1 Assignment 2 G.M. Arafat Rahman CSE 340

19101498 Section: 09

Sub: Day Time: Date: / /

1. mflo ~~$t0~~ $t2

add $t1, $t0, ~~$t0~~ $t2

2. DIV $s0, $s1

mflo $t2

add $t3, $t1, $t2

3. X = (A[4] + B[2]) + (B[3] - 5X); A[0] → $s0 → float

B[0] → $s1 → int

X → $s2

for A[4]+B[2]:

A[4]: lwc1 $f0, 16($s0)

B[2]: lwc1 $f1, 8($s1)

As B stores integer values; converting ~~to~~ it to float:

cvt.s.w $f1, $f1

A[4]+B[2] ⇒ add.s $f2, $f1, $f0

Now B[3] - 5X:

B[3]: lw $t0, 12($s1)

(11)

Sub :

Day

Time : Date : / /

5X ⇒ sll $t1, $s2, 2 [4x]

add $t1, $t1, $s2 [5X]

B[3] - 5X ⇒ sub $t0, $t0, $t1

value stored in $t0 to c1:

mtc1 $t0, $f4

$f4 value to floating point:

cvt. s.w $f4, $f4

Now (A[4] + B[2]) + (B[3] - 5X) ⇒

add. s $f5, $f2, $f4

coverting value in $f5 to integer:

cvt.w.s $f5, $f5

finally using mfc1:

mfc1 $s2, $f5 (Ans)

Sub :

Day

Time : Date : / /

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

$= (-1001000.01011000001)_2$

Normalized =

$-1.001000010110000 1 \times 2^6$

a. for single precision: (32 bit)

Exponent bit = 8

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

$\therefore$ bias exponents = $6 + 127 = 133$

b. Bias = $2^{6-1} - 1$ (6 bit for exponent)

$= 31$

bias exponents = $6 + 31 = 37$

c. Bias = $2^{7-1} - 1$ (7 bit for exponent)

$= 63$

bias exponents = $6 + 63 = 69$

(Ans)

$.3456 \times 2 = 0.6912 = 0$

$.6912 \times 2 = 1.3824 = 1$

$.3824 \times 2 = 0.7648 = 0$

$.7648 \times 2 = 1.5296 = 1$

$.5296 \times 2 = 1.0592 = 1$

$.0592 \times 2 = 0.1184 = 0$

$.1184 \times 2 = 0.2368 = 0$

$.2368 \times 2 = 0.4736 = 0$

$.4736 \times 2 = 0.9472 = 0$

$.9472 \times 2 = 1.8944 = 1$

5. multiplicand = 1000 , multiplier = 101 = 0101 (4bit)

number of iteration = number of bits of multiplier = 4

number of iteration	Multiplicand 0000 1000	Multiplier 0101	Multiplicand 0000 0000
	0000 1000	0101	0000 1000
1	0001 0000	0101	0000 1000
	0001 0000	0010	0000 1000
2	0010 0000	0010	0000 1000
	0010 0000	0001	0000 1000
3	0010 0000	0001	0010 1000
	0100 0000	0001	0010 1000
	0100 0000	0000	0010 1000
4	~~0100~~ 1000 0000	0000	0010 1000
	1000 0000	0000	0010 1000 = final result (Ans)

Sub :

Day

Time : Date : / /

6.

	multiplicand	Product
	0110	0000 0110
1	0110	0000 0011
2	0110	0110 0011 0011 0001
3	0110	1001 0001 0100 1000 ~~0000~~
4	0110	0010 0100 = result

7. X = 7ACD0000 and Y = 5BCA0000

X(binary) = 0111 1010 1100 1101 0000 0000 0000 0000
(7 A C D 0 0 0 0)

Y(binary) = 0101 1011 1100 1010 0000 0000 0000 0000
(5 B C A 0 0 0 0)

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

Sign bit 1 bit	(Biased) Exponent 8 bit	Fraction/ Mantissa 23 bit

Scanned with CamScanner

VI

Sub :

Day

Time : Date : / /

X = 0 11110101 100 1101 0000 0000 0000 0000

$\downarrow$ sign bit $\quad$ $\downarrow$ Exponent $\quad$ $\underbrace{\qquad\qquad}_{\text{fraction = 23 bits}}$

Y = 0 10110111 100 1010 0000 0000 0000 0000

$\downarrow$ sign bit $\quad$ Exponent $\quad$ fraction/mantissa

As Exponent bit = 8 bit, bias = 127

For X ⇒

∴ 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 ⇒

$= 1.100\ 1101\ 0000\ 0000\ 0000\ 0000 \times 2^{118}$

for Y ⇒

Biased Exponent = $(10110111)_2$

$= (183)_{10}$

Exponent = 183 − 127 = 56

(vii)

Sub :

Day

Time : Date : / /

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

As sign bit = 0 ⇒

$= 1.100\ 1010\ 0000\ 0000\ 0000\ 0000 \times 2^{56}$

Now, for X+Y ⇒

As x has exponent 118 > 56 of Y ⇒

we have to match 56 to 118. For that, 118 − 56 = 62 ⇒

$0.[61\ 0s]\ 1100\ 1010\ 0000\ 0000\ 0000\ 0000 \times 2^{118}$

$\therefore X+Y = (1.1001101[54\ 0s]\ 1100\ 1010\ [16\ 0s]) \times 2^{118}$ (Ans)

$= 1.6015625 \times 2^{118}$

$= 5.32210428 \times 10^{35}$

Sub: Day Time: Date: / /

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

$X = 10011.0111010100$

$X(\text{Normalized}) = 1.00110111010100 \times 2^4$

$.454 \times 2 = 0.908 = 0$

$.908 \times 2 = 1.816 = 1$

$.816 \times 2 = 1.632 = 1$

$.632 \times 2 = 1.264 = 1$

$.264 \times 2 = 0.528 = 0$

$.528 \times 2 = 1.056 = 1$

$.056 \times 2 = 0.112 = 0$

$.112 \times 2 = 0.224 = 0$

$Y = 11.0000\ 00011$

$Y(\text{Normalized}) = 1.1\ 0000\ 00011 \times 2^1$

$.0124 \times 2 = 0.0248 = 0$

$.0248 \times 2 = 0.0496 = 0$

$0.0496 \times 2 = 0.0992 = 0$

$.0992 \times 2 = 0.1984 = 0$

$.1984 \times 2 = 0.3968 = 0$

$.3968 \times 2 = 0.7936 = 0$

$.7936 \times 2 = 1.5872 = 1$

$.5872 \times 2 = 1.1744 = 1$

Sub:

Day

Time: Date: / /

$X * Y = (1.00110111\ 0100 \times 1.1\ 0000\ 00011) \times 2^{4+1}$

$= 1.1101001111\ 001001 \times 2^5$

$= 111010.0111100\ 10001 \times 2^0$

$= 58.472900390625$ (Ans)

9. $X = -9.435$

$= -1001.01101111$

$X(\text{Normalized}) = -1.0010110\ 1111 \times 2^3$

$.435 \times 2 = 0.87 = 0$

$.87 \times 2 = 1.74 = 1$

$.74 \times 2 = 1.48 = 1$

$.48 \times 2 = 0.96 = 0$

$.96 \times 2 = 1.92 = 1$

$.92 \times 2 = 1.84 = 1$

$.84 \times 2 = 1.68 = 1$

$.68 \times 2 = 1.36 = 1$

Scanned with CamScanner

(10)

Sub:

Day

Time: Date: / /

$Y = 15'129$

$Y_{(Binary)} = 1111'0010$
0001 ~~×2~~

$Y_{(Normalized)} = 1'111\ 0010$
0001×2^3

$'129 \times 2 = 0'258 = 0$
$'258 \times 2 = 0'516 = 0$
$'516 \times 2 = 1'032 = 1$
$'032 \times 2 = '064 = 0$
$'064 \times 2 = 0'128 = 0$
$'128 \times 2 = 0'256 = 0$
$'256 \times 2 = '512 = 0$
$'512 \times 2 = 1'024 = 1$

$X * Y = -(1'001\ 0110\ 1111 \times 1'111\ 0010$
$0001) 2^{3+3}$

$= -10'00\ 111\ 010\ 111\ 00001 \times 2^6$

$= -10\ 00\ 1110'10\ 111\ 00001 \times 2^0$

$= -142'7192382812 5$

(Ans)

(11)

Sub:

Day

Time: Date: / /

10. 63'7813

(a) = 111111'11001000

Normalized:

$1'11111\ 1100\ 1000 \times 2^5$
$\underbrace{11111\ 1100\ 1000}_{\text{fraction}}$

'7813×2= 1'5626 = 1

'5626×2= 1'1252 = 1

'1252×2 = 0'2504 = 0

'2504×2 = 0'5008 = 0

'5008×2 = 1'0016 = 1

'0016×2 = 0'0032 = 0

'0032×2 = 0'0064 = 0

'0064×2 = 0'0128 = 0

(a) Exponent bit = 6

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

biased exponent = 31+5 = 36 = 100100

sign bit and fraction:

sign bit = 0, fraction = 11111 1100 1000

for 21-bit register (IEEE floating point representation)

sign bit	biased exponent	fraction / mantissa
1	6 bit	19 bit

Sub :

Day

Time : Date : / /

$= \underset{\text{sign bit}}{0} \; \underbrace{100100}_{\substack{\text{exponent} \\ \text{6 bit}}} \; \underbrace{1111\ 1110\ 010000}_{\text{14 bit fraction/ mantissa}}$

$= 0000\ 1001\ 0011\ 1111\ 1001\ 0000$

$= 0x\,093F90$

(b) Exponent bit = 4 bit

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

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

sign bit = 0

Sign bit 1 bit	biased exponent 4 bit	Fraction $(12-(4+1))$ $= 7$ bit
0	1100	1111111

$= 0110\ 0111\ 1111$

$= 0x\,67F$ (Ans)