

Discrete Mathematics . Logical Equivalence Problem Set

1. Use the table of Logical Equivalence to show
 $(p \wedge \neg q) \vee (p \wedge q) \equiv q$

Start with Left-Side :

$$\begin{aligned}(p \wedge \neg q) \vee (p \wedge q) &\equiv (p \wedge \neg q) \vee (p \wedge q) && \text{Commutative Laws} \\ &\equiv p \vee (\neg q \wedge q) && \text{Distributive Laws} \\ &\equiv p \vee (c) && \text{Negation Laws} \\ &\equiv p && \text{Identity Laws } (p \vee c \equiv p)\end{aligned}$$

2. Use the table of Logical Equivalence to show
 $\neg(p \vee \neg q) \vee (\neg p \wedge \neg q) \equiv \neg p$

Start with Left-Side :

$$\begin{aligned}\neg(p \vee \neg q) \vee (\neg p \wedge \neg q) &\equiv \neg(p \vee \neg q) \vee (\neg p \wedge \neg q) && \text{Commutative Laws} \\ &\equiv (\neg p \wedge q) \vee (\neg p \wedge \neg q) && \text{Double Negation Law} \\ &\equiv \neg p \wedge (q \vee \neg q) && \text{Distributive Law} \\ &\equiv \neg p \wedge (t) && \text{Negation Law} \\ &\equiv \neg p && \text{Identity Law}\end{aligned}$$