

# Number Systems & Base Conversions

hexadecimal shortens binary

Three number systems:

- Binary
- Decimal (10)
- Hexadecimal (base 16)

## Decimal

numbers are sum of digits, each multiplied by a power of 10

$$735 = 700 + 30 + 5$$

$$700 = 7 \times 10^2$$

Index 2, 1, 0

## Hexadecimal

16 digits: 0-9, A-F

In base 10, A = 1010 (10), B = 1011 (11), ..., F=1111 (15)

Split into two sections, each with powers of 2

Each digit contains 4 bits

$15_{10}$  means 15 in decimal

## Convert Decimal to Binary

See if power numbers (64, 32, 16, 8) fit in 35?

$32 \leq 35$ , so 1 under 32, then  $35 - 32 = 3$

## Hex to Binary

Split into four digit segments

1111=0xf

## Binary to Hex

Conversion same except split into separate charts of 4 digits

If over ten but  $< 16$ , convert to letter

Concat, dont sum separate charts

11011001=0xD9

0x prefix represents a hexadecimal number

Also, 0xD9=D9h, h suffix also means hexadecimal

## Hex to Binary

Split each digit into chart of 4 binary digits

Only need 4 because hex only goes to 15 anyways

Also just concat at the end