Dr. Mohammad Aslam, Dept. Of physics B.Sc. part-2 physics (Hons) paper-iv lecture no-61

Topic: 1's and 2's Complement

1's and 2's complement of a Binary Number

Given a Binary Number as a string, print its 1's and 2's complements.

1's complement of a binary number is another binary number obtained by toggling all bits in it, i.e., transforming the 0 bit to 1 and the 1 bit to 0.

Examples:

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1's complement of "0111" is "1000"
1's complement of "1100" is  "0011
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2's complement of a binary number is 1 added to the 1's complement of the binary number.

Examples:

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2's complement of "0111" is  "1001
2's complement of "1100" is  "0100
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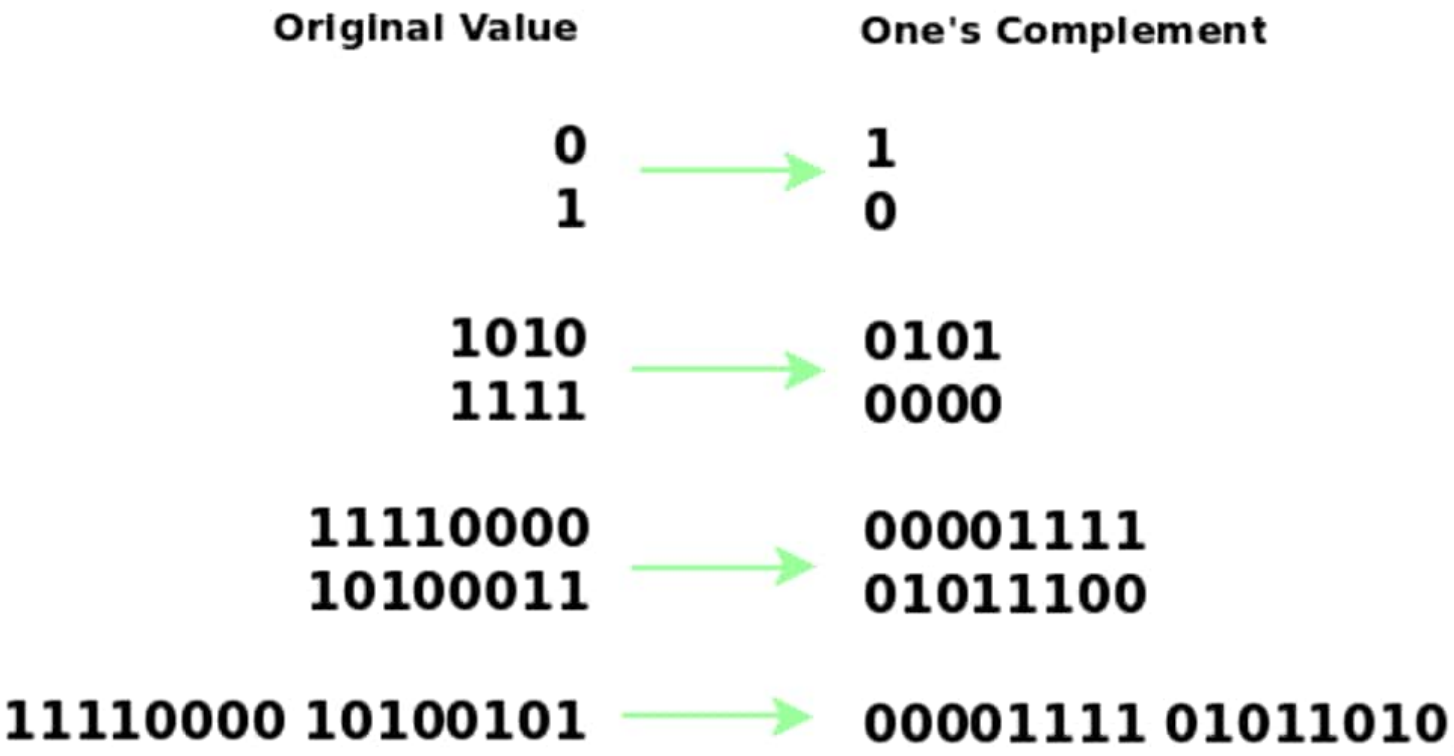
For 2's complement, we first find one's complement. We traverse the one's complement starting from LSB (least significant bit), and look for 0. We flip all 1's (change to 0) until we find a 0. Finally, we flip the found 0. For example, 2's complement of "01000" is "11000" (Note that we first find one's complement of 01000 as 10111). If there are all 1's (in one's complement), we add an extra 1 in the string. For example, 2's complement of "000" is "1000" (1's complement of "000" is "111").

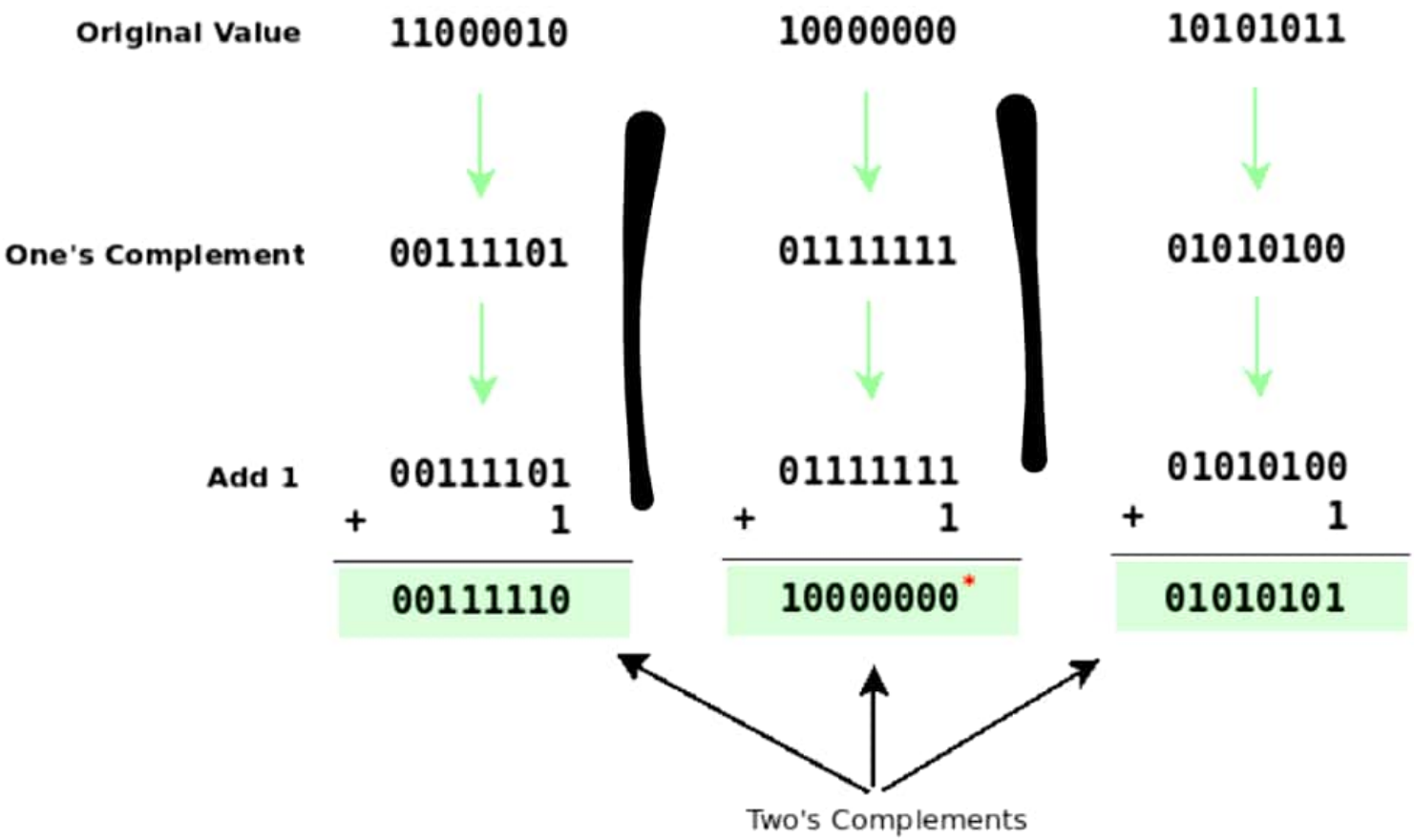
One's Complement

Invert all bits. Each 1 becomes a 0, and each 0 becomes a 1.



Two's Complement

First, find the one's complement of a value, and then add 1 to it.



Differences between 1's complement and 2's complement

These differences are given as following below –

1's complement	2's complement
To get 1's complement of a binary number, simply invert the given number.	To get 2's complement of a binary number, simply invert the given number and add 1 to the least significant bit (LSB) of given result.
1's complement of binary number 110010 is 001101	2's complement of binary number 110010 is 001110
Simple implementation which uses only NOT gates for each input bit.	Uses NOT gate along with full adder for each input bit.

Can be used for signed binary number representation but not suitable as ambiguous representation for number 0.	Can be used for signed binary number representation and most suitable as unambiguous representation for all numbers.
0 has two different representation one is -0 (e.g., 1 1111 in five bit register) and second is +0 (e.g., 0 0000 in five bit register).	0 has only one representation for -0 and +0 (e.g., 0 0000 in five bit register). Zero (0) is considered as always positive (sign bit is 0)