

CO 2021-Fall HW3 Solution

3.8

$$185_{ten} = 10111001_{bin} = -57_{ten}$$

$$122_{ten} = 01111010_{bin}$$

$$-57 - 122 = -179, \text{overflow, out of SM8 range.}$$

3.9

$$151_{ten} = 10010111_{bin} = -105_{ten}$$

$$214_{ten} = 11010110_{bin} = -42_{ten}$$

$$-105 - 42 = -147, \text{saturate} \Rightarrow -128$$

3.10

$$151_{ten} = 10010111_{bin} = -105_{ten}$$

$$214_{ten} = 11010110_{bin} = -42_{ten}$$

$$-105 - 42 = -63$$

3.11

$$151 + 214 = 365, \text{saturate} \Rightarrow 255$$

3.17

$$0x33 = 00110011_{bin}$$

$$0x33 * 0x55 = (0x55 \ll 5) + (0x55 \ll 4) + (0x55 \ll 1) + (0x55 \ll 0) = 0x10EF = 4335_{ten}$$

3.19

74 and 21 are octal.

$$74/21 = 3 \dots 11$$

Step	Action	Divisor	Remainder/Quotient
0	Initial Vals	010 001	000 000 111 100
1	R<<	010 001	000 001 111 000
	Rem=Rem-Div	010 001	111 000 111 000
	Rem<0, R+D	010 001	000 001 111 000
2	R<<	010 001	000 011 110 000
	Rem=Rem-Div	010 001	110 010 110 000
	Rem<0, R+D	010 001	000 011 110 000
3	R<<	010 001	000 111 100 000
	Rem=Rem-Div	010 001	110 110 110 000
	Rem<0, R+D	010 001	000 111 100 000
4	R<<	010 001	001 111 000 000
	Rem=Rem-Div	010 001	111 110 000 000
	Rem<0, R+D	010 001	001 111 000 000
5	R<<	010 001	011 110 000 000
	Rem=Rem-Div	010 001	111 110 000 000
	Rem>0, R0=1	010 001	001 101 000 001
6	R<<	010 001	011 010 000 010
	Rem=Rem-Div	010 001	001 001 000 010
	Rem>0, R0=1	010 001	001 001 000 011

$1.0111001100_{bin} \Rightarrow \text{mantissa} = 01111001100_{bin}$

FP16 = $0\ 01111\ 0111001100_{bin} = 1.4492931365966796875_{ten}$

3.32

$$A = 3.984375_{ten} * 10^{-1} = 1.1001100000_{bin} * 2^{-2}$$

$$B = 3.4375_{ten} * 10^{-1} = 1.0110000000_{bin} * 2^{-2}$$

$$C = 1.771_{ten} * 10^3 = 1.1011101011_{bin} * 2^{10}$$

shift binary point of smaller left 12 so exponents match

$$(A) \quad 1.1001100000$$

$$(B) \quad + 1.0110000000$$

10.1111100000 Normalize,

$$(A+B) \quad 1.0111110000 \times 2^{-1}$$

$$(C) \quad + 1.1011101011$$

$$(A+B) \quad .0000000000 \quad 10 \quad 111110000 \quad \text{Guard} = 1, \\ \text{Round} = 0, \text{Sticky} = 1$$

$$(A+B)+C \quad + 1.1011101011 \quad 10 \quad 1 \quad \text{Round up}$$

$$(A+B)+C = 1.1011101100 \times 2^{10} = 0110101011101100 = 1772$$

3.33

$$A = 3.984375_{ten} * 10^{-1} = 1.1001100000_{bin} * 2^{-2}$$

$$B = 3.4375_{ten} * 10^{-1} = 1.0110000000_{bin} * 2^{-2}$$

$$C = 1.771_{ten} * 10^3 = 1.1011101011_{bin} * 2^{10}$$

shift binary point of smaller left 12 so exponents match

$$(B) \quad .0000000000 \quad 01 \quad 0110000000 \quad \text{Guard} = 0, \\ \text{Round} = 1, \text{Sticky} = 1$$

$$(C) \quad + 1.1011101011$$

$$(B+C) \quad + 1.1011101011$$

$$(A) \quad .0000000000 \quad 011001100000$$

$$A+(B+C) \quad + 1.1011101011 \quad \text{No round}$$

$$A+(B+C) \quad + 1.1011101011 \quad \times 2^{10} = 0110101011101011 = 1771$$

3.34

No, $1772 \neq 1771$