Hexadecimal Counting Explanation

Hexadecimal counting is a system used to represent numbers in base-16. While the decimal system (what we use in everyday life) is based on 10 digits (0-9), hexadecimal uses 16 unique digits to represent values. These digits include:

- 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 (same as decimal)

- A, B, C, D, E, F, which represent the decimal values 10 through 15, respectively.

Counting in Hexadecimal:

When counting in hexadecimal, the process is similar to counting in decimal, but when you reach 16, you move up a place value. Here's how hexadecimal counting works:

Examples:

1. Decimal: 0–9

- The first 10 numbers in hexadecimal are identical to decimal: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9.

2. Decimal: 10–15

- After 9, instead of continuing with 10, we use letters to represent the next values:

  - Decimal 10 = Hexadecimal A

- Decimal 11 = Hexadecimal B

- Decimal 12 = Hexadecimal C

- Decimal 13 = Hexadecimal D

- Decimal 14 = Hexadecimal E

- Decimal 15 = Hexadecimal F

3. Decimal: 16

- In decimal, after 9 comes 10, which moves us to the next place value. In hexadecimal, after F comes 10 (which is 16 in decimal). This represents moving to the next place in hexadecimal, just as we move from 9 to 10 in decimal.

- Decimal 16 = Hexadecimal 10

Further Counting:

- Decimal 17 = Hexadecimal 11

- Decimal 18 = Hexadecimal 12

- …

- Decimal 31 = Hexadecimal 1F

- Decimal 32 = Hexadecimal 20

The counting continues by adding place values, just like in decimal, but every time you reach the equivalent of 16 in decimal, the count resets to 0 in the current place and increments the next higher place.

Place Value in Hexadecimal:

Just like in decimal, each position in a hexadecimal number represents a power of its base (16 instead of 10). The places go from right to left, increasing powers of 16:

- The rightmost place (1st position) represents 16^0 (ones),

- The next place (2nd position) represents 16^1 (sixteens),

- The next place (3rd position) represents 16^2 (two hundred fifty-sixes), and so on.

Example of Larger Numbers:

Let's look at the hexadecimal number 2A3:

- 3 is in the 16^0 (ones) place → 3 × 1 = 3

- A (which is 10 in decimal) is in the 16^1 (sixteens) place → 10 × 16 = 160

- 2 is in the 16^2 (two hundred fifty-sixes) place → 2 × 256 = 512

So, 2A3 in hexadecimal is equal to 512 + 160 + 3 = 675 in decimal.

Why It's Useful:

Hexadecimal is primarily used in computing because it's more compact than binary (base-2). Each hexadecimal digit represents exactly 4 bits, making it easy to convert between

binary and hexadecimal, which is why it's widely used in programming, especially when working with memory addresses or machine code.

In summary, hexadecimal counting follows the same rules as decimal but uses 16 digits, with place values increasing by powers of 16.