CSCI 4593: Homework 3

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3.17

0x33 × 0x55

	0000	0000	0011	0011
×	0000	0000	0101	0101
	0001	0000	1110	1111

0x33 × 0x55 = 0x03(2×2×2×2 + 0x01) × 0x55 ⇒
(2 + 0x01)(2×2×2×2 + 0x01) × 0x55 ⇒
(2×2×2×2×2 + 0x13)×0x55 ⇒
(0x55 << 5) + (2×2×2×2 + 0x03)×0x55 ⇒
(0x55 << 5) + (0x55 << 4) + (2 + 0x01)× 0x55 ⇒
(0x55 << 5) + (0x55 << 4) + (0x55 << 1) + 0x55 = 0x10EF

3.19

Iteration	Step	Quotient	Divisor	Remainder
0	Initial Values	000 000	010 001 000 000	000 000 111 100
1	1: Rem = Rem - Div	000 000	010 001 000 000	101 111 111 100
	2: Rem $<$ 0 $\Rightarrow$ +Div, sll Q, Q0 = 0	000 000	010 001 000 000	000 000 111 100
	3: Shift Div Right	000 000	001 000 100 000	000 000 111 100
2	1: Rem = Rem - Div	000 000	001 000 100 000	111 000 010 100
	2: Rem $<$ 0 $\Rightarrow$ +Div, sll Q, Q0 = 0	000 000	001 000 100 000	000 000 111 100
	3: Shift Div Right	000 000	000 100 010 000	000 000 111 100
3	1: Rem = Rem - Div	000 000	000 100 010 000	111 100 101 100
	2: Rem $<$ 0 $\Rightarrow$ +Div, sll Q, Q0 = 0	000 000	000 100 010 000	000 000 111 100
	3: Shift Div Right	000 000	000 010 001 000	000 000 111 100
4	1: Rem = Rem - Div	000 000	000 010 001 000	111 110 110 100
	2: Rem $<$ 0 $\Rightarrow$ +Div, sll Q, Q0 = 0	000 000	000 010 001 000	000 000 111 100
	3: Shift Div Right	000 000	000 001 000 100	000 000 111 100
5	1: Rem = Rem - Div	000 000	000 001 000 100	111 111 111 000
	2: Rem $<$ 0 $\Rightarrow$ +Div, sll Q, Q0 = 0	000 000	000 001 000 100	000 000 111 100
	3: Shift Div Right	000 000	000 000 100 010	000 000 111 100
6	1: Rem = Rem - Div	000 000	000 000 100 010	000 000 011 010
	2: Rem $\geq$ 0 $\Rightarrow$ sll Q, Q0 = 1	000 001	000 000 100 010	000 000 011 010
	3: Shift Div Right	000 001	000 000 010 001	000 000 011 010
7	1: Rem = Rem - Div	000 001	000 000 010 001	000 000 001 001
	2: Rem $\geq$ 0 $\Rightarrow$ sll Q, Q0 = 1	000 011	000 000 010 001	000 000 001 001
	3: Shift Div Right	000 011	000 000 001 000	000 000 001 001

Quotient = 03, Remainder = 11

Dividend = Quotient $\times$ Divisor + Remainder

$74 = 03 \times 21 + 11$

3.22

$(-1)^{S} \times (1 + \text{Fraction}) \times 2^{\text{Exponent}-\text{Bias}}$

0x0c000000 = 0000 1100 0000 0000 0000 0000 0000 0000

Sign = 0 so it is positive
Exponent = 000 1100 0 = 24
Fraction = 000 0000 0000 0000 0000 0000
$(-1)^0 \times (1 + 0) \times 2^{24-127}$
Solution = $\mathbf{1.0 \times 2^{-103}}$

3.23

$63.25 = 0111111.01 \times 2^0$
Normalized = 1.1111101×2^5
Sign = 0
Exponent = 127 + 5 = 132
Solution = 0 10000100 11111010000000000000000
= 0100 0010 0111 1101 0000 0000 0000 0000 = 0x427d0000

E3.1

Exponent is 5 bits.
Mantissa is 10 bits.
Sign is 1 bit.
$5.0073 \times 10^3 = .0050073 \times 10^0 \Rightarrow .00000001010010000010100010011 \times 2^0 \Rightarrow$
$1.01001000001010001000011 \times 2^{-8}$
The fraction 01001000001010001000011 is rounded up to 0100100001
Exponent = -8 + 15 = 7
Solution = 1 00111 0100100001 = 1001 1101 0010 0001 = 0x9d21

E3.2

$2.3109375 \times 10^1 + 6.391601562 \times 10^{-1}$
$2.3109375 \times 10^1 = 23.109375 \times 10^0 \Rightarrow 10111.0001110000 \times 2^0 \Rightarrow 1.0111000111 \times 2^4$
$6.391601562 \times 10^{-1} = .6391601562 \times 10^0 \Rightarrow .1010001110011111 \times 2^0 \Rightarrow 1.010001110011111 \times 2^{-1}$

		GRS
	1.0111000111	000
+	0.0000101000	111
	1.1000011000	111

$1.0111101111\ 111 \times 2^4$

Guard is 1, Round is 1, Sticky is 1 so round up

$1.0111110000 \times 2^4 = 10111.110000 \times 2^0 = \mathbf{23.75}$