Summary

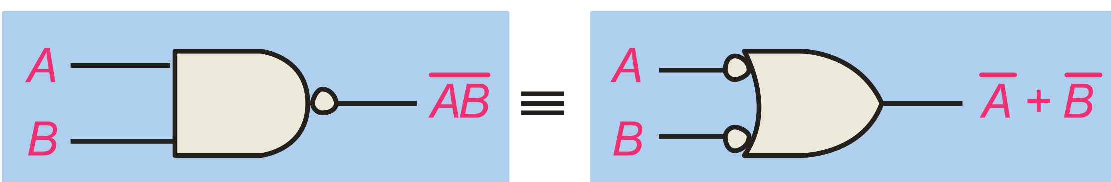
DeMorgan's Theorem

<u>DeMorgan's 1st Theorem</u>

The complement of a product of variables is equal to the sum of the complemented variables.

$$\overline{AB} = \overline{A} + \overline{B}$$

Applying DeMorgan's first theorem to gates:



NAND

Negative-OR

Inputs		Output	
A	B	$\overline{AB}$	$\overline{A} + \overline{B}$
0	0	1	1
0	1	1	1
1	0	1	1
1	1	0	0

Summary

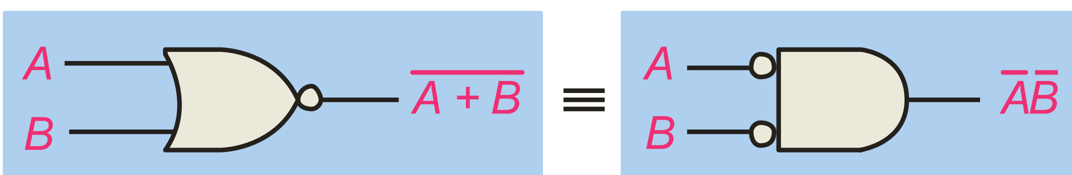
DeMorgan's Theorem

DeMorgan's 2[nd] Theorem

The complement of a sum of variables is equal to the product of the complemented variables.

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

Applying DeMorgan's second theorem to gates:



NOR   Negative-AND

Inputs		Output	
A	B	$\overline{A + B}$	$\overline{A}\overline{B}$
0	0	1	1
0	1	0	0
1	0	0	0
1	1	0	0

Summary

DeMorgan's Theorem

Example Apply DeMorgan's theorem to remove the overbar covering both terms from the expression $X = \overline{\overline{C} + D}$.

Solution To apply DeMorgan's theorem to the expression, you can break the overbar covering both terms and change the sign between the terms. This results in $X = \overline{\overline{C}} \cdot \overline{D}$. Deleting the double bar gives $X = C \cdot \overline{D}$.

SECTION 4–3 CHECKUP **Homework**

1. Apply DeMorgan's theorems to the following expressions:

(a) $\overline{ABC} + (\overline{\overline{D} + E})$ (b) $\overline{(A + B)C}$ (c) $\overline{A + B + C + \overline{D}E}$

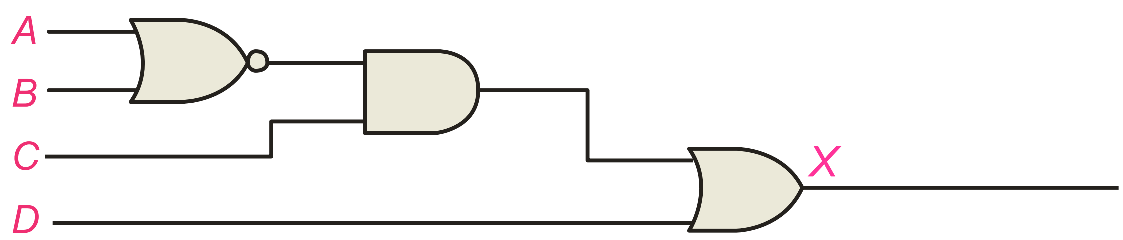
Summary

Boolean Analysis of Logic Circuits

Combinational logic circuits can be analyzed by writing the expression for each gate and combining the expressions according to the rules for Boolean algebra.

Example Apply Boolean algebra to derive the expression for X.

Solution Write the expression for each gate:



Applying DeMorgan's theorem and the distribution law:

Summary

Boolean Analysis of Logic Circuits

Combinational logic circuits can be analyzed by writing the expression for each gate and combining the expressions according to the rules for Boolean algebra.

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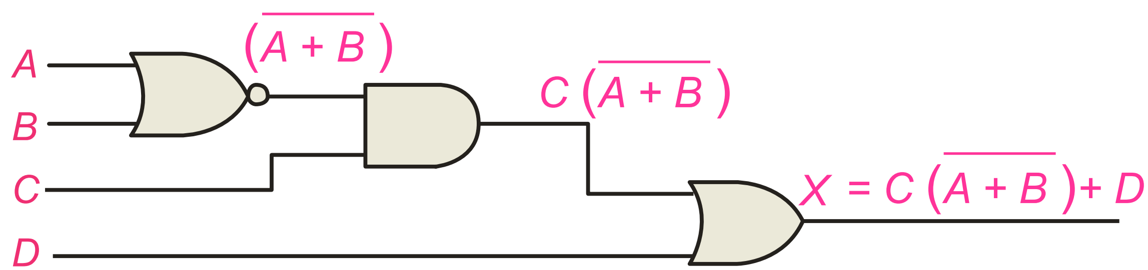

Applying DeMorgan's theorem and the distribution law:

$$X = C(\overline{A}\,\overline{B}) + D = \overline{A}\,\overline{B}\,C + D$$

EXAMPLE 4–9

Using Boolean algebra techniques, simplify this expression:

$$AB + A(B + C) + B(B + C)$$

EXAMPLE 4–9

Using Boolean algebra techniques, simplify this expression:

$$AB + A(B + C) + B(B + C)$$

$$AB + AB + AC + BB + BC$$

$$AB + AB + AC + B + BC$$

$$AB + AC + B + BC = AB + AC + B = B + AC$$