**Question 1 (30%)**

You have two predicates $p$ and $q$. Express the following situations in first order logic:

(a) there is no $p$ that is not also $q$.

(b) there is exactly one $p$.

(c) there are exactly two $p$s.

(d) there is at most one $p$.

**Question 2 (20%)**

Render the following sentence in first order logic.

(1) Every farmer who owns a donkey beats it.

If you cannot come up with a satisfactory formula, briefly comment on why your efforts have failed.

**Question 3 (50%)**

Specify a lexicon for all the items in the following sentences and drive their meaning specifying their order of combination, syntactic categories, semantic interpretations and semantic types in each step:

(a) Every donkey sleeps.

(b) John walks slowly.

(c) A lazy donkey walks.

(d) Every student and a lazy donkey walk.