Maths for Computing
Tutorial 2

1. Show that the following pairs are logically equivalent without using truth table.
   a) $\neg(p \vee \neg q) \vee (\neg p \wedge \neg q) \equiv \neg p$
   b) $(\neg p \wedge (p \vee q)) \rightarrow q \equiv T$

2. Let $S(x)$ be the predicate "x is a student," $F(x)$ the predicate "x is a faculty member," and $A(x, y)$ the predicate "x has asked y a question," where the domain consists of all people associated with your school. Use quantifiers to express each of these statements.
   a) Every student has asked Professor Gross a question.
   b) Every faculty member has either asked Professor Miller a question or been asked a question by Professor Miller.
   c) Some student has not asked any faculty member a question.
   d) There is a faculty member who has never been asked a question by a student.

3. Find the truth value of the following propositions where the domain is the set of integers.
   a) $\forall x \forall y(x^2 = y^2 \rightarrow x = y)$
   b) $\forall x \exists y(y^2 = x)$
   c) $\forall x \forall y(xy^2 \geq x)$

4. Find a common domain for the variables x, y, and z for which the statement $\forall x \forall y((x \neq y) \rightarrow \forall z((z = x) \vee (z = y)))$ is true and another domain for which it is false.