Ma 236 Extra Credit — Due March 20 in class

Name: _____

Pledge: _____

Your score on this take home exam (normalized to 0-4) will be added to your course score (0-100 points) before converting to a letter grade.

1. True or False.

   (a) Every argument with a false conclusion is unsound. True ☐ or False ☐

   (b) Every argument that is valid and has a true conclusion is sound. True ☐ or False ☐

   (c) Every valid argument has at least one true premise. True ☐ or False ☐

   (d) Every argument with all true premises and a false conclusion is invalid. True ☐ or False ☐

2. Translate the following statements into the language of predicate logic. Use Fx and Gx as the predicates "x is a frog" and "x is green" respectively.

   (a) Some frogs are green.

   (b) There are at least two green frogs.

   (c) Not all green things are frogs.

   (d) Everything is a frog unless it is not green.

3. Translate the following items into logic. Define the names and predicates which you use.

   (a) Bob likes nothing.

   (b) Cathy likes something which Bob likes.

   (c) There is at least one thing which is liked by everything.

   (d) If Bob likes something, then he likes everything.

4. Let a be a name, Q a two-place predicate, and R a three-place predicate.

   Consider the interpretation whose domain consists all positive integers $\{1, 2, 3, \ldots, \}$ with the following extensions.

Name or predicate	Extension
a	1
Q	All pairs (m, n) with m less than n.
R	All triples (m, n, p) with $m + n = p$.

   (a) Is $\forall x \, \forall y \, \exists z \, R_{xyz}$ true or false in the interpretation? Show your work.

   (b) What about $\forall x \, \neg \forall z \, (Q_{xz} \rightarrow \exists y \, R_{xyz})$? Show your work.

   (c) Translate the following sentence into logic: One plus one is bigger than one.