Philosophy 240: Symbolic Logic Fall 2013

## 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	Ax: x is an altruist
b: Bud	Jx: x is joyful
c: Cindy	Nx: x is a novel
e: Ed	Px: x is a philosopher
m: Megha	Rx: x is Russian
n: Nietzsche	Tx: x is thoughtful
p: Plato	
	Bxy: x is a brother of y
f(x): the father of x	Mxy: x mocks y
g(x): the mother of x	Pxy: x produces y
f(x,y): the only son of x and y	Rxy: x is richer than y
	Sxy: x is smarter than y

- 1. All altruists are philosophers.
- 2. All thoughtful altruists are philosophers.
- 3. Nietzsche mocks all altruists.
- 4. Nietzsche mocks everything that Plato produces.
- 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 altruist philosophers are richer than some thoughtful philosopher, then something thoughtful is smarter than all altruists.
- 9. Megha's only brother is Al. Ed produces 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 joyful. So, there are exactly two things.
- 12. The brother of Cindy is joyful. So, Cindy has a brother.
- 13. Everything is joyful, except Megha and Bud. Al is not joyful. So, Al is either Megha or Bud.
- 14. Bud's father is an altruist, but Cindy's mother is not.
- 15. The only son of Cindy and Ed has no brother.
- 16. If Cindy is thoughtful, then her mother is a joyful Russian and her father is an altruist who produces 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. $(\forall x)(\exists y)(\neg Ax \lor By)$	$/(\forall x)Ax \supset (\exists y)By$
2.	1. $(\forall x)(\exists y)Axy \supset (\forall x)(\exists y)Bxy$ 2. $(\exists x)(\forall y) \sim Bxy$	/ (∃x)(∀y)~Axy
3.	1. $(\forall x)[(Ax \lor Bx) \supset (Dx \cdot Kx)]$ 2. $(\forall x)\{(Dx \lor Lx) \supset [(Dx \cdot Nx) \supset Px]\}$	$/(\forall x)[Ax \supset (Nx \supset Px)]$
4.	<ol> <li>~(∃x)(Axa · ~Bxb)</li> <li>. ~(∃x)(Dxd · Dbx)</li> <li>. (∀x)(Bex ⊃ Dxg)</li> </ol>	/ ~(Aea · Dgd)
5.	1. $(\forall x)(Ax \supset Bx)$	$/(\forall x)[(\exists y)(Ay \cdot Cxy) \supset (\exists z)(Bz \cdot Cxz)]$
6.	1. $(\exists x)(Nx \cdot Pjx \cdot Ix)$ 2. Nc $\cdot Pjc \cdot (\forall x)[(Nx \cdot Pjx) \supset x=c]$	/ Ic
7.	1. $(\exists x) \{ Mx \cdot Tx \cdot (\forall y) [(My \cdot y \neq x) \supset Dxy] \}$	$/(\exists x) \{ Mx \cdot Tx \cdot (\forall y) [(My \cdot \neg Ty) \supset Dxy] \}$
8.	1. $(\forall x)(\forall y)(\forall z)[(Sx \cdot Lx \cdot Sy \cdot Ly \cdot Sz \cdot Lz) \supset (z)]$ 2. $(\exists x)(\exists y)(Sx \cdot Lx \cdot Sy \cdot Ly \cdot Rx \cdot Ry \cdot x \neq y)$	$x=y \lor y=z \lor x=z)]$
	2. $(\exists x)(\exists y)(\exists x \land Lx \land Sy \land Ly \land Kx \land Ky \land x \neq y)$ 3. $(\forall x)(Rx \supset \sim Cx)$	$/(\mathbf{Sa} \cdot \mathbf{Ca}) \supset \sim \mathbf{La}$
9.	1. $(\forall x)(\forall y)f(x,y)=f(y,x)$ 2. $(\forall x)f(x,o)=o$	/ (∀x)f(o,x)=o
10.	1. $(\forall x)(\forall y)(Bxy \equiv Lyx)$ 2. $(\forall x)Bf(x)x$	$/(\forall x)Lxf(x)$
11.	1. $(\forall x)(\forall y)(\exists z)Sf(x)yz$ 2. $(\forall x)(\forall y)(\forall z)[Sxyz \supset \sim(Cxyz \lor Mzyx)]$	$(\exists x)(\exists y)(\exists z) \sim Mzg(y)f(g(x))$

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