Number Systems (cont)

Scientific Notation (cont)

0.06640625_{10} = 0.6640625x10^(-1)

Convert to Binary

Positions →	2^(-1)	2^(-2)	2^(-3)	2^(-4)	2^(-5)	2^(-6)	2^(-7)	2^(-8)
0.06640625_{10} =	0.5	0.25	0.125	0.0625	0.03125	0.015625	0.0078125	0.00390625
				1x2^(-4)				1x2^(-8)

= 0.00010001_2

0.00010001_2 = 0.10001x2^(-3)

Once you have a number in Base 2, 8, or 16 then the conversion to any of the other is direct

0.00010001_2 = .0001 0001 Base 2 use every 4 digits to convert to Base 16

= 0.1 1 Base 16 = 0.11_{16}

0.00010001_2 = .000 100 010 Base 2 use every 3 digits to convert to Base 8

.0 4 2 = 0.042_8

As a check convert Base 8 result back to Base 10 and see if same value

4*8^(-2)	2*8^(-3)		
0.0625	0.00390625	=	0.06640625

Therefore 0.6650625x10^(-1) = 0.10001x2^(-3) = 0.42x8^(-1) = 0.11x16^(0)
where the base is represented by the power exponent

Quickest Conversion for Integer

Example converting base 10 to base 16, then base 2, and finally base 8

1023.60546875_{10}

The approach should be to split the number between the integer and float.
2 parts, convert the integer first, then the floating part

Here is how I quickly convert the integer, I mod with the base, divide by the base and repeat for each digit till less than 1
All the following are integer operations, no floats/fractions involved

				Value	Digit
1023	→	1023 % 16	=	F	1
		(1023/16 = 63) % 16	=	F	2
		(63/16 = 3) %16	=	3	3

So, 1023 Base 10 is equivalent to 3FF Base 16

Convert to Base 2

3	F	F	→ Base 16
0011	1111	1111	→ Base 2

Convert to Base 8

001	111	111	111	→ Base 2
1	7	7	7	→ Base 8

As a check, convert the Base 8 solution back to Base 10, if agree then all intermediate steps check. Is 1777 Base 8 = 1023 Base 10
Add

1x8^3	7x8^2	7x8^1	7x8^0		
512	448	56	7	=	**1023**

Quickest Conversion for Float

Example converting base 10 to base 16, then base 2, and finally base 8

1023.60546875_{10}

Now for the quick conversion of the fraction. Simply multiply by the base and keep the integer, repeat with remainder

0.60546875 Base 10					Value	Digit
0.60546875	x	16	=	9.6875	9	1
0.6875	x	16	=	11	B	2

There is no fraction/decimal to continue therefore 0.60546875 Base 10 = 0.9B Base 16

Converting Base 16 to Base 2

.9	B	→ Base 16
0.1001	1011	→ Base 2

0.100	110	110	→ Base 2
0.4	6	6	→ Base 8

Checking Base 8 final value and comparing to Base 10 starting point will assure all intermediate steps were correct.

4x8^(-1)	6x8^(-2)	6x8^(-3)			
0.5	0.09375	0.01171875	=	0.60546875	→ Base 10

It checks, so the conversion equivalence is

1023.60546875_{10} = $3FF.9B_{16}$ = 1111111111.10011011_{2} = 1777.466_{8}

0.102360546875 x 10^(4) = 0.3FF9B x 16^(3) = 0.1111111111110011011 x 2^(10) = 0.1777466 x 8^(4)