COSC 1MC3
Lab 0

Consider any natural number like 43 605, we may take for granted this integer exists in a base ten system. 43 605 really represents:

$$4\times10^4+3\times10^3+6\times10^2+0\times10^1+5\times10^0$$

As it turns out it is possible to represent any number using any base we would like. For instance, binary or base 2 would work in a similar fashion to base 10.

1	0	1	0	0	1	1	1
2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0

Which would correspond to:

$$1\times2^7+0\times2^6+1\times2^5+0\times2^4+0\times2^3+1\times2^2+1\times2^1+1\times2^0$$

So we can gather a few rules about base conversion from these couple examples. For instance in base ten we could have the numbers 0 to 9 in any spot and in binary we could have 0 to 1. We may conclude from this that in any position we may only have the numbers 0 to the base number. Furthermore we can also notice that the position from right to left represent the base to increasing exponents starting from zero, and that the number in that position is being multiplied by that base.

So in general a number in some base *A* would work as follows.

$$x_n\times A^n\ldots x_3\times A^3+x_2\times A^2+x_1A^1+x_0A^0$$

Where x could be equal to the numbers 0 through *A* itself. If A is greater then 10 it has become general practice to use letters so 0-9-A-E would be 0 through 15. A base 15 number is a hexadecimal number and one may look as follows:

$$1E3$$

Would represent:

$$1\times15^2+14\times15^1+3\times15^0=438$$

So how would we convert from say a base ten number to a base two number. This is fairly easy, we simply look for the largest multiple of two that can be subtracted from our base ten number, and continuing down marking a 1 when the number can be subtracted and a zero for when our number is too large. The following flowchart may demonstrate this more clearly:

Practice:

Convert the following base ten numbers to base 2 (binary):
(a) 17 (b) 178

Convert the following binary numbers to base 10:
(a) 0110110 (b) 1010

Convert to the indicated base:
(a) 32 to base 4 (b) 100 to base 100

Convert from indicated base to base ten:
(a) base 7: 435 (b) base 3: 21

Extra flow chart practice:

Draw a flowchart showing how to make a change using nickels 5¢ and pennies 1¢.
Use the following variables:

owed= amount owed
nickels= the number of nickels to give
pennies= the number of pennies to give