

## Logic Simplification Rules for Boolean Variables

$$1. \quad x \cdot x = x \qquad x + x = x$$

$$2. \quad x \cdot x' = 0 \qquad x + x' = 1$$

$$3. \quad x \cdot 0 = 0 \qquad x + 0 = x$$

$$4. \quad x \cdot 1 = x \qquad x + 1 = 1$$

$$5. \quad x \cdot y = y \cdot x \qquad x + y = y + x \qquad (\text{Commutative})$$

$$6. \quad (x \cdot y) \cdot z = x \cdot (y \cdot z) \qquad (\text{Associative})$$

$$(x + y) + z = x + (y + z)$$

$$7. \quad x \cdot (y + z) = x \cdot y + x \cdot z \qquad (\text{Distributive})$$

$$x + (y \cdot z) = (x + y) \cdot (x + z)$$

$$8. \quad (x \cdot y)' = x' + y' \qquad (\text{DeMorgan's Law0s})$$

$$(x + y)' = x' \cdot y'$$

$$9. \quad (x')' = x$$

$$\text{Note: } x \cdot y + x' \cdot y = (x + x') \cdot y = 1 \cdot y = y$$

*This is the basis for circuit simplification using Karnaugh maps.*