Title: Octal and Hexadecimal Number Systems

Why do we need more number systems?

Humans understand ~~Binary~~ Decimal

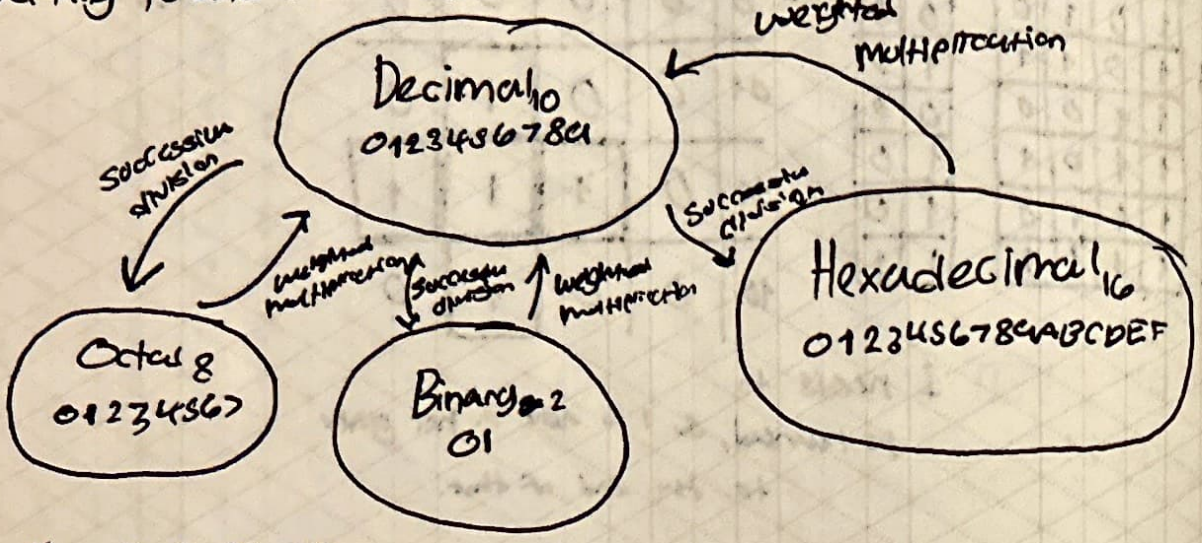
Computers understand binary

Since computers have 32, 64, and even 128 bit busses to display numbers in binary is cumbersome.

Data on even a 32 bit bus would be very long.

Hexadecimal and octal numbers systems represent a compact binary data form

Converting to and from decimal



Counting 2, 8, 10, 16

Decimal	Binary	Octal	Hexadecimal
0	0000	0	0
1	0001	1	1
2	0010	2	2
3	0011	3	3
4	0100	4	4
5	0101	5	5
6	0110	6	6
7	0111	7	7
8	1000	10	8
9	1001	11	9
10	1010	12	A
11	1011	13	B
12	1100	14	C

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Conversion Process Decimal-Base$_n$

Base$_{10}$ DECIMAL ⟶ (successive division) ⟶ Base$_N$ ANY BASE

Ⓐ Divide the decimal number by N; the remainder is the least significant digit of the ANY BASE Number.

Ⓑ If the quotient is zero, the conversion is complete. Otherwise repeat Ⓐ using the quotient as the decimal number. The new remainder is the next most significant digit MSD of the ANY BASE number.

Base$_N$ ANY BASE ⟶ (Weighted Multiplication) ⟶ Base$_{10}$ DECIMAL

Ⓐ Multiply each bit of the ANY BASE number by its corresponding bit-weighting factor (ie. Bit-0 → N^0, Bit-1 → N^1, Bit-2 → N^2, etc.)

Ⓑ Sum up all of the products in step Ⓐ to get the decimal number.

Decimal-Octal Division

$8 \overline{)94}$ = 11 r=6 ∴ $94_{10} = 136_8$

$8 \overline{)11}$ = 1 r=3

$8 \overline{)1}$ = 0 r=1

$8 \overline{)189}$ = 23 r=~~5~~ C ∴ $189_{10} = 275_8$

$8 \overline{)23}$ = 2 r=7

$8 \overline{)2}$ = 0 r=2

1	3	6
8^2	8^1	8^0
64	8	1

$64 + 24 + 6 = 94_{10}$

Decimal-Hexadecimal Conversion

$16 \overline{)94}$ = 5 r=E ∴ $94_{10} = 5E_{16}$

$16 \overline{)5}$ = 0 r=5

$16 \overline{)429}$ = 26 r=D ∴ $429_{10} = 1AD_{16} = 1AD_H$

$16 \overline{)26}$ = 1 r=A

$16 \overline{)1}$ = 0 r=1

5	E
16^1	16^0
16	1

$80 + 14 = 94_{10}$

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