CSE 340 Assignment 3

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Sec: 8

CamScanner

Ans to qr 1

① mul x28, x5, x6

② add x16, x7, x28

Ans to qr 2

① mul x28, x5, x6

② add x16, x7, x28

Ans to qr 3

X = (A[3] + B[5]) − (B[2] + 5x);

f18 x16 x17

① flw f5, 12(x16) # f5 = A[3]

② flw f6, 20(x17) # f6 = B[5]

③ fadd.s f5, f5, f6 # f5 = A[3] + B[5]

④ flw f6, 8(x17) # f6 = B[2]

⑤ addi x5, x0, 5 # x5 = 5

⑥ fmul.s f19, x5, f18 # f19 = 5x

⑦ fadd.s f19, f6, f19 # f19 = B[2] + 5x

⑧ fsub.s f18, f5, f19 # f18 = result.

Ans to Q 4

(a) -63.7712

$= 111111.1100010101$

$= 1.1111110001010 \times 2^5$

exponent = 6 bits, fraction = 21 − 6 = 14 bits

Biased exponent = $5 + (2^{6-1} - 1)$

$= (36)_{10}$

$= (100100)_2$

sign = 1

frac = 1111 1110 0010 10

Floating point representation:

= 1 | 100100 | 1111 1110 0010 10

Hex: 0001 1001 0011 1110 1000 1010

= 193E8A

(b) -63.7712

exp = 4 bit
s = 1 bit
frac = 7 bit

$= 1.1111111 \times 2^5$

Biased exp $= 5 + (2^{4-1} - 1) = (12)_{10}$

$= (1100)_2$

floating point representation

1 | 1100 | 1111111

Hex: E7F

Ans to qr 5

iteration	multiplier 4 bit	multiplicand 8 bit	product 8 bit
0	0111	00001001	00000000
1	0111 0011	00001001 00010010	00001001 –
2	– 0001	– 00100100	00011011 –
3	– 0000	– 01001000	00111111 –
4	– 0000	– 10010000	– –

product = 00111111

Ans to Q 6

i	multiplicand 4 bit	Product 8 bit	i <= multiplier bit len
0	0101	0000 0011	0 <= 4
1		0101 0011 0010 1001	1 <= 4
2		0111 1001 0011 1100	2 <= 4
3		0001 1110	3 <= 4
4		0000 1111	4 <= 4 stop

Product 0000 1111

Ans to Q7

$X = 7ACD\ 0000$

$= 0111\ 1010\ 1100\ 1101\ 0000\ldots$

$= 1.11\ 1010\ 1100\ 1101\ 0\ldots \times 2^{30}$

$Y = 5BCA\ 0000$

$= 0101\ 1011\ 1100\ 1010\ 00\ldots$

$= 1.0110111100101 0\ldots \times 2^{30}$

Add $X+Y = 1\ 1.01\ 0110\ 1001\ 0111 \times 2^{30}$

$= 1.101\ 0110\ 1001\ 0111 \times 2^{31}$

Bias exp $= 31 + (2^{8-1} - 1)$

$= 158$

range $= 1$ to $2^8 - 1 - 1$

$= 1$ to 254

∴ No overflow / underflow

∴ result $= 1.101\ 0011\ 0100\ 1011\ 1 \times 2^{31}$

$= 1.6507A \times 2^{31}$

$= 3549940554$

Ans to Q 8

$X = -9.325$

$(9.325)_{10} = 1001.0101001 = 1.0010101 \times 2^{3}$ 10^{3}

$\therefore \quad Y = 14.409$

$(14.409)_{10} = 1110.011010 = 1.110011 \times 2^{3}$

$X * Y = 10.000100111110 \times 2^{3+3}$

$= 1.0000100111 \times 2^{6+1}$

$= -1.0000100111 \times 2^{7}$

Biased exp $= 7 + (2^{7} - 1)$

$= 134$

range $= 1$ to 254 $\therefore$ no over/underflow

$\therefore \quad X * Y = -1.0000100111 \times 2^{7}$

$= -1.03711 \times 2^{7}$

$= -132.75$

CSE340: Computer Architecture

Assignment 3 [MSDH]

Chapter 3 (Arithmetic For Computers)

Total Marks: 30 (Marks are indicated in third brackets after each question)

[CO2] Question 1 [Marks: 3]

Let's assume you are trying to multiply the contents of register *x5* and *x6*. Now, **write** the RISCV code for adding the *lower 32-bit* of the multiplication result with the value stored in register *x7*, saving the result in register *x16*.

[CO2] Question 2 [Marks: 3]

Let's assume you are trying to divide the contents of register *x5* with *x6*. Now, **write** the RISCV code for adding the *remainder* of the result with the value stored in register *x7*, saving the result in register *x16*.

[CO2] Question 3 [Marks: 5]

Consider the below equation and **write** RISCV code for it:

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

Assume array A stores floating point values and its base address in *x16* and array B stores floating point values and its base address is in *x17* variable X is in floating point register *f18*, all variables are of the *float datatype*. You can also use *mul/div instructions!*

[CO1] Question 4 [Marks: 6]

Consider the value - 63.7712

a. Let's assume you have a 21-bit register having 6-bit for exponent. Now **convert** this value using IEEE floating point representation. Also convert this into hexadecimal form. **[3]**
b. Let's assume you have a 12-bit register having 4-bit for exponent. Now **convert** this value using IEEE floating point representation. Also convert this into hexadecimal form. **[3]**

[CO1] Question 5 [Marks: 4]

Perform multiplication between 1001 (Multiplicand) and 111 (Multiplier) using the *long multiplication* approach. Suppose the *product* and *multiplicand* registers are 8-bit and the *multiplier* register is 4-bit.

[CO1] Question 6 [Marks: 3]

Perform multiplication between 0101 (Multiplicand) and 11 (Multiplier) using the *optimized multiplication approach*. Suppose the *product* register is 8-bit and the *multiplicand* register is 4-bit.

[CO1] Question 7 [Marks: 3]

Suppose X = 7ACD0000 and Y = 5BCA0000. **Perform** X + Y using IEEE floating point representation.

[CO1] Question 8 [Marks: 3]

Suppose X = - 9.325 and Y = 14.409. **Perform** X * Y using IEEE floating point representation.