# PHIL 112 Homework 1

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1. Define

   (a) Quantificational truth

   There are three values for quantificational truth. Sentences of Pl can be: quantificationally true, quantificationally false, or quantificationally indeterminate

   - A sentence **P** of PL is quantificationally true if and only if **P** is true for all interpretations.
   - A sentence **P** of PL is quantificationally false if and only if **P** is false for all interpretations.
   - A sentence **P** of PL is quantificationally indeterminate if and only if **P** is neither quantificationally true nor quantificationally false.

   (b) Quantificational equivalence

   Two sentences **P** and **Q** of PL are quantificationally equivalent if and only if there is no interpretation on which **P** and **Q** have different quantificational truth values.

2. Symbolize the following sentences, using the symbolization key given. UD: Everything Ixy: x is identitcal to y Mx: x is a math problem Lx: x is a logic problem Sxy: x is easier to solve than is y

   (a) Math problems are easier to solve than logic problems.

   (b) Some logic problems are easier to solve than are others.

3. Determine the truth values of the following with the given interpretation. UD: Set of people and planets Hx: x is a human being Lxy: x lives on y Px: x is a planet Sx: x is in the solar system e: earth

   (a) $(\exists x)(\forall y)[Hx \wedge (Py \supset Lxy)]$

   (b) $(Pe \wedge Se) \wedge (\exists w)(Hw \wedge Lwe)$

   (c) $(\exists x)(Hx \wedge Lxe) \equiv Se$

   (d) $(\forall x)(\forall y)[(Hx \wedge Py) \supset \neg x \equiv y]$

4. Determine the truth values for the following with the given interpretation. UD: Set of people Mx: x is a male Sx: x is a scientist Oxy: x is older than y a: Albert Einstein

   (a) $(\forall x)(Mx \wedge Sx) \supset \neg Sa$

(b) $(\forall x)[(Mx \wedge Sx) \supset \neg Sa]$

(c) $(\forall x)(\forall y)(Oxy \supset \neg Oyx)$

(d) $(\forall y)[\neg y \equiv [a \wedge (My \wedge Sy)]]$

5. Construct an expansion of each of the following sentences for the set of constants $\{a, s\}$

(a) $(\forall x)(\exists y)Sxy \wedge D$

(b) $(\exists x)Fx \equiv \neg(\forall y)Gsy$

6. Show that the following argument is not quantificationally valid. Use both the interpretation method and the truth-functional expansion method.

$$\begin{array}{l} (\forall y)(\exists x)(Py \supset Cyx) \\ (\exists x)Cxx \\ \hline (\exists x)\neg Cxx \end{array}$$

7. Are the sentences $(\forall y)Fy$ and $\neg(\exists y)\neg Fy$ quantificationally equivalent?