

## Closure property:

x	y	x and y
true	true	true
true	false	false
false	true	false
false	false	false

x	y	x or y
true	true	true
true	false	true
false	true	true
false	false	false

AND satisfies  
closure property

(if  $x, y \in B$  then  
 $x \text{ and } y \in B$ )

OR satisfies  
closure property

(if  $x, y \in B$ ,  
 $x \text{ or } y \in B$ )

# ASSOCIATIVE PROPERTY:

x	y	z	$x \text{ and } y$	$(x \text{ and } y) \text{ and } z$	$x \text{ and } (y \text{ and } z)$	$x \text{ and } (y \text{ and } z)$
true	true	true	true	true	true	true
true	true	false	false	false	false	false
true	false	true	false	false	false	false
true	false	false	false	false	false	false
false	true	true	false	false	true	false
false	true	false	false	false	false	false
false	false	true	false	false	false	false
false	false	false	false	false	false	false

equal?

so, AND satisfies  
ASSOCIATIVE PROPERTY AND

$x$	$y$	$z$	$x \text{ or } y$	$(x \text{ or } y) \text{ or } z$	$y \text{ or } z$	$x \text{ or } (y \text{ or } z)$
T	T	T	T	T	T	T
T	T	F	T	T	T	T
T	F	T	T	T	T	T
T	F	F	T	T	F	T
F	T	T	T	T	T	T
F	T	F	T	T	T	T
F	F	T	F	T	T	T
F	F	F	F	F	F	F

OR satisfies  
Associative property

So,

Columns B & C are equal for all rows.

B

C

# Distributive property:

AND over OR

checking  $\rightarrow$

$$x \text{ And}(y \text{ OR} z) = (x \text{ and } y) \text{ OR} (x \text{ and } z)$$

$x$	$y$	$z$	$y \text{ OR } z$	$\text{law}(y \text{ OR } z)$	$x \text{ and } y$	$x \text{ and } z$	$(x \text{ and } y) \text{ OR } (x \text{ and } z)$
T	T	T	T	T	T	T	T
T	T	F	T	T	T	F	T
T	F	T	T	T	F	T	T
T	F	F	F	F	F	F	F
F	T	T	T	F	F	F	F
F	T	F	T	F	F	F	F
F	F	T	T	F	F	F	F
F	F	F	F	F	F	F	F

Or over all

$x \text{ or}(y \text{ and } z) = (\text{or}y) \text{ and}(x \text{ or}z)$

Commutative property:

AND

or

x	y	$x \text{ and } y$	$y \text{ and } x$
T	T	T	T
T	F	F	F
F	T	F	F
F	F	F	F

x	y	$x \text{ or } y$	$y \text{ or } x$
T	T	T	T
T	F	T	T
F	T	T	T
F	F	F	F

AND, OR  
satisfy  
Satisfies commutative  
PROPERTY