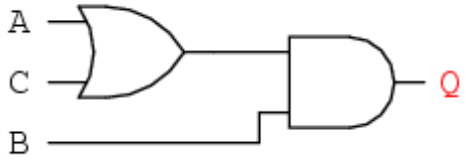
CM1103 Week 6: Exercises 1 – Logic: solution

Optional:

10. $Q \equiv (A \wedge B) \vee \big((B \wedge C) \wedge (B \vee C)\big) \equiv (A \wedge B) \vee \Big(\big((B \wedge C) \wedge B\big) \vee \big((B \wedge C) \wedge C\big)\Big) \equiv$
$(A \wedge B) \vee ((B \wedge C) \vee (B \wedge C)) \equiv (A \wedge B) \vee (B \wedge C) \equiv B \wedge (A \vee C)$



11. Commutative law:

p	q	p ⊕ q	q ⊕ p
T	T	F	F
T	F	T	T
F	T	T	T
F	F	F	F

p ⊕ q and q ⊕ p have the same truth table, so p ⊕ q≡ q ⊕ p

Associative law:

p	q	r	p ⊕ q	(p ⊕ q) ⊕ r	q ⊕ r	p ⊕ (q ⊕ r)
T	T	T	F	T	F	T
T	T	F	F	F	T	F
T	F	T	T	F	T	F
T	F	F	T	T	F	T
F	T	T	T	F	F	F
F	T	F	T	T	T	T
F	F	T	F	T	T	T
F	F	F	F	F	F	F

(p ⊕ q) ⊕ r and p ⊕ (q ⊕ r) have the same truth table, so (p ⊕ q) ⊕ r≡ p ⊕ (q ⊕ r)

Idempotent:

p	p	p ⊕ p
T	T	F
F	F	F

p ⊕ p and p do not have the same truth table, so p ⊕ p is not equivalent to p.