Truth-Value Analysis

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Truth-tables and tautologies:

1. Show that $P \wedge Q$ and $\sim(\sim P \vee \sim Q)$ are tautologically equivalent by constructing a truth-table.

2. Determine by means of truth-value analysis whether or not the following sentence is a tautology: $R \leftrightarrow ((R \vee S) \wedge (R \vee \sim S))$.

3. Determine by means of truth-value analysis whether or not the following sentence is a tautology: $R \rightarrow ((\sim S \wedge R) \vee R)$.

Check by the method of truth tables whether or not the following arguments are valid:

4. $P \vee Q.\quad \sim P \therefore P \rightarrow Q$

P	Q	$P \vee Q$	$\sim P$	$P \rightarrow Q$

5. $P \rightarrow Q.\quad \sim P \therefore \sim Q$

P	Q	$P \rightarrow Q$	$\sim P$	$\sim Q$

6. $(P \to Q) \land R.\ \ {\sim}R \lor P \therefore Q$

P	Q	R	$(P \to Q) \land R$	${\sim}R \lor P$	Q

7. ${\sim}(P \leftrightarrow Q).\ \ R \to (P \lor Q) \therefore P \lor {\sim}R$

For each of the following either construct a derivation of the conclusion from the premises or show by the method of truth tables that it is invalid (i.e. provide a countermodel).

8. ${\sim}R \to P.\ {\sim}S \to {\sim}P.\ R \to S \therefore R$

9. ${\sim}Z.\ (R \to {\sim}Z) \to (Q \land P) \therefore (Q \land P)$

10. ${\sim}R.\ P \leftrightarrow (R \land (P \lor S)) \therefore P \to {\sim}S$

11. ${\sim}((P \leftrightarrow Q) \lor {\sim}(Q \to P)) \therefore {\sim}Q \land P$

"A tautology leaves open to reality the whole—the infinite whole—of logical space: a contradiction fills the whole of logical space leaving no point of it for reality." – Wittgenstein