

Tutorial 3 – Equivalent transformations, Normal forms

Revision: Equivalent transformations

1.	$(p \supset q) \Leftrightarrow (\neg p \vee q)$
2.	$p \wedge (q \vee r) \Leftrightarrow (p \wedge q) \vee (p \wedge r)$
3.	$p \vee (q \wedge r) \Leftrightarrow (p \vee q) \wedge (p \vee r)$
4.	$p \vee \neg p \Leftrightarrow \top$
5.	$p \wedge \neg p \Leftrightarrow \text{F}$
6.	$\top \wedge p \Leftrightarrow p$
7.	$p \vee p \Leftrightarrow p / p \wedge p \Leftrightarrow p$
8.	$\text{F} \wedge p \Leftrightarrow \text{F}$
9.	$\text{F} \vee p \Leftrightarrow p$
10.	$\top \vee p \Leftrightarrow \top$
11.	$p \wedge q \Leftrightarrow q \wedge p / p \vee q \Leftrightarrow q \vee p$
12.	$\neg\neg p \Leftrightarrow p$

Exercise 1:

For following formulas, decide which type of formula they are (satisfiable, tautology, contradiction) using equivalent transformations of formulas.

- $[(p \supset q) \wedge p] \supset q$
- $[(p \supset q) \wedge \neg q] \supset \neg p$
- $(p \vee q) \wedge (p \supset \neg q)$
- $(q \wedge p) \supset [(p \supset q) \wedge (\neg p \vee q)]$
- $[(p \supset q) \wedge (q \vee p)] \supset (\neg p \vee q)$
- $(p \supset q) \equiv (p \wedge \neg q)$

Exercise 2:

Find CCNF, CDNF of following formulas using truth table and equivalent transformations.

- $p \equiv \neg q$
- $[(p \supset q) \wedge p] \vee q$
- $(p \vee q) \wedge (p \supset \neg q)$
- $(p \wedge (p \supset q)) \supset ((\neg p \vee q) \wedge (q \vee p))$
- $((p \supset q) \wedge (\neg r \supset \neg q)) \wedge \neg r \wedge p$
- $[(p \supset r) \wedge (\neg q \vee p)] \vee r$