



### Logic and Set Identities:

The identities below are shown in the language of Boolean Algebra on the left (P, Q, R are Boolean variables) and Set Algebra on the right (A, B, C are subsets of some universal set U). We use (and prefer) the C superscript:  $A^C$  to indicate the complement operation, though others use the bar notation:  $\bar{A}$ . The notations mean the same thing.

#### Associative Laws

$$(P \vee Q) \vee R = P \vee (Q \vee R)$$

$$(P \wedge Q) \wedge R = P \wedge (Q \wedge R)$$

$$(A \cup B) \cup C = A \cup (B \cup C)$$

$$(A \cap B) \cap C = A \cap (B \cap C)$$

#### Double Negation

$$\neg \neg P = P$$

$$(A^C)^C = A$$

#### DeMorgan's Laws

$$\neg(P \vee Q) = \neg P \wedge \neg Q$$

$$\neg(P \wedge Q) = \neg P \vee \neg Q$$

$$(A \cup B)^C = A^C \cap B^C$$

$$(A \cap B)^C = A^C \cup B^C$$

#### Distributive Laws

$$P \wedge (Q \vee R) = (P \wedge Q) \vee (P \wedge R)$$

$$P \vee (Q \wedge R) = (P \vee Q) \wedge (P \vee R)$$

$$A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$$

$$A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$$

#### Absorption Laws

$$P \wedge (P \vee Q) = P$$

$$P \vee (P \wedge Q) = P$$

$$A \cap (A \cup B) = A$$

$$A \cup (A \cap B) = A$$

#### Complement Laws

$$P \vee \neg P = T$$

$$P \wedge \neg P = F$$

$$A \cup A^C = U$$

$$A \cap A^C = \emptyset$$

#### Idempotent Laws

$$P \vee P = P$$

$$P \wedge P = P$$

$$A \cup A = A$$

$$A \cap A = A$$

#### Identity

$$\text{False} \vee P = P$$

$$\text{True} \wedge P = P$$

$$\emptyset \cup A = A$$

$$U \cap A = A$$

#### Domination:

$$\text{True} \vee P = \text{True}$$

$$\text{False} \wedge P = \text{False}$$

$$U \cup A = U$$

$$\emptyset \cap A = \emptyset$$