Dr.SNS RAJALAKSHMI COLLEGE OF ARTS AND SCIENCE

(AUTONOMOUS)
COIMBATORE-641049
Accredited by NAAC(Cycle III) with "A+" Grade
Recognised by UGC, Approved by AICTE, New Delhi and
Affiliated to Bharathiar University, Coimbatore.

DEPARTMENT OF COMPUTER SCIENCE

Computer System Architecture

I YEAR - I SEM

UNIT 1 – Data Representation

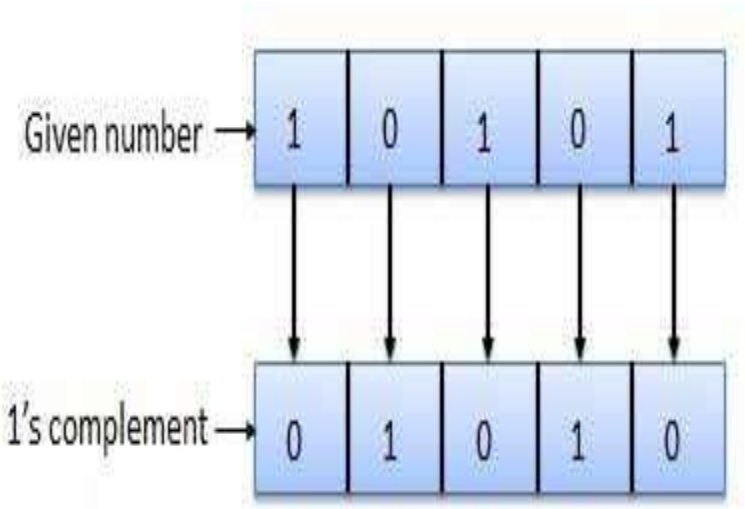
Complements

Complements are used in the digital computers in order to simplify the subtraction operation and for the logical manipulations.

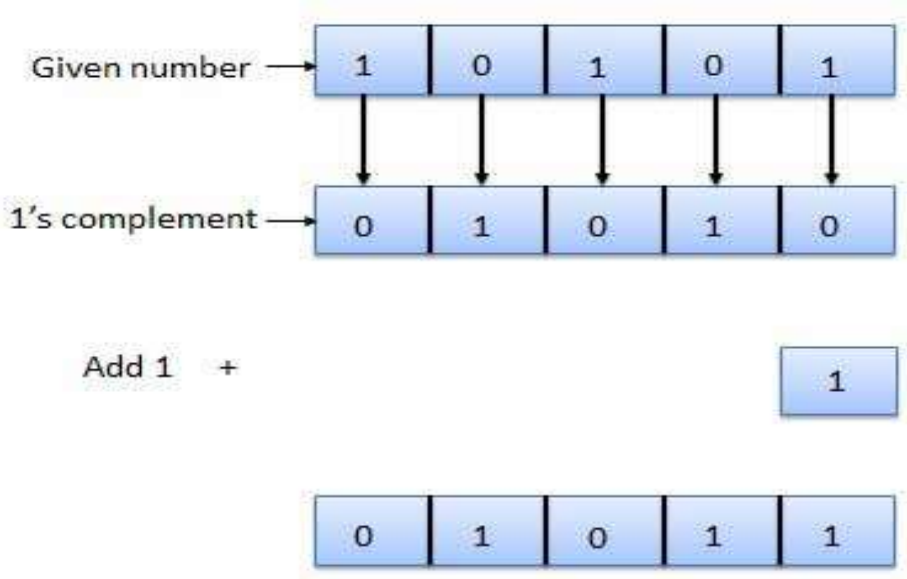
S.No.	Complement	Description
1	Radix Complement	The radix complement is referred to as the r's complement
2	Diminished Radix Complement	The diminished radix complement is referred to as the (r-1)'s complement

Complements

1's complement



2's complement



Binary Addition

Case	A + B	Sum	Carry
1	0 + 0	0	0
2	0 + 1	1	0
3	1 + 0	1	0
4	1 + 1	0	1

Example: 0011010 + 001100

(26) (12)

0011010 (26)

0001100 (12)

0100110 (38)

Binary Subtraction

Case	A - B	Subtract	Borrow
1	0 - 0	0	0
2	1 - 0	1	0
3	1 - 1	0	0
4	0 - 1	0	1

Example: 0011010 - 001100
(26) (12)

11 Borrow

0011010 (26)

0001100 (12)

0001110 (14)

Binary Subtraction using 1's Complement

Step-1: Determine the 1's complement of the smaller number.

Step-2: Add this to the larger number.

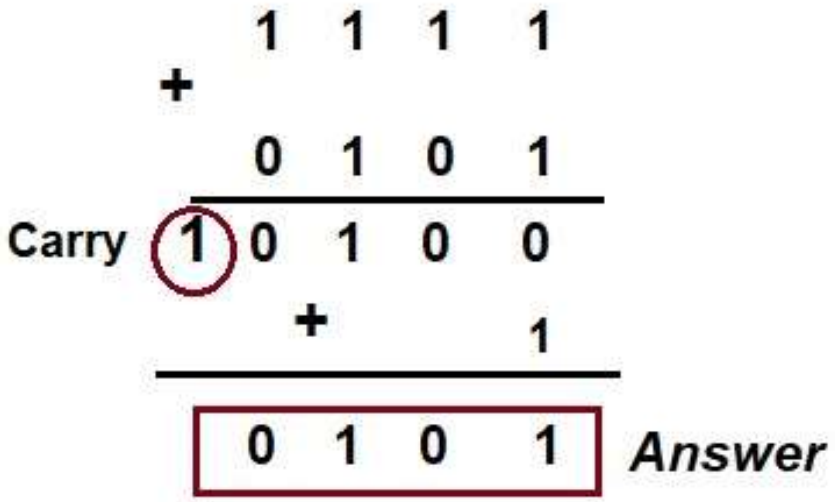
Step-3: Remove the carry and add it to the result. This carry is called end-around-carry.

Example: Subtract $(1010)_2$ from $(1111)_2$

(10) (15)

$(1111)_2 - (1010)_2 = 0101_2$

(5)



Binary Subtraction using 1's Complement

Step-1: Determine the 1's complement of the larger number.

Step-2: Add this to the smaller number.

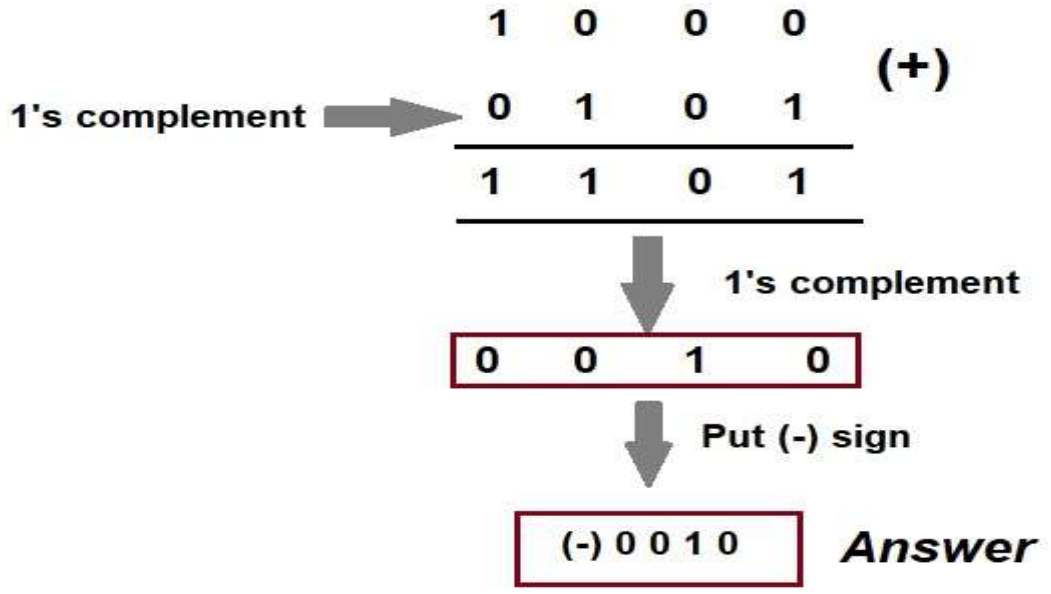
Step-3: The answer is the 1's complement of the true result and opposite in sign. There is no carry.

Example: Subtract $(1010)_2$ from $(1000)_2$

(10) (8)

$(1010)_2 - (1000)_2 = -0010_2$

(-2)



Binary Subtraction using 2's Complement

Step-1: Determine the 2's complement of the smaller number

Step-2: Add this to the larger number.

Step-3: Omit the carry. Note that, there is always a carry in this case.

Subtract $(1010)_2$ from $(1111)_2$

(10) (15)

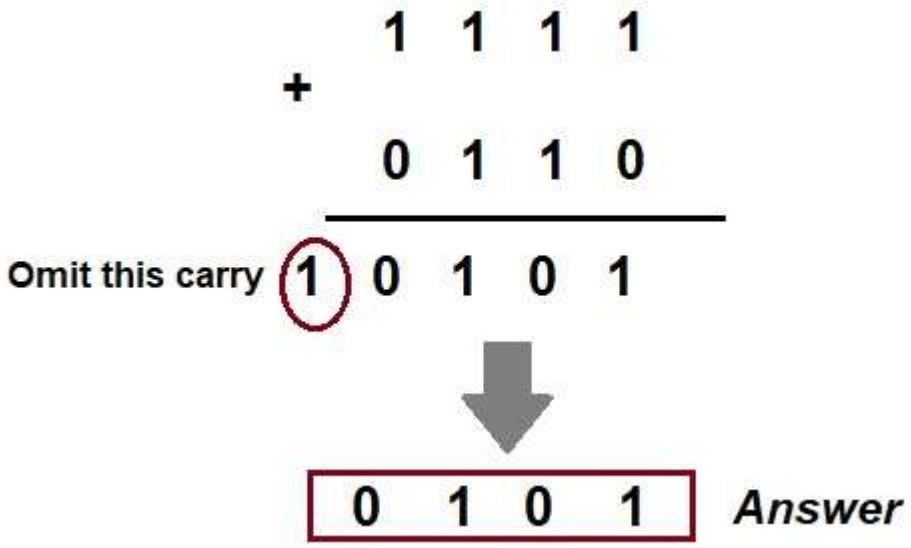
1's complement of 1010 = 0101

Add 1 = 1

2's complement of 1010 = 0110

$(1111)_2 - (1010)_2 = 0101_2$

(5)



Binary Subtraction using 2's Complement

Step-1: Determine the 2's complement of the largest number

Step-2: Add this to the smaller number.

Step-3: There is no carry in this case. The result is in 2's complement form and is negative.

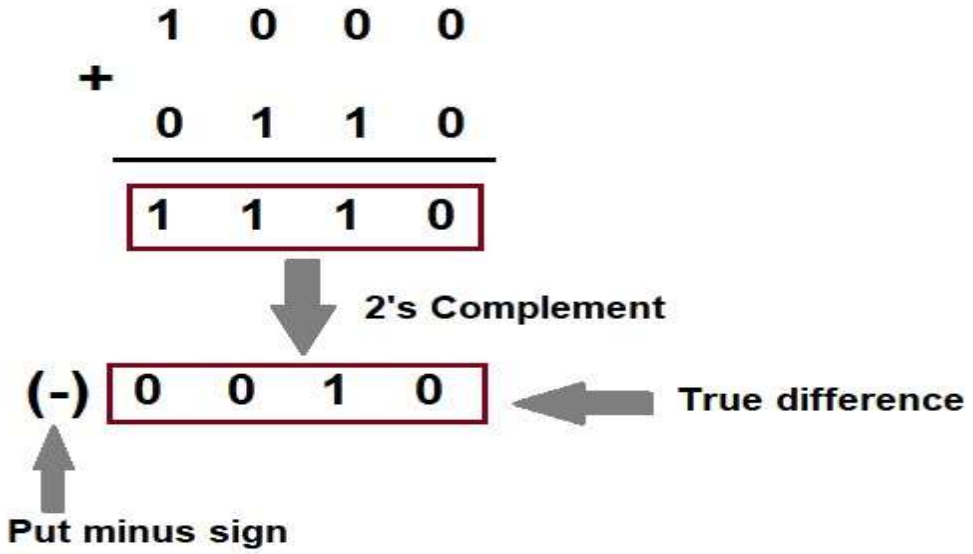
Step-4: To get answer in true form, take 2's complement and change its sign.

Example: Subtract $(1010)_2$ from $(1000)_2$

(6) (8)

$(1010)_2 - (1000)_2 = -0010_2$

(-2)



9's and 10's Complement

Example1:1423

9999-1423 = 8576

9's Complement of 1423 is 8576

Add 1 in the Result 8576 +1 = 8577

10's Complement of 1423 is 8577

Example 2 : 456

9's	10's
999	543
(-) 456	(+)1
543	544

Decimal digit	9's complement
0	9
1	8
2	7
3	6
4	5
5	4
6	3
7	2
8	1
9	0

Subtraction using 9's Complement

When subtrahend is smaller than the minuend

General Subtraction

841
- 329
512

Subtraction using 9's Complement

841
+ 670 ← (9's Complement of 329)
①511
+1
512

When subtrahend is greater than the minuend

General Subtraction

841
- 983
- 142

Subtraction using 9's Complement

841
+016 ← (9's Complement)
857 (No carry indicates - ve value)
↓
-142 (9's Complement of result)

Subtraction using 10's Complement

When subtract end is smaller than the minuend

When subtract end is greater than the minuend

When subtrahend is smaller than the minuend

General Subtraction

```
  821
- 413
-----
  408
```

Subtraction using 10's Complement

```
  821
+ 587   (10's Complement of 413)
-----
(1)408  (Ignore the carry)
-----
  408
```

General Subtraction

```
  325
- 641
-----
- 316
```

Subtraction using 10's Complement

```
  325
+ 359   <-- (10's Complement of 641)
-----
  684   <-- (No carry indicate negative -ve value)
-----
- 316   <-- (10's Complement of result)
```

Thank You