**Experiment No. 2**

**Title: Binary subtraction using 1’s and 2’s complement**

**Batch: B1 Roll No.: 1914078 Experiment No.: 2**

**Aim:** Binary subtraction using 1’s and 2’s complement.

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**Resources needed: Simulation Platform (circuitverse)**

**Theory:**

**Subtraction using 1’s Complement**

The steps to be followed in subtraction by 1’s complement are:

i) To write down 1’s complement of the subtrahend.

ii) To add this with the minuend.

iii) If the result of addition has a carry-over then it is dropped and 1 is added in the last bit.

iv) If there is no carry over, then 1’s complement of the result of addition is obtained to get

the final result and it is negative.

**Subtraction using 2’s Complement:**

(i) At first, 2’s complement of the subtrahend is found.

(ii) Then it is added to the minuend.

(iii) If the final carry-over of the sum is 1, it is dropped and the result is positive.

(iv) If there is no carry over, the two’s complement of the sum will be the result and it is negative.

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**Show how to perform the following operations using**

**One’s Complement and Two’s Complement arithmetic.**

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(a) -9 + 5

(b) 9 + (-5)

(c) (-9) + (-5)

Ans (a)

**Using ones Complement**

5 = 0101

9 = 1001

-9 = 0110 = 0110 (ones complement)

Now -9 +5 =

0 1 1 0

+ 0 1 0 1

1 0 1 1

1011 taking complement = 0100 = 4

As the negative no. is of lager magnitude the result hence -4.

**Using twos Complement**

5 = 0101

9 = 1001

-9 = 0110 = 1 0110(ones complement) = 1 0111(twos complement)

Now -9 +5 =

0 1 1 1

+ 0 1 0 1

1 1 0 0

Taking 2’s complement of the result i.e add 1 to one’s complement of the result,

0011 + 1 = 0100 = 4

As the negative no. is of lager magnitude the result is

it becomes -4

Ans (b)

**Using ones Complement**

5 = 0101

9 = 1001

-5 = (one’s complement) 1010

Now 9 + (-5) =

1001+1010 = 1 0011

Adding carry to result, we get = 0011 + 1 = 0100 = 4

**Using twos Complement**

5 = 0101

9 = 1001

-5 = (one’s complement) 1010 = 1011

|  |
| --- |
|  |

1001

+1011

1. 0100

Since there is carry we discard the carry bit.

And as the positive no. is of lager magnitude the result is 4

Ans(c)

**Using ones Complement**

5 = 0101

9 = 1001

Taking 1’s complement of the (5) and (9)= 1010 and 0110

0110

+ 1010

1 0000

As there is a carry bit present, we add this carry to the LSB

= 0001

Taking 1’s compliment of 0001 = 1110 = 14

as both the numbers are negative the result = -14

**Using twos Complement**

5 = 0101

9 = 1001

0111

+1011

1 0010

Since there is carry we discard the carry bit.

taking 2’s complement of 0010 = 1101+1 = 1110 = 14

as both the numbers are negative the result = -14

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**Observations and Results:** Solve the given examples during lab session using 1’s and 2’s Complement method and verify the 2’s complement results by the implemented circuit.

**Outcomes: CO1:**Solve problems on number system conversion and boolean algebra.

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**Conclusion:** We used Binary subtraction using 1’s and 2’s complement to find answers for questions.

**Grade: AA / AB / BB / BC / CC / CD /DD**

**Signature of faculty in-charge with date**

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**References:**

**Books/ Journals/ Websites:**

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