INST0072 Logic and Knowledge Representation: Exercise Sheet 1

INST0072 Exercise Sheet 1 - Question 1

(This question is equivalent to Exercise 2.2 on page 37 of Ertel.)

Use truth tables to show that the following formulas are tautologies:

(a) $\neg(a \wedge b) \leftrightarrow \neg a \vee \neg b$

(b) $a \rightarrow b \leftrightarrow \neg b \rightarrow \neg a$

(c) $((a \rightarrow b) \wedge (b \rightarrow a)) \leftrightarrow (a \leftrightarrow b)$

(d) $(a \vee b) \wedge (\neg b \vee c) \rightarrow (a \vee c)$

[Example Answer]

INST0072 Exercise Sheet 1 - Question 2

(This question is equivalent to Exercise 2.3 on page 37 of Ertel.)

Transform the following formulas into conjunctive normal form:

(a) $a \leftrightarrow b$

(b) $a \wedge b \leftrightarrow a \vee b$

(c) $a \wedge (a \rightarrow b) \rightarrow b$

[Example Answer]

INST0072 Exercise Sheet 1 - Question 3

(This question is equivalent to Exercise 2.4 on page 37 of Ertel.)

Check the following formulas for satisfiability and validity:

(a) $(play\_lottery \wedge six\_right) \rightarrow win$

(b) $(play\_lottery \wedge six\_right \wedge (six\_right \rightarrow win)) \rightarrow win$

(c) $\neg(\neg petrol \wedge (petrol \vee \neg car\_starts) \rightarrow \neg car\_starts)$

[Example Answer]

INST0072 Exercise Sheet 1 - Question 4

Use the Deduction Theorem (Lecture 1, Slide 14) the defintion of soundness of an inference rule (Lecture 1, Slide 16) and truth tables, to show that the inference rules Modus Ponens and Modus Tollens (Lecture 1, Slide 16) are both sound.

[Example Answer]