CISC 260

Solution set: HW5

Exercise 1

a. $-37.625_{10} = -100101.101_2 = (-1.00101101 \times 2^5)_2$
$S = 1$
$E = 5 + 127 = 132_{10} = 10000100_2$
$M = 00101101$
$-32.625_{10} = 0xC216800$
The number can be represented exactly.

b. $0.4_{10} = 0.0110_2\ recurring = (1.1001 \times 2^{-2})_2\ recurring$
$S = 0$
$E = -2 + 127 = 125_{10} = 01111101_2$
$M = 1001\ recurring$
$0.4_{10} = 0x3ECCCCCC$
The number cannot be represented exactly because of the recurring mantissa.

Exercise 2

a. $0xC012000$
$S = 1$
$E = 10000000_2 = 128_{10} \Rightarrow 128 - 127 = 1$
$M = 001001$
$0xC012000 = -2.28125_{10}$

b. $0xD1B40000$
$S = 1$
$E = 10100011_2 = 163_{10} \Rightarrow 163 - 127 = 36$
$M = 01101$
$0xD1B40000 = -9.6636764160 \times 10^{10}{}_{10}$

Exercise 3

The basic idea is to deal with the exponent. You are not allowed to use any floating-point instructions; therefore, you can add 5 to the exponent of the number making it multiplied by $32 = 2^5$.

Exercise 4

$z1 = 0.298080$

$z2 = 0.298073$

The reason is: $z1 = x^2 - y^2$ where each number is multiplied first and then subtracted. $z2 = (x + y)(x - y)$ where the addition and subtraction occur first, and then it is multiplied. In both the cases, the numbers x and y are truncated floating numbers and since they can not be represented accurately, there remains some sort of error value. For $z1$, the error values are multiplied two times and then subtracted once whereas for $z2$ it not the case. Also, this can be explained using 'underflow'.

$z1$ is more accurate since the actual answer is 0.29808435.

Exercise 5

Implementations can be different. Multiple solutions exist.