# Assignment 1: CS205

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## 1.1

**32c)**

Problem: Construct a truth table for $p \oplus (p \vee q)$

| $p$ | $q$ | $p \vee q$ | $p \oplus (p \vee q)$ |
|-----|-----|-----------|-----------------------|
| T | T | T | F |
| T | F | T | F |
| F | T | T | T |
| F | F | F | F |

**32f)**

Problem: Construct a truth table for $(p \oplus q) \wedge (p \oplus \neg q)$

| $p$ | $q$ | $\neg q$ | $p \oplus q$ | $p \oplus \neg q$ | $(p \oplus q) \wedge (p \oplus \neg q)$ |
|-----|-----|----------|--------------|-------------------|------------------------------------------|
| T | T | F | F | T | F |
| T | F | T | F | F | F |
| F | T | F | T | F | F |
| F | F | F | F | T | F |

**36c)**

Problem: Construct a truth table for $(p \vee q) \vee r$

| $p$ | $q$ | $r$ | $p \vee q$ | $(p \vee q) \vee r$ |
|---|---|---|---|---|
| T | T | T | T | T |
| T | T | F | T | T |
| T | F | T | T | T |
| T | F | F | T | T |
| F | T | T | T | T |
| F | T | F | T | T |
| F | F | T | F | T |
| F | F | F | F | F |

**36f)**

Problem: Construct a truth table for $(p \wedge q) \vee r$

| $p$ | $q$ | $r$ | $\neg r$ | $p \wedge q$ | $(p \wedge q) \vee r$ |
|---|---|---|---|---|---|
| T | T | T | F | T | T |
| T | T | F | T | T | T |
| T | F | T | F | F | F |
| T | F | F | T | F | T |
| F | T | T | F | F | F |
| F | T | F | T | F | T |
| F | F | T | F | F | F |
| F | F | F | T | F | T |

## 1.3

**26)**

Problem: Use boolean algebra to show that $\neg p \rightarrow (q \rightarrow r)$ and $q \rightarrow (p \vee r)$ are logically equivalent

- $\neg p \rightarrow (q \rightarrow r) \equiv p \vee (\neg q \vee r)$ by the implication law

- $p \vee (\neg q \vee r) \equiv \neg q \vee (p \vee r)$ by the commutative and associative laws

- $\neg q \vee (p \vee r) \equiv q \rightarrow (p \vee q)$ by the implication law

**30)**

Problem: Use boolean algebra to show that $(p \vee q) \wedge (\neg p \vee r) \rightarrow (q \vee r)$ is a tautology

- $\neg p \rightarrow (q \rightarrow r) \equiv p \vee (\neg q \vee r)$ by the implication law

- $p \vee (\neg q \vee r) \equiv \neg q \vee (p \vee r)$ by the commutative and associative laws

- $\neg q \vee (p \vee r) \equiv q \rightarrow (p \vee q)$ by the implication law