**Conversion of Positive and Negative Decimal Numbers to Binary and Vice Versa**

**1. Converting Positive Decimal to Binary (Integer Part Only)**

**Example: Convert 25₁₀ to Binary**

**Steps:**

1. **Divide the number by 2**, keeping track of the quotient and remainder.
2. **Write down the remainder** (0 or 1).
3. **Repeat the process** until the quotient becomes 0.
4. **Read the remainders in reverse order** to get the binary equivalent.

**Step-wise Conversion**

| **Division** | **Quotient** | **Remainder** |
| --- | --- | --- |
| 25 ÷ 2 | 12 | 1 |
| 12 ÷ 2 | 6 | 0 |
| 6 ÷ 2 | 3 | 0 |
| 3 ÷ 2 | 1 | 1 |
| 1 ÷ 2 | 0 | 1 |

**Binary representation of 25₁₀** = **11001₂**

**2. Converting Binary to Decimal (Integer Part Only)**

Each binary digit represents a power of 2.

**Example: Convert 11001₂ to Decimal**

**Steps:**

1. **Multiply each bit by 2ⁿ**, where *n* is its position from right, starting from 0.
2. **Sum all the values**.

**Step-wise Calculation**

(1×24)+(1×23)+(0×22)+(0×21)+(1×20)(1×2⁴) + (1×2³) + (0×2²) + (0×2¹) + (1×2⁰) =16+8+0+0+1=2510= 16 + 8 + 0 + 0 + 1 = 25₁₀

**3. Converting Negative Decimal to Binary Using Two’s Complement**

**Example: Convert -25₁₀ to Binary (Using 6-bit Representation)**

**Steps:**

1. **Convert the absolute value to binary** → 25₁₀ = **11001₂**.
2. **Make it a 6-bit representation** → **011001₂** (adding a leading 0).
3. **Find the one's complement** (invert all bits) → **100110₂**.
4. **Add 1 to the one's complement** to get two’s complement.
5. 100110₂ + 1₂ = 100111₂

**Binary representation of -25₁₀ (in 6-bit)** = **100111₂**

**4. Converting Two’s Complement Binary to Decimal**

**Example: Convert 100111₂ (6-bit) to Decimal**

**Steps:**

1. **Check if the first bit (MSB) is 1** → Yes, it's negative.
2. **Find the two’s complement** (invert bits and add 1).
   * Invert bits: **011000₂**
   * Add 1: **011001₂** = **25₁₀**
3. **Negate the result** → **-25₁₀**

**Final Decimal Value:** **-25₁₀**

**Summary Table**

| **Conversion Type** | **Steps** |
| --- | --- |
| **Positive Decimal to Binary** | Divide by 2, record remainders, read in reverse. |
| **Binary to Decimal** | Multiply digits by powers of 2, sum results. |
| **Negative Decimal to Binary (Two’s Complement)** | Convert absolute value, pad to required bits, invert bits, add 1. |
| **Two’s Complement Binary to Decimal** | If MSB is 1, invert, add 1, and negate. |