

## 2.6 More Laws of Logic Cont'd

### Absorption Laws

$$A(A+B) = A$$

$$A(\bar{A}+B) = AB$$

$$A+AB = A$$

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

Ex: Rewrite using the absorption laws.

$$\text{a) } \bar{C}(\bar{C}+A) = \bar{C}$$

$$A(A+B) = A$$

$$\text{b) } \bar{C}(\bar{C}+A) = \bar{C}A$$

$$A(\bar{A}+B) = AB$$

$$\text{c) } \underbrace{AB} + \underbrace{ABC} = AB$$

$$A+AB = A$$

$$\text{d) } \overline{AB} + \overline{\overline{AB}C} = \overline{AB} + C$$

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

Ex: Simplify  $(\sim p \vee \sim q) \wedge (p \vee \sim q)$

$$\Leftrightarrow (\sim q \vee \sim p) \wedge (\sim q \vee p) \quad \text{Commutative (twice)}$$

$$\Leftrightarrow \sim q \vee (\sim p \wedge p) \quad \text{Distributive}$$

$$[(p \vee q) \wedge (p \vee r) \Leftrightarrow p \vee (q \wedge r)]$$

$$\Leftrightarrow \sim q \vee 0 \quad \text{Complement Identity}$$

$$\Leftrightarrow \sim q$$

Ex: Simplify  $AB(\bar{A} + \bar{B})$

$$= AB \overline{AB} \quad \text{De Morgan's Complement}$$

$$= 0$$

Ex: Show  $\bar{A} + \overline{\bar{A} \bar{B}} = \overline{B \cdot 0}$

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

$$= \bar{\bar{A}} + \bar{\bar{A} \bar{B}} \quad \text{De Morgan's Complement (twice)}$$

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

$$\overline{B \cdot 0}$$

$$= \overline{0} \quad \text{Identity}$$

$$= 1 \quad \text{Definition of 0 and 1}$$



$$= 1 + B \quad \text{Complement}$$

$$= 1 \quad \text{Identity}$$

SAME

Ex: Simplify  $\overline{B}(\overline{A} + \overline{\overline{B}}) + \overline{A}(\overline{A} + B)$

$$= \overline{B}(\overline{B} + \overline{A}) + \overline{A}(\overline{A} + B) \quad \text{Commutative}$$

$$= \overline{B}\overline{A} + \overline{A} \quad \text{Absorption (twice)}$$

$$= \overline{A} + \overline{A}\overline{B} \quad \text{Commutative (twice)}$$

$$= \overline{A} \quad \text{Absorption}$$

## 2.7 The Conditional

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Conditional statement:

$$p \rightarrow q$$

"p implies q"

"if p then q"

Ex: The following statement is true:

"If Barney is a dog then  
Barney has 4 legs."

Answer YES, NO, or MAYBE.

a) Barney is a dog. Does he have 4 legs?  
YES

b) Barney is not a dog.  
Does he have 4 legs?  
MAYBE

c) Barney has 4 legs. Is he a dog?  
MAYBE

d) Barney doesn't have 4 legs.  
Is he a dog?  
NO

Ex: The following is true:

"If the client likes you then you get promoted."

Client Likes You	Promoted	Promise
No	No	Kept
No	YES	Kept
YES	No	Broken
YES	YES	Kept

p	q	$p \rightarrow q$
0	0	1
0	1	1
1	0	0
1	1	1