

Mathematical Methods for Philosophy:
Problem Set 4

Due Date: Complete the following exercises, as well as lab problems in chapter 9 from *Logic and Proofs* textbook. This problem set is due November 12th, 2013 at the beginning of class.

Exercise 1 For each of the following English sentences, first choose predicate variables and constant symbols to the natural language predicates and names respectively discussed in the sentence. Then, using variables and constants, write a well-formed formula in the language of predicate logic that represents said sentence.

- All Canadians are polite, but Ruth is especially nice.
- If there are any flightless birds, then not all birds fly!
- Maria finished her problem set early, and so at least one student finished his or her work on time.
- Every one loves someone.
- Every class has a tallest student.

Exercise 2 For the following two sets of sentences, construct a model. If possible, give an informal interpretation of what the model might represent. If you can, also try to draw the model.

- $\Gamma_1 = \{((\exists x)(\forall y)T(x, y) \rightarrow (\exists x)P(x)), (\forall x)T(c, x), (\forall x)(\forall y) (T(x, y) \rightarrow \neg P(y))\}$
- $\Gamma_2 = \{(\forall x)(\exists y)(\forall z)T(x, y, z), (\forall x)(\forall y)\neg T(x, x, y)\}$

Exercise 3 Represent the following argument in the language of predicate logic. Use a truth-tree to show that each is valid. You may need to add implicit premises.

- Although Maria did well on the last exam, she did not have the highest score.
- Because the class was small, every student had the highest score on at least one exam.
- **Conclusion:** Maria had the highest score on at least one exam.

Exercise 4 Write a set of sentences that has no finite models. Explain why you think the set has no finite models.