Prelab 4

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Decimal to Float

My Decimal: -79
We will first begin by converting the decimal into a 32-bit binary form. The number is negative, so we know that the first bit is a 1. The next 8 bits represent the exponent. To find this, we must calculate for what n such that $1 \leq \frac{79}{2^n} < 2$. This should be $\lfloor \log_2 79 \rfloor = 6$. Adding 127 to that tells us to represent 133 in binary for our exponent. Dividing 79 by 64 and subtracting one gives us what our mantissa needs to represent:

$$\frac{79}{64} - 1 = 0.234375$$

We begin from $\frac{1}{2}$ and work our way down:

$$\begin{aligned}
0.234375 &< \frac{1}{2} \\
0.234375 &< \frac{1}{4} \\
0.234375 - \frac{1}{8} &= 0.109375 \\
0.109375 - \frac{1}{16} &= 0.046875 \\
0.046875 - \frac{1}{32} &= 0.015625 \\
0.015625 - \frac{1}{64} &= 0
\end{aligned}$$

Since we have reached zero, the rest of the bits in the mantissa are all zeros. The entire mantissa should be:

00111100000000000000000

Putting it all together, the entire big-endian binary string, hex, and little-endian float are:

1100 0010 1001 1110 0000 0000 0000 0000

c29e0000

0x00009ec2

Float to Decimal

My Float: 0x00009f41
We will start by first converting our little-endian hex to big-endian, and then to binary:

$$00009f41 \Rightarrow 419f0000$$
$$419f0000 = 0100\ 0001\ 1001\ 1111\ 0000\ 0000\ 0000\ 0000$$

The first bit tells us that the number is positive. The next 8 bits are 10000011, which is equivalent in decimal to 131, telling us that the exponent is $131 - 127 = 4$. The rest is the mantissa, which we can cumulatively sum up:

$$0 * \frac{1}{2^1} + 0 * \frac{1}{2^2} + 1 * \frac{1}{2^3} + 1 * \frac{1}{2^4} + 1 * \frac{1}{2^5} + 1 * \frac{1}{2^6} + 1 * \frac{1}{2^7} + 0 * \cdots = 0.2421875$$

So, putting it all together, our final decimal form is:

$$1.2421875 * 2^4 = \mathbf{19.875}$$