Maths for Computing
Tutorial 3

1. Show that the following arguments are valid. (Write all the steps with reasons.)

   a) Premises: $p \to q$, $(q \vee r) \wedge (\neg(q \wedge r))$. Conclusion: $\neg q \to (\neg p \wedge r)$.

   b) Premises: $\forall x(P(x) \vee Q(x))$, $\forall x(\neg Q(x) \vee S(x))$, $\forall x(R(x) \to \neg S(x))$, and $\exists x \neg P(x)$
   Conclusion: $\exists x \neg R(x)$. (Domain for all quantifiers are the same.)

2. Find the flaw in the below proof that shows that if $\exists x P(x) \wedge \exists x Q(x)$ is true, then $\exists x(P(x) \wedge Q(x))$ is true.

1. $\exists x P(x) \wedge \exists x Q(x)$	Premise
2. $\exists x P(x)$	Simplification of 1
3. $\exists x Q(x)$	Simplification of 1
4. $P(c)$	Existential instantiation from 2
5. $Q(c)$	Existential instantiation from 3
6. $P(c) \wedge Q(c)$	Conjunction from 4 and 5
7. $\exists x(P(x) \wedge Q(x))$	Existential Generalization

3. Suppose an argument A has premises p, q, and r, where each premise can be a compound proposition, and conclusion s, where s can be a compound proposition too. Show that the argument A is valid if and only if $(p \wedge q \wedge r) \to s$ is a tautology.

4. Prove the following:

   a) If n is an integer and $3n + 2$ is odd, then n is odd.

   b) If x is irrational, then $1/x$ is irrational.