Solution 3.3

3.3.1

a.	Underflow (–39)
b.	Neither (63)

3.3.2

a.	Overflow (result = –215, which does not fit into an SM 8-bit format)
b.	Neither (65)

3.3.3

a.	Neither (39)
b.	Overflow (result = –179, which does not fit into an SM 8-bit format)

Solution 3.11

3.11.1

a.	$-1.5625 \times 10^{-1} = -.15625 \times 10^{0}$ $= -.00101 \times 2^{0}$ move the binary point 2 to the right $= -.101 \times 2^{-2}$ exponent = –2, mantissa = –.101000000000000000000000 answer: 111111111110101100000000000000000000
b.	$9.356875 \times 10^{2} = 935.6875 \times 10^{0}$ $= 0x3A7.B \times 16^{0} = 1110100111.1011 \times 2^{0}$ move the binary point 10 to the left $= .11101001111011 \times 2^{10}$ exponent = +10, mantissa = +.11101001111011 answer: 000000001010011101001111011000000000

3.11.2

a.	$-1.5625 \times 10^{-1} = -.15625 \times 10^{0}$ $= -.00101 \times 2^{0}$ move the binary point 3 to the right, $= -1.01 \times 2^{-3}$ exponent = –3 = –3 + 16 = 13, mantissa = –.0100000000 answer: 1011010100000000
b.	$9.356875 \times 10^{2} = 935.6875 \times 10^{0}$ $= 0x3A7.B \times 16^{0} = 1110100111.1011 \times 2^{0}$ move the binary point 9 to the left $= 1.1101001111011 \times 2^{9}$ exponent = +9 = 9 + 16 = 25, mantissa = +.1101001111011 answer: 0110011101001111

3.11.4 Please refer to page 266-268 for explanation of Guard, Round, and Sticky bits

a.	$2.6125 \times 10^1 + 4.150390625 \times 10^{-1}$ $2.6125 \times 10^1 = 26.125 = 11010.001 = 1.1010001000 \times 2^4$ $4.150390625 \times 10^{-1} = .4150390625 = .011010100111 = 1.1010100111 \times 2^{-2}$ Shift binary point 6 to the left to align exponents, <pre> GR 1.1010001000 00 +.0000011010 10 0111 (Guard = 1, Round = 0, Sticky = 1) --------------------- 1.1010100010 10</pre>In this case the extra bits (G,R,S) are more than half of the least significant bit (0). Thus, the value is rounded up. $1.1010100011 \times 2^4 = 11010.100011 \times 2^0 = 26.546875 = 2.6546875 \times 10^1$

3.11.4

b.

$-4.484375 \times 10^1 + 1.3953125 \times 10^1$

$-4.484375 \times 10^1 = -44.84375 = -101100.11011 = -1.0110011011 \times 2^5$

$1.3953125 \times 10^1 = 13.953125 = 1.1011111010 \times 2^3$

Shift binary point 2 to the left and align exponents,

```
                GR
-1.0110011011  00
 0.0110111110  10   (Guard =1, Round =0, Sticky =0)
--------------------------
 -0.1111011100  10
```

In this case, the Guard is 1 and the Round and Sticky bits are zero. This is the "exactly half" case – if the LSB was odd (1) we would add, but since it is even(0) we do nothing.

$-0.1111011100 \times 2^5 = -11110.11100 = -30.875 = -3.0875 \times 10^1$