Model Answers for InClass Exercises

Week 8

(a) Construct a proposition/statement in that is true precisely when:

1. *p* is true and *q* is false
2. *p* is false and *q* is false or when *p* is false and *q* is true
3. *p* is false or *q* is true, and *r* is false

Answer:

1. $p \wedge \neg q$
2. $(\neg p \wedge \neg q) \vee (\neg p \wedge q)$
3. $(\neg p \vee q) \wedge \neg r$

(b) Show that the statements below are tautologies and/or contradictions:

1. $((p \to q) \wedge (q \to r)) \to (p \to r)$
2. $\neg (p \wedge \neg p) \wedge (r \wedge \neg r)$

Answer:

Use logical equivalence/truth table, one can show that:

1. is tautology
2. is contradiction

(c) Use the laws of equivalence to show that the below statements are logically equivalent:

1. $(p \wedge \neg q) \vee q \equiv p \vee q$
2. $\neg p \vee p \equiv p \wedge \neg p$

Answer:

Using commutative, distributive, or tautology, identity and commutative laws, one can show:

1. $(p \wedge \neg q) \vee q \equiv q \vee (p \wedge \neg q) \equiv (q \vee p) \wedge (q \vee \neg q) \equiv (q \vee p) \wedge T \equiv q \vee p \equiv p \vee q$
2. Note that $\neg p \vee p \not\equiv p \wedge \neg p$ since one is Or Tautology and another one is And Contradiction