

## Mathematics 2200H – Mathematical Reasoning

TRENT UNIVERSITY, Fall 2025

### Assignment #4

#### A little pidgeon quibbled with my Aristotelian logic ...

*Due on Friday, 3 October.\**

Suppose we have a first-order language whose symbols are the necessary ones (variables, connectives, quantifiers, and equality), plus two one-place relations,  $P$  and  $Q$ , with the usual formation rules for formulas.  $Px$  is supposed to mean “ $x$  is a pidgeon” and  $Qx$  is supposed to mean “ $x$  is a quibbler”.

1. Translate the four sentences

*All pidgeons are quibblers.*

*Some pidgeons are quibblers.*

*No pidgeons are quibblers.*

*Some pidgeons are not quibblers.*

into logically equivalent formulas of the first-order language described above. [4]

NOTE: The four sentences reflect the four main sentence forms involving quantifiers studied in Aristotle’s logic.

2. If there are no pidgeons, but there are some quibblers, in the universe the four sentences in question 1 are talking about, which of them must be true? If, instead, there are no quibblers, but there are some pidgeons in that universe, which of the four sentences must be true? (Explain why in each case.) [3]
3. Aristotelian logic pretty much consists of propositional logic, plus just enough first-order logic to properly handle the four sentence forms given above. Give an example of a mathematical result and its proof that Aristotelian logic is *not* adequate to handle, and explain why this is so. [3]

*Hint.* Look for a definition with alternating universal and existential quantifiers and then a result that depends on that definition.

Probable-Possible, my black hen,  
She lays eggs in the Relative When.  
She doesn’t lay eggs in the Positive Now  
Because she’s unable to Postulate How.

Flappity, Floppity, Flip!  
The Mouse on the Möbius Strip.  
The Strip revolved,  
The Mouse Dissolved  
In a chronodimensional skip.

From *The Space Child’s Mother Goose* by Frederick Winsor.

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\* Please submit your solutions, preferably as a single pdf, via Blackboard’s Assignments module. If that fails, please submit them to the instructor on paper or via email to [sbilaniuk@trentu.ca](mailto:sbilaniuk@trentu.ca) as soon as you can,