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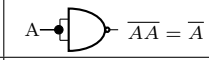
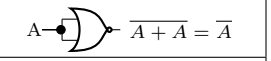
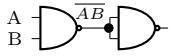
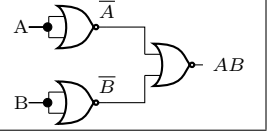
ASEN 3300
Fall 2020

Logic Gates

Type	Gate	Truth Table	Boolean Logic
not		in | out 0 | 1 1 | 0	$Y = \overline{A}$
and		A B | out 0 0 | 0 0 1 | 0 1 0 | 0 1 1 | 1	$Y = AB$
nand		A B | out 0 0 | 1 0 1 | 1 1 0 | 1 1 1 | 0	$Y = \overline{AB}$
or		A B | out 0 0 | 0 0 1 | 1 1 0 | 1 1 1 | 1	$Y = A + B$
nor		A B | out 0 0 | 1 0 1 | 0 1 0 | 0 1 1 | 0	$Y = \overline{A + B}$
xor		A B | out 0 0 | 0 0 1 | 1 1 0 | 1 1 1 | 0	$Y = A \oplus B$
xnor		A B | out 0 0 | 1 0 1 | 0 1 0 | 0 1 1 | 1	$Y = \overline{A \oplus B}$

Logic Identities

1. $A + B = B + A$
2. $AB = BA$
3. $A + (B + C) = (A + B) + C$
4. $A(BC) = (AB)C$
5. $A(B + C) = AB + AC$
6. $(A + B)(C + D) = AC + AD + BC + BD$
7. $\overline{1} = 0$
8. $\overline{0} = 1$
9. $A \cdot 0 = 0$
10. $A \cdot 1 = A$
11. $A + 0 = A$
12. $A + 1 = 1$
13. $A + A = A$
14. $AA = A$
15. $\overline{\overline{A}} = A$
16. $A + \overline{A} = 1$
17. $A\overline{A} = 0$
18. $\overline{A + B} = \overline{A} \cdot \overline{B}$
19. $\overline{A \cdot B} = \overline{A} + \overline{B}$
20. $A + \overline{A}B = A + B$
21. $A \oplus B = \overline{A}B + A\overline{B} = (A + B)(\overline{AB})$
22. $\overline{A \oplus B} = AB + \overline{A} \cdot \overline{B}$

Logic Gate	NAND Eq.	NOR Eq.
		
		

Boolean Math

Commutative Rules
$A \cdot B = B \cdot A$ $A + B = B + A$
Associative Rules
$(A \cdot B) \cdot C = A \cdot (B \cdot C)$ $(A + B) + C = A + (B + C)$
Distributive Rules
$A \cdot (B + C) = A \cdot B + A \cdot C$ $(A + B) \cdot (A + C) = A + (B \cdot C)$
Absorption Rules
$A \cdot (A + B) = A$ $A + (A \cdot B) = A$

De Morgan's Theorem

$\overline{A \cdot B} = \overline{A} + \overline{B}$
$\overline{A \cdot B \cdot C} = \overline{A} + \overline{B} + \overline{C}$
$\overline{A + B} = \overline{A} \cdot \overline{B}$
$\overline{A + B + C} = \overline{A} \cdot \overline{B} \cdot \overline{C}$