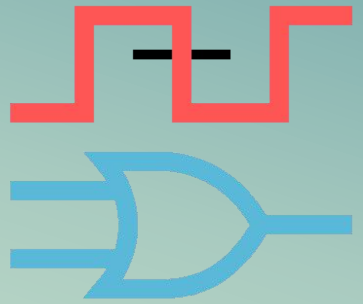
Digital Electronics

Class X
lab 18



1's complement

One's Complement

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

Original Value		One's Complement
0	→	1
1	→	0
1010	→	0101
1111	→	0000
11110000	→	00001111
10100011	→	01011100
11110000 10100101	→	00001111 01011010

transforming the 0 bit to 1 and the 1 bit to 0

1’s complement Examples

1's complement of 7 (0111) is 8 (1000)

1's complement of 12 (1100) is 3 (0011)

2’s complement Examples

Example #1

```
 5 = 00000101  ┐
     ↓↓↓↓↓↓↓↓  ├ Complement Digits
     11111010  ┘
           +1  ┐
     ────────  ├ Add 1
-5 = 11111011  ┘
```

Example #2

```
-13 = 11110011  ┐
      ↓↓↓↓↓↓↓↓  ├ Complement Digits
      00001100  ┘
            +1  ┐
      ────────  ├ Add 1
 13 = 00001101  ┘
```

1 is added to the 1’s complement of the binary number

Boolean Postulates

(1)	$A + 0 = A$	$A \cdot 1 = A$	identity
(2)	$A + {}^{NOT}[A] = 1$	$A \cdot {}^{NOT}[A] = 0$	complement
(3)	$A + B = B + A$	$A \cdot B = B \cdot A$	commutative law
(4)	$A + (B + C) = (A + B) + C$	$A \cdot (B \cdot C) = (A \cdot B) \cdot C$	associative law
(5)	$A + (B \cdot C) = (A + B) \cdot (A + C)$	$A \cdot (B + C) = (A \cdot B) + (A \cdot C)$	distributive law

Boolean Algebra

(6)	$A + A = A$	$A \cdot A = A$	
(7)	$A + 1 = 1$	$A \cdot 0 = 0$	
(8)	$A + (A \cdot B) = A$	$A \cdot (A + B) = A$	
(9)	$A + (^{NOT}[A] \cdot B) = A + B$	$A \cdot (^{NOT}[A] + B) = A \cdot B$	
(10)	$(A \cdot B) + (^{NOT}[A] \cdot C) + (B \cdot C) = (A \cdot B) + (^{NOT}[A] \cdot C)$	$A \cdot (B + C) = (A \cdot B) + (A \cdot C)$	
(11)	$^{NOT}[A + B] = {}^{NOT}[A] \cdot {}^{NOT}[B]$	$^{NOT}[A \cdot B] = {}^{NOT}[A] + {}^{NOT}[B]$	de Morgan's theorem

Thank You

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