

PRINT NAME: \_\_\_\_\_

**LGIC 010 & PHIL 005**  
**Practice Examination I**  
**Spring Term, 2013**

1. (20 points) For each of the following truth-functional schemata, indicate in the space provided whether it is valid, satisfiable but not valid, or unsatisfiable.

(a)  $((p \oplus q) \oplus (\neg p \oplus \neg q))$      unsatisfiable

(b)  $((p \oplus q) \oplus r) \oplus ((\neg p \oplus \neg q) \oplus \neg r)$      valid

2. (20 points) For each of the following pairs of truth-functional schemata, write “YES” in the space provided, if the first schema of the pair implies the second, and write “NO,” if the first schema does not imply the second.

(a)  $(p \oplus p)$       $(\neg p \oplus \neg p)$      YES

(b)  $(p \supset r) \wedge (q \supset r)$       $(p \vee q) \supset r$      YES

3. (40 points) Answer each of the following questions.

(a) How long a list of truth-functional schemata involving only the sentence letters “ $p$ ,” “ $q$ ,” “ $r$ ,” and “ $s$ ” can you write down so that each schema on your list implies the next schema on your list, but is not implied by it? 17

(b) How long a list of truth-functional schemata involving only the sentence letters “ $p$ ,” “ $q$ ,” “ $r$ ,” and “ $s$ ” can you write down so that each schema on your list implies the next schema on your list, but is not implied by it, and no schema on your list implies “ $(p \wedge s) \vee (q \wedge r)$ ”? 16

(c) How many truth assignments to the sentence letters “ $p$ ,” “ $q$ ,” “ $r$ ,” and “ $s$ ” satisfy the schema “ $(p \oplus r) \equiv (q \oplus s)$ ”? 8

(d) How long a list of truth-functional schemata involving only the sentence letters “ $p$ ,” “ $q$ ,” “ $r$ ,” and “ $s$ ” can you write down so that no two schemata on your list are equivalent and no schema on your list implies, or is implied by, “ $((p \oplus q) \oplus (r \oplus s))$ ”? 65, 025

4. (20 points) Answer each of the following questions.

- (a) How many structures with universe of discourse  $\{1, 2, 3, 4, 5\}$  interpreting only the monadic predicate letter “ $F$ ” satisfy the following schema? 30

$$(\exists x)Fx \oplus (\forall x)Fx$$

- (b) How many structures with universe of discourse  $\{1, 2, 3, 4, 5\}$  interpreting only the monadic predicate letters “ $F$ ,” “ $G$ ,” and “ $H$ ” satisfy the following schema? 1024

$$(\forall x)((Fx \oplus Gx) \oplus Hx)$$