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Section: 12

Course : CSE 340

Assignment: 2

Ans to the Q: N: 1

We need to multiply $s0 and $s1.

mult $s0, $s1

mflo $s2 $\quad$ $s2 ← lower 32 bit

add $s3, $s2, $t0 $\quad$ $s3 = $s2 + $t0

Ans to the Q: N: 2

div $s0, $s1

quotient → Lower 32 bit

mflo $t0

add $s2, $t0, $t1

(Ans)

Ans to the Q: N: 3

A $\longrightarrow$ \$s0

B $\longrightarrow$ \$s1

X $\longrightarrow$ \$s2

Given equation:

$$X = (A[4] + B[2]) + (B[3] - 5X)$$

Now,

lwc1 \$f0, 16(\$s0) // A[4] → \$s0

cvt.w.s \$f1, \$f0 // int(\$f0) → \$f1

lw \$t1, 8(\$s1) // B[2] → \$t1

add \$t2, \$f1, \$t1 // A[4]+B[2] → \$t2

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lw   $t3, 12($s1)      // B[3] → $t3

sll  $t4, $s2, 2       // 4x → $t4

add  $t4, $t4, $s2     // 5x → $t4

sub  $t3, $t3, $t4     // B[3]-5x → $t3

add  $s2, $t2, $t3
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(Ans)

Ans to the Q: N: 4

(a)

Single Precision (32 bit)

Sign bit	Exponent	fraction
1 bit	8 bit	23 bit

biased exponent = 8 bits

$\therefore$ bias $= 2^{(8-1)} - 1$

$= 127$

Given digit $= -72.3456$

$(72)_{10} = (1001000)_2$

$(0.3456)_{2} = (01011000011110010011110)_{2}$

$\therefore (72.3456)_{10} = (1001000.01011000011110010011110 \times 2^{0})_{2}$

Normalized binary $= 1.00100001011000011110010011110 \times 2^{6}$

Exponent $= 6$

$\therefore$ Biased exponent $= 6 + 127$

$= 133$

(b)

For a 18 bit register,

biased exponent bits = 6 bits

$\therefore$ bias $= 2^{6-1} - 1$

$= 31$

~~$\therefore$ bias~~ From a,

Exponent = 6

$\therefore$ biased exponent = $6 + 31$

$= 37$ (Ans)

(c)

For 21 bit register,

biased exponent bit = 7 bits.

$\therefore$ bias $= 2^{7-1} - 1$

$= 63$

$\therefore$ biased exponent $= 6 + 63 = 69$ (Ans)

Ans to the Q: N: 5

	Multiplicand	Multiplier	Product
	~~0001010 0~~ 0000 1000	0101	0000 0000
1	0001 0000	0010	0000 1000
2	0010 0000	0001	0000 1000
3	0100 0000	0000	0010 1000
4	1000 0000	0000	0010 1000

$\therefore (1000)_2 = 8$

$(101)_2 = 5$

$(0010\ 1000)_2 = 40$

$\therefore$ Product = 0010 1000

(Ans)

Ans to the Q: N: 6

Multiplicand $(0110)_2 = (6)_{10}$

Multiplier $(0110)_2 = (6)_{10}$

LSB half bitt of product = Multiplier

	Multiplicand	Product
	0110	0000 0110
1	0110	0000 0011
2	0110	0110 0011 0011 0001
3	0110	1001 0001 0100 1000
4	0110	0010 0100

$\therefore$ Product $= (0010\ 0100)_2 = (36)_{10}$

Ans to the Q: No. 7

$X = (7AC\,D0000)_{16}$

$= (01111010110011010000000000000000)_2$

$= 0 \quad 11110101 \quad 10011010000000000000000$

sign Exponent fraction

Biased exponent $= (11110101)_2$

$= (245)_{10}$

Bias $= 127$ [$\because$ single precision]

$\therefore$ Exponent $= 245 - 127$

$= 118$

Fraction $= (0.1001\ 1010000\ 0000\ 0000\ 0000)_2$

$\therefore$ Normalize binary of

$X = 1.1001\ 101000000000000000000 \times 2^{118}$

Again, $Y = (5BCA0000)_{16}$

$= (0101\ 1011\ 1100\ 1010000000000000000000)_2$

$= 0 \quad 10110111 \quad 10010100000000000000000$

Sign Exponent Fraction

Biased Exponent $= (1011\ 0111)_2$

$= (183)_{10}$

$\therefore$ Exponent $= 183 - 127$

$= 56$

$\therefore$ Normalized $Y = 1.10010100000000000000000 \times 2^{58}$

$= 0.[61\ 0s\ldots]11001010000000000000000 \times 2^{118}$

$\therefore X+Y = 1.10011010000000000000000 +$

$0.[61\ 0s\ldots]11001010000000000000000) \times 2^{118}$

$= 1.1001101[54\ 0s\ldots]11001010000000000000000 \times 2^{118}$

(Ans)

Ans to the Q: N: 8

$X = (19.454)_{10}$

$= (10011 \cdot 0111010)_2$

Normalized $X = (1.00110111010)_2 \times 2^4$

$Y = (3.0125)_{10}$

$= (11.000000001100)_2$

$= 1.1000000001100 \times 2^1$

$\therefore X * Y = (1.0011\ 0111\ 010 * 1.1000000001100) \times 2^5$

$= 1.11\ 0101001\ 011\ 001 \times 2^5$

(Ans)

Ans to the Q: N: 9

$X = (-9.435)_{10}$

$= (-1001 \cdot 011\,0111101)_2$

$= -1 \cdot 001\,011\,0111101 \times 2^3$

$Y = (15 \cdot 129)_{10}$

$= (1111 \cdot 0010000100)_2$

$= 1 \cdot 111\,00\cancel{1}\,0000100 \times 2^3$

$\therefore X * Y = -(1 \cdot 001\,011\,0111101 \times 1 \cdot 111\,0010000100)$
$\times 2^6$

$= -10 \cdot 0011101\,0111 \times 2^6$

(Ans)

Ans to the Q:N: 10

Given value = $(63.7813)_{10}$

$= (111111.110010000000001)_2$

$= 1.11111110010000000001 \times 2^5$

(a)

For 21 bit register,

Exponent = 6 bits

bias = $2^{6-1} - 1$

$= 31$

$\therefore$ Biased exponent = $(5+31)$

$= (36)_{10}$

$= (100100)_2$

sign bit = 0 [1 bits]

fraction = 11111110010000 [14 bits]

∴ floating point representation,

0	100100	11111110010000
sign	Exponent	fraction

$= (0x093F90)_{16}$

(Ans)

(b)

For 12 bit register,

Exponent = 4 bit

bias = $2^{4-1} - 1$

$= 7$

∴ Biased exponent = 7 + 5

$= (12)_{10}$

$= (1100)_2$

Sign bit = 0 [1 bits]

Fraction = 1111111 [7 bits]

∴ Floating point = $\underbrace{0}_{\text{Sign}}\ \underbrace{1100}_{\text{Exponent}}\ \underbrace{1111111}_{\text{Fraction}}$

$= (67F)_{16}$ (Ans)