PHIL 120: Symbolic Logic I
Practice Final

The questions are collectively worth 110 points, but only 100 points are needed for a perfect score. Having more than 100 points won’t give you extra credit.

1. Symbolize the following sentences:
   (Be sure to make clear which predicate-letters, names and sentence-letters are being used, and say what each of them means. Your symbolizations should display as much logical structure as possible. In particular, try to use quantifier-symbols, predicate-letters and names, rather than sentence-letters. Here and throughout the exam, informal notation is okay.)

   (a) Adam, who is neither quick nor slow, will pass just in case he studies.  (5 points)

   (b) Either Claire passes without studying or Adam studies without passing, but both fail to both study and pass.  (5 points)

   (c) Among dolphins, only those that fail to jump fail to sing.  (5 points)

   (d) Only dolphins and canaries jump or sing.  (5 points)

   (e) If all canaries sing, they can fly.  (5 points)

   (f) Either no dog that fails to be petted is long-haired, or some long-haired dog that jumps fails to be petted.  (5 points)

   (g) No dog is neither yellow nor long-haired.  (5 points)
2. Perform the following derivations:
(Use the derivation style of Logic2000. Any rules which are recognized by Logic2000 are acceptable.)

(a) \( \sim(P \rightarrow R) \cdot Q \vdash \sim(P \rightarrow (Q \rightarrow R)) \) (10 points)
(b) \( ((P \leftrightarrow Q) \leftrightarrow (R \leftrightarrow S)) \vdash ((P \leftrightarrow R) \leftrightarrow (Q \leftrightarrow S)) \) (10 points)
(c) \( \sim R \leftrightarrow (\sim S \rightarrow \sim Q) \cdot \sim((P \leftrightarrow Q) \rightarrow (P \leftrightarrow R)) \vdash S \) (10 points)
(d) \( \bigwedge x (Fx \rightarrow Hx) \cdot \bigwedge x (Gx \rightarrow Hx) \cdot \bigvee x (Fx \lor Gx) \vdash \bigvee x Hx \) (10 points)
(e) \( \bigvee x (Fx \rightarrow \bigwedge x Gx) \vdash \bigwedge x Fx \rightarrow \bigwedge x Gx \) (10 points)
(f) \( \bigwedge x Fx \leftrightarrow \bigwedge x Gx \vdash \bigvee x \bigvee y (Fx \leftrightarrow Gy) \) (10 points)

3. Produce a truth-table for the following argument:

(a) \( \sim((P \leftrightarrow Q) \lor \sim(Q \rightarrow P)) \vdash \sim Q \land P \) (5 points)

4. Produce a counter-model for the following argument:

(a) \( \bigvee x (Fx \rightarrow \bigwedge x Fx) \vdash \bigwedge x (\bigvee y Fy \rightarrow Fx) \) (10 points)