Propositional Logic II

A Reminder

Conjunction

ϕ	ψ	ϕ & ψ
T	T	T
T	F	F
F	T	F
F	F	F

Disjunction

ϕ	ψ	$\phi \vee \psi$
T	T	T
T	F	T
F	T	T
F	F	F

Mat. Implication

ϕ	ψ	$\phi \supset \psi$
T	T	T
T	F	F
F	T	T
F	F	T

Equivalence

ϕ	ψ	$\phi \equiv \psi$
T	T	T
T	F	F
F	T	F
F	F	T

1. Evaluate these complex propositions under the given situations.[1]
   (a) ~(P & ~(~Q ∨ R)); where P is true (T), Q is false (F), and R is true (T)
   (b) (P ∨ (R & ~S)) & ~(Q & ~P); where P (T), Q (F), R (T), and S (F)
   (c) (S & ~(Q & ~P)) ∨ (R ∨ ~~Q); where P (T), Q (F), R (F), and S (F)
   (d) ($P \supset Q$) ∨ ((~$R \supset P$) & Q); where P (T), Q (T), and R (F)
   (e) ~((P ∨ R) ⊃ (Q & ~P)) ∨ S; where P (F), Q (T), R (T), and S (F)

2. Consider this proposition: 'Locke is right and Descartes's argument fails or Aristotle is wrong'. Formalise in two ways.[2] Are they equivalent?
   Interpretation: P = Locke is right; Q = Descartes's argument fails; R = Aristotle is wrong.

3. 'If Poppy cries, this is because she does not get what she wants or does not want what she gets.' Formalise this sentence.[3]

4. Jack says, 'If Tom is at home, then he has a visitor'. Jill says, 'If Tom is at home, then he does not have a visitor'. If Jack and Jill are both right, where is Tom?[4]
   Interpretation: P = Tom is at home; Q = Tom has a visitor.

5. A detective secures these true statements: The gardener says, 'Bill could leave the house unnoticed if and only if Jack was in the garden.' The butler says, 'If John was in the library, then Bill could not leave the house unnoticed.' The cook says, 'Jack was in the garden or it is not the case that John was in the library.' Where was John?[5]
   Interpretation: P = Bill could leave the house unnoticed; Q = Jack is in the garden; R = John is in the library.

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1 Hint: hence no full truth table is needed; only one line (see Handout 5, available from the course website). Some examples from Smith, *Introduction to Formal Logic*, ch. 9.
2 Hint: keep an eye on brackets.
3 Hint: use three atomic propositions.
4 Hint: use a full truth table with the conjunction of both propositions.
5 Hint: use a full truth table with the conjunction *all* propositions.