One's and Two's Complement Method of Subtraction

Introduction

- **What is Binary Subtraction?**
  - Binary subtraction is the process of subtracting binary numbers (base-2).
  - Direct subtraction can be complex due to borrowing.
  - Complement methods simplify binary subtraction by converting it into addition.

Why Use Complement Methods for Subtraction?

- Simplifies subtraction by converting it into addition.
- Avoids the complexity of borrowing in binary..
- Widely used in computer systems for arithmetic operations.

One's Complement method

- One's complement is obtained by inverting all the bits (0 → 1, 1 → 0) of a binary number.
- Example:
  - Binary number: 1011--0100
- Steps:
  - Find the one's complement of the subtrahend (the number being subtracted).
  - Add the complement to the minuend (the number from which subtraction is done).
  - If there is a carryover, add it back to the result (end-around carry).
  - If not the result is negative and in it’s 1 complement form.

- **Example:** Subtract 0101 (5) from 1010 (10):

  - step 1:One's complement of subtrahend: 1010
  - step 2:

```
 1010
+1010
-----
10100
```

  - step 3: End-around carry:

```
 0100
+   1
-----
0101 (5)
```

  - Result: 0101 (5)

Two's Complement Method

- Two's complement is obtained by inverting all the bits and adding 1 to the least significant bit (LSB).

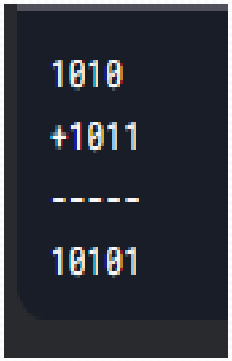
  - Example:Binary number: 1011
    - One's complement: 0100
    - add 1 to the one’s complement
    - Two's complement: 0101

Steps for Subtraction:

- Steps:
  - Find the two's complement of the subtrahend.
  - Add the complement to the minuend
  - If final carry generated the result is in its true form (discard the carry)
  - Otherwise the result is negative and in it’s 2 complement form

Example: Subtract 0101 (5) from 1010 (10):

- Step 1: Two's complement of subtrahend: 1011
- Step 2: Add minuend and complement



- Step 3: Discard the carry: Result is 0101 (5).

Comparison of One's and Two's Complement

Aspect	One's Complement	Two's Complement
Definition	Invert all bits	Invert all bits and add 1
End-around Carry	Required	Not required
Complexity	Slightly more complex	Simpler and more efficient
Usage	Less common	Widely used in computers

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