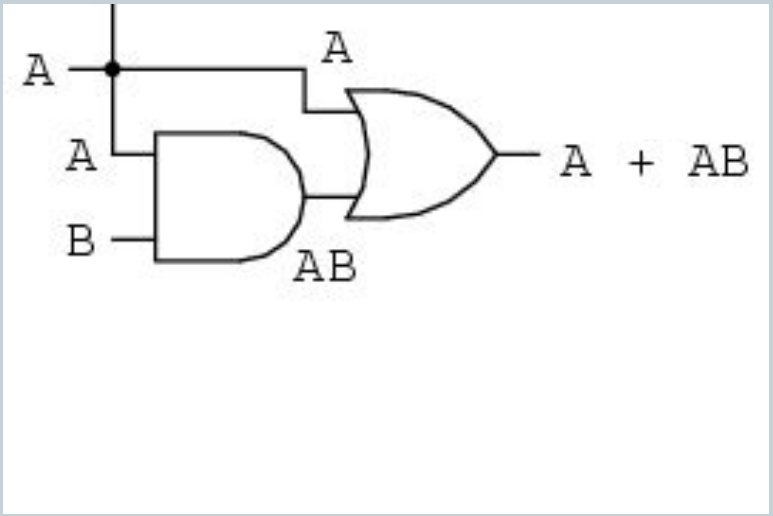
CIRCUIT SIMPLIFICATION

BY BOOLEAN ALGEBRA

Example 1



A + AB

↓ Factoring **A** out of both terms

A(1 + B)

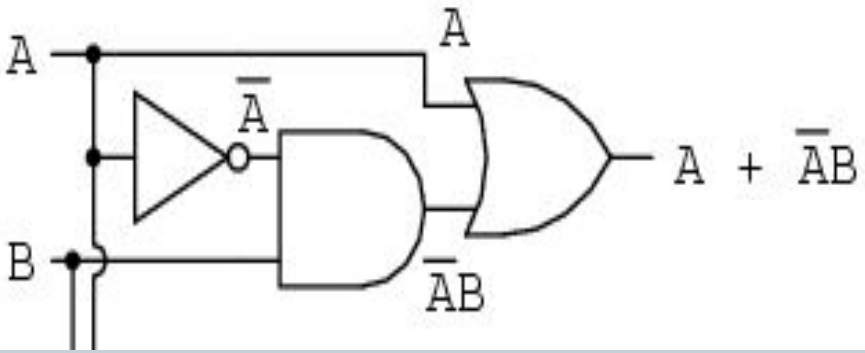
↓ Applying identity **A + 1 = 1**

A(1)

↓ Applying identity **1A = A**

A

Example 2



$A + \overline{A}B$

↓ Applying the previous rule to expand **A** term

A + AB = A

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

↓ Factoring **B** out of 2nd and 3rd terms

$A + B(A + \overline{A})$

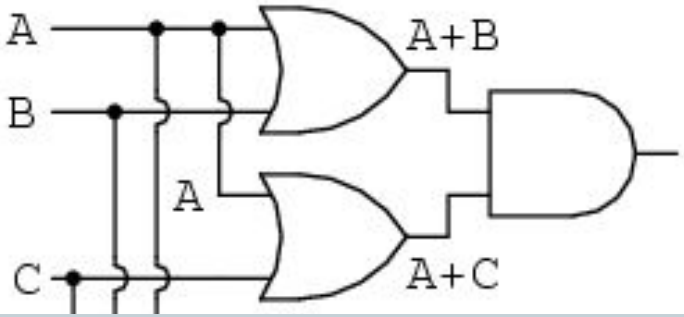
↓ Applying identity $\mathbf{A + \overline{A} = 1}$

$A + B(1)$

↓ Applying identity **1A = A**

$A + B$

Example 3



(A + B)(A + C)

↓ Distributing terms

AA + AC + AB + BC

↓ Applying identity **AA = A**

A + AC + AB + BC

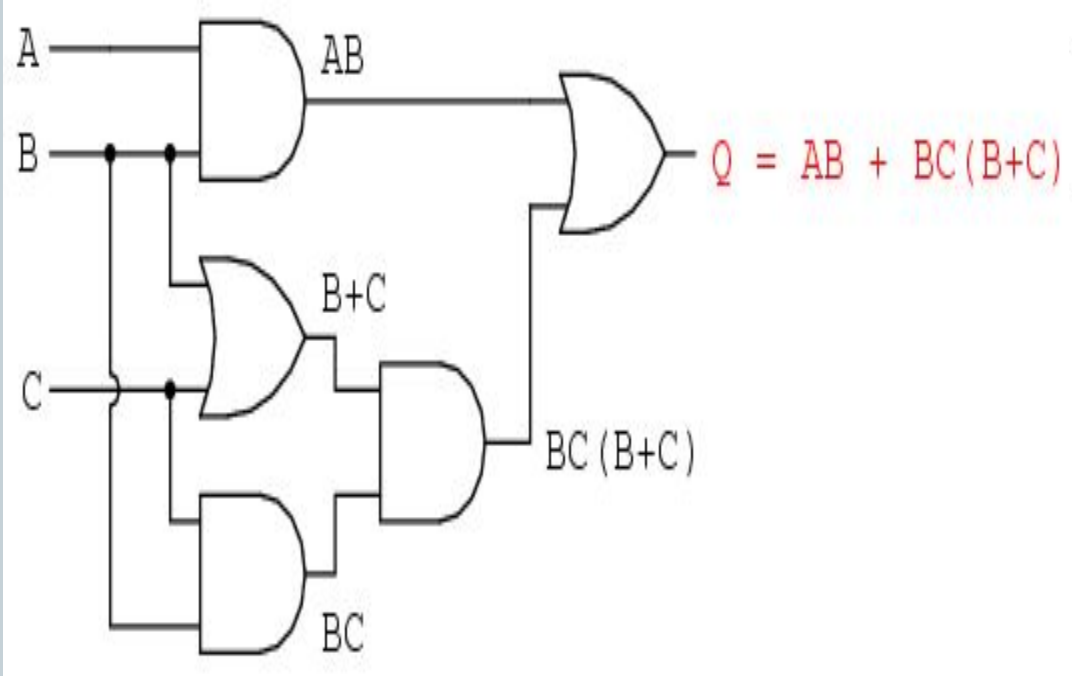
↓ Applying rule **A + AB = A** to the A + AC term

A + AB + BC

↓ Applying rule **A + AB = A** to the A + AB term

A + BC

Example 4



AB + BC(B + C)

↓ Distributing terms

AB + BBC + BCC

↓ Applying identity **AA = A** to 2nd and 3rd terms

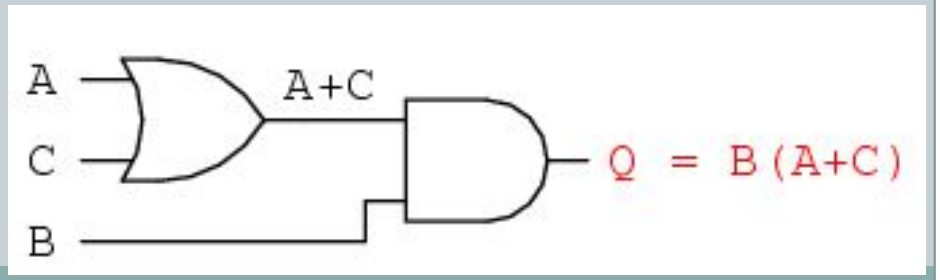
AB + BC + BC

↓ Applying identity **A + A = A** to 2nd and 3rd terms

AB + BC

↓ Factoring **B** out of terms

B(A + C)



Variation in Boolean Expressions

Boolean expression (textbook style):

$$\overline{A}\ \overline{B} = Y$$

Boolean expression (keyboard style):

$$A'\ B' = Y$$

DeMorgan's Theorems

First theorem:

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

Both used to eliminate long overbars

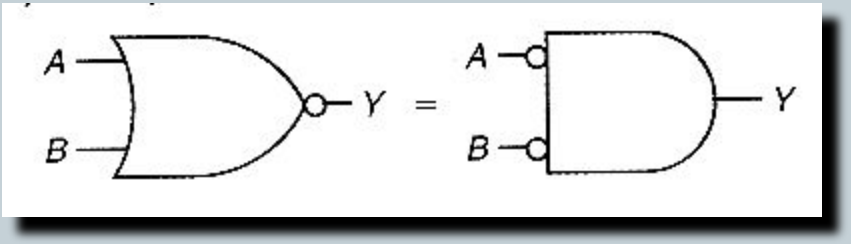
Second theorem:

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

DeMorgan's Theorems

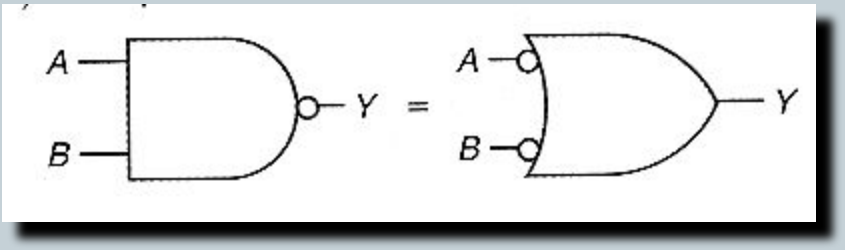
First theorem:

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



Second theorem:

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



Basic Identities

1. $X + 0 = X$	2. $X \cdot 1 = X$
3. $X + 1 = 1$	4. $X \cdot 0 = 0$
5. $X + X = X$	6. $X \cdot X = X$
7. $X + \overline{X} = 1$	8. $X \cdot \overline{X} = 0$
9. $\overline{\overline{X}} = X$ *two dashes means NOT, NOT	
10. $X + Y = Y + X$	11. $XY = YX$
12. $X + (Y + Z) = (X + Y) + Z$	13. $X(YZ) = (XY)Z$
14. $X(Y + Z) = XY + XZ$	15. $X + YZ = (X + Y)(X + Z)$
16. $\overline{X + Y} = \overline{X} \cdot \overline{Y}$	17. $\overline{X \cdot Y} = \overline{X} + \overline{Y}$