McGill University
Math 240: Discrete Structures 1
Assignment 1: due Friday, September 16, 2005

Reading: Text: 1.1: Logic, 1.2: Propositional Equivalences, 1.3: Predicates and Quantifiers, 1.4: Nested Quantifiers, 1.6: Sets, 1.7: Set Operations

Questions:

1. Using truth tables, show that the following propositions are tautologies.
   (a) $((p \vee q) \wedge (\neg p \vee r)) \rightarrow (q \vee r)$
   (b) $((p \vee q) \wedge (p \rightarrow r) \wedge (q \rightarrow r)) \rightarrow r$

2. Without using truth tables, prove that the following propositions are logically equivalent.
   (a) $p \leftrightarrow q$
   (b) $(p \wedge q) \vee (\neg p \wedge \neg q)$
   (c) $\neg(p \oplus q)$

3. If A, B, C are sets, prove or disprove the following statements:
   (a) $(A \cup C = B \cup C) \rightarrow (A = B)$
   (b) $(A \cap C = B \cap C) \rightarrow (A = B)$
   (c) $(A \oplus B) \cap C = (A \cap C) \oplus (B \cap C)$
   (d) $(A \oplus B) \cup C = (A \cup C) \oplus (B \cup C)$

4. If A, B, C are sets, prove that $A \oplus (B \oplus C) = (A \oplus B) \oplus C$.