HW 1-1: Find a method similar to the remainder method for the integer numbers that applies to fractional numbers.
(As in converting $.379_{10} = .???_2$)

4 bit precision works for all bases so we use that

$0.379 \times 2 = 0.758$

$\downarrow$

$0.758 \times 2 = 1.516$

$\downarrow$

$0.516 \times 2 = 1.032$

$\downarrow$

$0.032 \times 2 = 0.064$

4 bit precision for 0.379_{10} = 0110

Pattern observed: multiply decimal part ($0.\underset{\uparrow}{123}$) by 2 then note that value aside as 0 or 1. Keep doing that till you achieve specific byte precision.

HW 1-2: Consider the two decimal numbers:

$M = 3892.74_{10}$

$N = 9341.65_{10}$

Convert them to bases 2 and 16, and then add & subtract them in those bases.

$M = 3892.74_{10}$

Biggest base of 2 is 2048 here.

$3892.74 - 2048 = 1844.74 - 1024 = 820.74 - 512 = 308.74$

$2^{11} + 2^{10} + 2^{9} +$

$308.74 - 256 = 52.74 - 32 = 20.74 - 16 = 4.74$

$2^{8} + 2^{5} + 2^{4} +$

$4.74 - 4 = 0.74$

$2^{2} + 2^{-1} + 2^{-3} + 2^{-4} + 2^{-5} + 2^{-6}$

$2^{11} + 2^{10} + 2^{9} + 2^{8} + 2^{5} + 2^{4} + 2^{2} + 2^{-1} + 2^{-3} + 2^{-4} + 2^{-5} + 2^{-6}$

1111 0011 0100. 1011 1100

$N = 9341.65_{10}$

Biggest base of 2 is 8192 here.

$9341.65 - 8192 = 1149.65 - 1024 = 125.65 - 64 = 61.65 - 32 =$

$2^{13} + 2^{10} + 2^{6} + 2^{5}$

$29.65 - 16 = 13.65 - 8 = 5.65 - 4 = 1.65 - 1 = 0.65$

$2^{4} + 2^{3} + 2^{2} + 2^{0} + 2^{-1} + 2^{-3} + 2^{-6}$

$2^{13} + 2^{10} + 2^{6} + 2^{5} + 2^{4} + 2^{3} + 2^{2} + 2^{0} + 2^{-1} + 2^{-3} + 2^{-6}$

0010 0100 0111 1101. 1010 0100

Addition: 11 0011 1011 0010. 0110 00

Subtraction: 1 0101 0100 1000. 1110 10

HW 1-A

Which is the largest binary number that can be expressed with 15 bits? What are the equivalent decimal and hexadecimal numbers?

The largest binary number that can be expressed with 15 bits is 0111 1111 1111 1111.

This is equivalent to $2^{15}-1$ as $2^0=1$

0111 1111 1111 1111 in hexadecimal is

$$\left.\begin{array}{l} 0111 \\ 0+2^2+2^1+2^0=7 \\ 1111 \\ 2^3+2^2+2^1+2^0=15=F \\ 1111 \\ 2^3+2^2+2^1+2^0=15=F \\ 1111 \\ 2^3+2^2+2^1+2^0=15=F \end{array}\right] \quad 7FFF$$

HW 1-B

Consider a system that contains 32K bytes. Assume we are using byte addressing, that is assume that each byte will need to have its own address, and therefore we will need 32K different addresses. For convenience, all addresses will have the same number ***n***, of bits, and ***n*** should be as small as possible.

What is the value of ***n*** ?

32K bytes

$32 \cdot K$ bytes

$\downarrow \quad \downarrow$

$2^5 \cdot 2^{10}$ bytes

2^{15} bytes so $n = 15$

HW 1-C

The numbers in each of the following equalities are all expressed in the same base, ***r***. Determine this radix ***r*** in each case for the following operations to be correct.
(a) 14/2 = 5
(b) 54/4 = 13

a) $\frac{14}{2} = 5$

$\frac{r+4}{2} = 5$

$r+4 = 10$

$r = 10-4$

$r = 6$

b) $\frac{54}{4} = 13$

$\frac{5r+4}{4} = r+3$

$5r+4 = 4(r+3)$

$5r+4 = 4r+12$

$5r-4r = 12-4$

$r = 8$