

PRINT NAME: _____

LGIC 010 & PHIL 005
Practice Examination II
Spring Term, 2014

1. (10 points) How long a list of pure monadic schemata involving only the predicate letters “ F ” and “ G ” can be constructed so that no two schemata on the list are equivalent, and every schema on the list implies $(\forall x)(Fx \oplus Gx)$?
2. (10 points) How long a list of pure monadic schemata involving only the predicate letters “ F ” and “ G ” can be constructed so that no two schemata on the list are equivalent and each schema on the list is satisfied by exactly 228 structures with universe of discourse $\{1, 2, 3, 4\}$?

3. Let S_1 be the following schema.

$$(\exists x)\neg Lxx \wedge (\forall x)(\forall y)(Lxy \supset Lyx).$$

- (a) (10 points) Specify a structure A_1 of size at least 4 which satisfies S_1 , that is, U^{A_1} has at least 4 members and $A_1 \models S_1$.

$$U^{A_1} =$$

$$L^{A_1} =$$

- (b) (10 points) How many structures with universe of discourse $\{1, 2, 3, 4\}$ satisfy S_1 ?

4. Let S_2 be the following schema.

$$(\forall x)(\exists y)Lxy \wedge (\forall x)(\exists y)\neg Lxy.$$

- (a) (10 points) Specify a structure A_2 of size at least 4 which satisfies S_2 .

$$U^{A_2} =$$

$$L^{A_2} =$$

- (b) (10 points) How many structures with universe of discourse $\{1, 2, 3, 4\}$ satisfy S_2 ?

5. Let S_3 be the following schema.

$$(\forall x)(\exists y)(\forall z)(Rxx \equiv z = y) \wedge (\forall x)(\forall y)(Rxy \supset \neg Ryx) \wedge (\forall x)(\forall y)(\forall z)((Rxy \wedge Ryz) \supset Rzx).$$

(a) (10 points) Specify a structure A_3 of size at least 4 which satisfies S_3 .

$$U^{A_3} =$$

$$R^{A_3} =$$

(b) (10 points) How many structures with universe of discourse $\{1, 2, 3, 4, 5, 6\}$ satisfy S_3 ?

6. We say that a schema S admits a positive natural number n if and only if there is a structure A of size n which satisfies S .

(a) (10 points) Write down a schema S involving only the dyadic predicate letter “ L ” and the identity predicate such that S admits n if and only if n is divisible by two, and S implies

$$(\forall x)Lxx \wedge (\forall x)(\forall y)(Lxy \supset Lyx) \wedge (\forall x)(\forall y)(\forall z)(Lxy \supset (Lyz \supset Lxz)).$$

(b) (10 points) Write down a schema S involving only the dyadic predicate letter “ R ” and the identity predicate such that S admits n if and only if n is divisible by three, and S implies

$$(\forall x)(\exists y)(\forall z)(Rxx \equiv z = y).$$