**Week 01 Journal - Number Systems** Seraphim Gerber

In mathematics, a “base” or a “radix” is the number of different digits or combination of digits and letters that a system of counting uses to represent numbers. There are several types such as base 10 (decimal) representing any number from 0-9, base 2 (binary) representing any number from 0-1, base 8 (octal) representing any number from 0-7, and base 16 (hexadecimal) representing any number and character from 0-9 and A-F.

In number systems, zero is considered a significant place-holding value. As you count upwards in a number system, you add digits until you have run out of symbols. Once you’ve used up all the symbols, you add a 0 to the right and 1 on the left. When there are ten different symbols, adding digits to the left side of a number means each position is worth ten times more than the previous. In hexadecimal notation, hexadecimal numbers are represented by 0x or 0X in Java and C. Characters A-F can be written either in upper or lower case, as it is not case sensitive.

A computer “word” is known as a unit of data with a determined bit length processed in one go by a CPU. Although they were more commonly 32-bit, many machines have switched to 64-bit. In a bit word, the left side is considered the “most significant bit” and the right side is considered the “least significant bit.”

If there are 32 bits, with unsigned encoding, every number between 0 and 2³² -1 is mapped to a unique bit pattern. To represent negative values, computers use two’s complement encoding. With this type of encoding, the “most significant bit” has a negative value, meaning all negative numbers will have 1 in the “most significant bit,” also known as the “sign bit.” When the sign bit is 1, the value is negative. When the sign bit is 0, the value is positive.