

#### 4.13(Associativity)

$(A \wedge B) \wedge C$  and  $A \wedge (B \wedge C)$

A	B	C	$A \wedge B$	$B \wedge C$	$(A \wedge B) \wedge C$	$A \wedge (B \wedge C)$	$((A \wedge B) \wedge C) \Leftrightarrow (A \wedge (B \wedge C))$
T	T	T	T	T	T	T	T
T	F	T	F	F	F	F	T
T	T	F	T	F	F	F	T
T	F	F	F	F	F	F	T
F	T	T	F	T	F	F	T
F	T	F	F	F	F	F	T
F	F	T	F	F	F	F	T
F	F	F	F	F	F	F	T

4.22

Large(a)

Cube(a)  $\vee$  Dodec(a)

-----

(Cube(a)  $\wedge$  Large(a))  $\vee$  (Dodec(a)  $\wedge$  Large(a))

Dodec(a)	Cube(a)	Large(a)	Cube(a) $\vee$ Dodec(a)	Cube(a) $\wedge$ Large(a)	Dodec(a) $\wedge$ Large(a)	$\vee$
T	T	T	T	T	T	T
F	T	T	T	T	F	T
T	F	T	T	F	T	T
F	F	T	T	F	F	F
T	T	F	F	F	F	F
F	T	F	F	F	F	F
T	F	F	F	F	F	F
F	F	F	F	F	F	F

4.33

$$(A \wedge B) \wedge A \Leftrightarrow A \wedge (A \wedge B) \Leftrightarrow A \wedge (B \wedge A) \Leftrightarrow (A \wedge A) \wedge B \Leftrightarrow A \wedge B$$

4.34

$$(B \wedge (A \wedge B \wedge C)) \Leftrightarrow (B \wedge A \wedge B) \wedge C \Leftrightarrow (B \wedge B \wedge A) \wedge C \Leftrightarrow (B \wedge A) \wedge C$$

4.35

$$(A \vee B) \vee (C \wedge D) \vee A \Leftrightarrow (A \vee B) \vee A \vee (C \wedge D) \Leftrightarrow (A \vee B \vee A) \vee (C \wedge D) \\ \Leftrightarrow (A \vee B) \vee (C \wedge D)$$

4.36

$$(\sim A \vee B) \vee (B \vee C) \Leftrightarrow \sim A \vee B \vee B \vee C \Leftrightarrow \sim A \vee B \vee C$$