$908 \times 2 = 1.816 = 1$

$816 \times 2 = 1.632 = 1$

$632 \times 2 = 1.264 = 1$

$264 \times 2 = 0.528 = 0$

$528 \times 2 = 1.056 = 1$

$056 \times 2 = 0.112 = 0$

$112 \times 2 = 0.224 = 0$

$0124 \times 2 = 0.0248 = 0$

$0248 \times 2 = 0.0496 = 0$

$0496 \times 2 = 0.0992 = 0$

$0992 \times 2 = 0.1984 = 0$

$1984 \times 2 = 0.3968 = 0$

$3968 \times 2 = 0.7936 = 0$

$7936 \times 2 = 1.5872 = 1$

$5872 \times 2 = 1.1744 = 1$

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$$X * Y = (4.001101110100 \times 1.100000011) \times 2^{4+1}$$

$$= 1.110101111001001 \times 2^5$$

$$= 11101011110010001 \times 2^0$$

$$= 58.47280380625 \text{ (Ans)}$$

$$9. X = -9.935$$

$$X(\text{Normalized}) = -1.00101110111 \times 2^3$$

$$.435 \times 2 = 0.87 = 0$$

$$.87 \times 2 = 1.74 = 1$$

$$.74 \times 2 = 1.48 = 1$$

$$.48 \times 2 = 0.96 = 0$$

$$.96 \times 2 = 1.92 = 1$$

$$.92 \times 2 = 1.84 = 1$$

$$.84 \times 2 = 1.68 = 1$$

$$.68 \times 2 = 1.36 = 1$$

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$$Y = 15.129$$

$$Y_{(\text{Binary})} = 1111.0010$$

$$Y_{(\text{Normalized})} = 1.1110010$$

$$0001 \times 2^3$$

$$129 \times 2 = 0.258 = 0$$

$$258 \times 2 = 0.516 = 0$$

$$516 \times 2 = 1.032 = 1$$

$$032 \times 2 = 0.64 = 0$$

$$64 \times 2 = 0.128 = 0$$

$$128 \times 2 = 0.256 = 0$$

$$256 \times 2 = 0.512 = 0$$

$$512 \times 2 = 1.024 = 1$$

$$X * Y = -(1.0010110111 \times 1.1110010) \\ (0001) \times 2^{3+3}$$

$$= -10.00111011011100001 \times 2^6$$

$$= -1000111011011100001 \times 2^0$$

$$= -142.71923828125$$

(Ans)

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10.

63.7813

$$63.7813 = 111111.11001000$$

Normalized:

$$1.11111111001000 \times 2^5$$

↓
fraction

$$.7813 \times 2 = 1.5626 = 1$$

$$.5626 \times 2 = 1.1252 = 1$$

$$.1252 \times 2 = 0.2504 = 0$$

$$.2504 \times 2 = 0.5008 = 0$$

$$.5008 \times 2 = 1.0016 = 1$$

$$.0016 \times 2 = 0.0032 = 0$$

$$.0032 \times 2 = 0.0064 = 0$$

$$.0064 \times 2 = 0.0128 = 0$$

(a) Exponent bit = 6

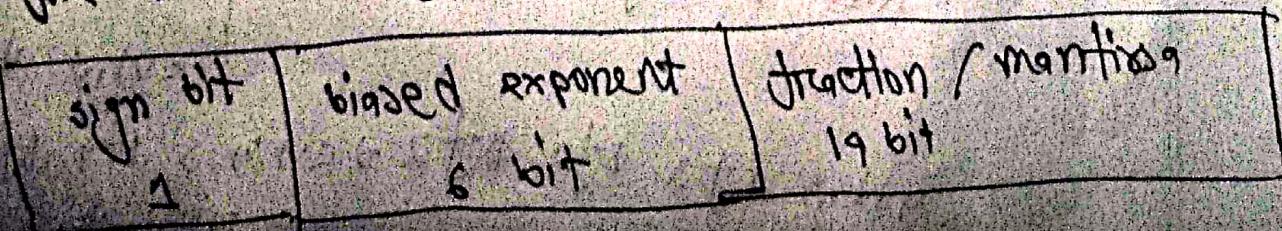
$$\text{Bias} = 2^{6-1} - 1 = 31 = 11111$$

$$\text{biased exponent} = 31 + 5 = 36 = 100100$$

Sign bit and fraction:

sign bit = 0, fraction = 111111001000

for 21-bit register (IEEE floating point representation)



= 0 100100 1111 1110 0100 00
 sign bit exponent 6 bit 14 bit fraction/mantissa

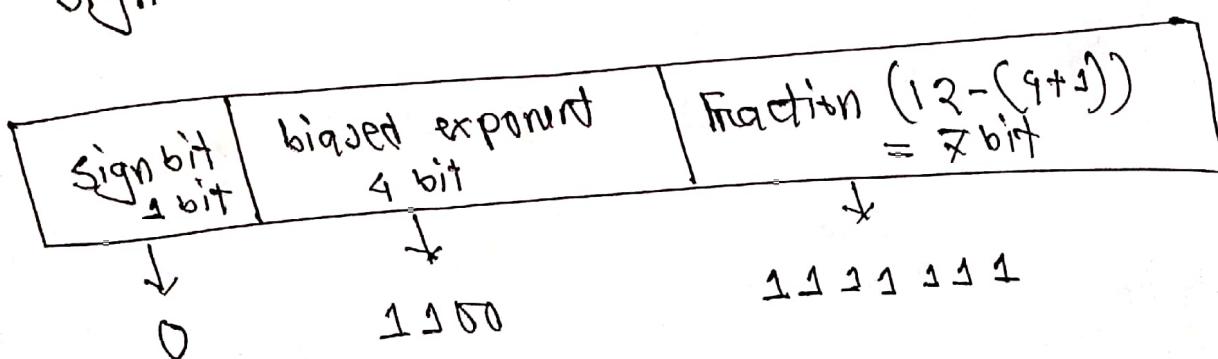
= 0000 1001 0011 1111 1001 0000
 = 0x093F90

(b) Exponent bit = 4 bit

$$\text{Bias} = 2^{4-1} - 1 = 7$$

$$\text{biased exponent} = 7 + 5 = 12 = 1100$$

sign bit = 0



$$= 0110 0111 1111$$

$$= 0x67F \text{ (Ans)}$$