Philosophy 240: Symbolic Logic
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Practice Problems for Test #6

I. Translations.

Use the following legend to translate the sentences below. For questions 1-13, do not use any functions.

a: Al
b: Bud
c: Cindy
e: Ed
m: Megha
n: Nietzsche
p: Plato

f(x): the father of x
g(x): the mother of x
f(x,y): the only son of x and y

Fx: x is a feminist
Gx: x is Greek
Hx: x is happy
Nx: x is a novel
Px: x is a philosopher
Rx: x is Russian

Bxy: x is a brother of y
Mxy: x mocks y
Rxy: x is richer than y
Sxy: x is smarter than y
Wxy: x wrote y

1. All feminists are philosophers.
2. All Greek feminists are philosophers.
3. Nietzsche mocks all feminists.
4. Nietzsche mocks everything that Plato wrote.
5. Nietzsche mocks everything smarter than him.
6. Nietzsche mocks a thing if it does not mock itself.
7. If one thing is smarter than a second, then the second is not smarter than the first.
8. If all feminist philosophers are richer than some Greek philosopher, then some Greek is smarter than all feminists.
9. Megha's only brother is Al. Ed writes novels. Al doesn't. So, Ed isn't Megha's brother.
10. If one thing is richer than a second, then the two aren't identical. So, nothing is richer than itself.
11. There are at most two things. Something other than Cindy is happy. So, there are exactly two things.
12. The brother of Cindy is happy. So, Cindy has a brother.
13. Everything is happy, except Megha and Bud. Al is unhappy. So, Al is either Megha or Bud.
14. Bud's father is a feminist, but Cindy's mother is not.
15. The only son of Cindy and Ed has no brother.
16. If Cindy is Greek, then her mother is a happy Russian and her father is a feminist who writes novels.
17. There are properties that Nietzsche has that Plato lacks.
18. All Russians have something in common.
19. Some transitive relations are asymmetric.
20. Everything is self-identical. Therefore, there is some relation that everything has to itself.

II. Derivations. Derive the conclusions of each of the following arguments.

1. 1. $(\forall x)(\exists y)(\sim Fx \vee Gy)$ / $(\forall x)Fx \supset (\exists y)Gy$

2. 1. $(\forall x)(\exists y)Fxy \supset (\forall x)(\exists y)Gxy$
   2. $(\exists x)(\forall y)\sim Gxy$ / $(\exists x)(\forall y)\sim Fxy$

3. 1. $(\forall x)[(Fx \vee Gx) \supset (Hx \cdot Kx)]$
   2. $(\forall x)\{(Hx \vee Lx) \supset [(Hx \cdot Nx) \supset Px]\}$ / $(\forall x)[Fx \supset (Nx \supset Px)]$

4. 1. $\sim(\exists x)(Axa \cdot \sim Bxb)$
   2. $\sim(\exists x)(Dxd \cdot Dbx)$
   3. $(\forall x)(Bex \supset Dxg)$ / $\sim(Aea \cdot Dgd)$

5. 1. $(\forall x)(Ax \supset Bx)$ / $(\forall x)[(\exists y)(Ay \cdot Cxy) \supset (\exists z)(Bz \cdot Cxz)]$

6. 1. $(\exists x)(Nx \cdot Wjx \cdot Ix)$
   2. $Nc \cdot Wjc \cdot (\forall x)[(Nx \cdot Wjx) \supset x=c]$ / Ic

7. 1. $(\exists x)\{Mx \cdot Tx \cdot (\forall y)[(My \cdot y\neq x) \supset Hxy]$ / $(\exists x)\{Mx \cdot Tx \cdot (\forall y)[(My \cdot \sim Ty) \supset Hxy]\}$

8. 1. $(\forall x)(\forall y)(\forall z)[(Sx \cdot Lx \cdot Sy \cdot Ly \cdot Sz \cdot Lz) \supset (x=y \vee y=z \vee x=z)]$
   2. $(\exists x)(\exists y)(Sx \cdot Lx \cdot Sy \cdot Ly \cdot Rx \cdot Ry \cdot x\neq y)$
   3. $(\forall x)(Rx \supset \sim Cx)$ / $(Sa \cdot Ca) \supset \sim La$

9. 1. $(\forall x)(\forall y)f(x,y)=f(y,x)$
   2. $(\forall x)f(x,o)=o$ / $(\forall x)f(o,x)=o$

10. 1. $(\forall x)(\forall y)(Gxy \equiv Lyx)$
    2. $(\forall x)Gf(x)x$ / $(\forall x)Lxf(x)$

11. 1. $(\forall x)(\forall y)(\exists z)Sf(x)yz$
    2. $(\forall x)(\forall y)(\forall z)[Sxyz \supset \sim(Cxyz \vee Mzyx)]$ / $(\exists x)(\exists y)(\exists z)\sim Mzg(y)f(g(x))$

There will be no derivations in second-order logic on the test.