Number Systems Day 4

Binary → Octal (shortcut)

- group binary digits by 3's starting at radix point and working way out
- turn each group of 3 bits into an octal digit

$\overline{2^2}\ \overline{2^1}\ \overline{2^0}$ → gives a # between 0 and 7 inclusive

EX: convert 10101.11_2 to octal.

010 101 . 110

$2^2\ 2^1\ 2^0$ | $2^2\ 2^1\ 2^0$ | $2^2\ 2^1\ 2^0$

2 5 6

$\therefore 10101.11_2 = 25.6_8$

EX: convert 1011.1111_2 to base 8.

001 011 . 111 100

1 3 7 4

$\therefore 1011.1111_2 = 13.74_8$

Octal → Binary

- take octal digit and convert to a series of 3 binary digits

$\overline{2^2}\ \overline{2^1}\ \overline{2^0}$

EX: Convert 14.7_8 to binary

$1_8 = 001_2$ $\quad 7_8 = 111_2$

$4_8 = 100_2$ $\quad \therefore 14.7_8 = 1100.111_2$

EX: Convert 243.6_8 to binary.

010 100 011 110

$243.6_8 = 10100011.11_2$

Hexadecimal System (Base 16)

16 symbols:

0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A (10), B (11), C (12),

D (13), E (14), F (15)

Binary → Hexadecimal

* similar to converting to octal but group digits by 4's instead of 3's

2^3 2^2 2^1 2^0
8 4 2 1

gives us a hexadecimal digit between 0 and F (15)

each group of 4 will get converted to a hexadecimal digit

EX: Convert 10111011_2 to base 16.

$1011|1011_2 = BB_{16}$

$2^1 \not{2}^{\not{1}} 2^1 2^0$ $2^3 \not{2}^{\not{1}} 2^1 2^0$
11 11
B B

EX: Convert 11000.111_2 to base 16.

$0001|1000 . 111\bigcirc_2 = 18.E_{16}$

$2^3 2^2 2^1 2^0$
$8+4+2$

1 8 14
E

Hexadecimal → Binary

turn each hexadecimal digit into a series of 4 binary digits

EX: Convert $8B_{16}$ to binary.

1000 "11" 1011

$2^3|2^2|2^1|2^0$

$\therefore 10001011_2$