

# Assignment 2

Madiba Hudson-Quansah

### Question 1

$$(p \rightarrow q) \wedge (p \rightarrow r) \equiv p \rightarrow (q \wedge r)$$

**Solution:**

$$\begin{aligned}(p \rightarrow q) \wedge (p \rightarrow r) &\equiv (\neg p \vee q) \wedge (\neg p \vee r) && \text{Conditional Disjunction Equivalence} \\ &\equiv \neg p \vee (q \wedge r) && \text{By the First Distributive Law} \\ &\equiv p \rightarrow (q \wedge r) && \text{Conditional Conjunction Equivalence}\end{aligned}$$

### Question 2

$$p \wedge p \equiv p$$

**Solution:**

$$\begin{aligned}p &\equiv p \wedge T && \text{By the First Identity Law} \\ &\equiv p \wedge (p \vee \neg p) && \text{By the First Negation Law} \\ &\equiv (p \wedge p) \vee (p \wedge \neg p) && \text{By the Second Distributive Law} \\ &\equiv (p \wedge p) \vee F && \text{By the Second Negation Law} \\ &\equiv p \wedge p && \text{By the Second Identity Law}\end{aligned}$$

### Question 3

1.  $\exists x N(x)$
2.  $\forall x N(x)$
3.  $\neg \exists x N(x)$
4.  $\exists x \neg N(x)$
5.  $\neg \forall x N(x)$
6.  $\forall x \neg N(x)$

**Solution:**

1. There are some students in my school that have visited North Dakota
2. All students in my school have visited North Dakota
3.  $\neg \exists x N(x) \equiv \forall x \neg N(x) \therefore$  All the students in my class have not visited North Dakota
4. There are some students in my school that have not visited North Dakota
5.  $\neg \forall x N(x) \equiv \exists x \neg N(x) \therefore$  There are some students in my school that have not visited North Dakota
6. All the students in my class have not visited North Dakota