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**First Midterm  
Philosophy 112  
Winter 2002**

Answer the following questions in the spaces below them.

1. (7 points each) Give the substitution instance using the constant 'a' for each of the following sentences of *PL*:

a.  $(\exists x)(\exists y)(G_{xy} \ \& \ (\forall z)(G_{zxy} \supset \ B_{yxa}))$

b.  $(\forall y)(\exists x)(\forall z)(X_{xz} \supset \ (G_x \equiv \ B_{yav}))$

2. (9 points) Show all the subformulas of the following *PL* sentence:

$(\exists x)[V_{cx} \ \& \ (\forall y)\sim((\forall z)X_{xz} \vee \ (\exists z)(R_{zc} \equiv \ C_{zxa}))]$

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3. (7 points each) Symbolize the following sentences in *PLI*, using the symbolization key provided.

UD: Everything

b: The Bush administration    g: The GAO    e: The Enron Corporation

Sxy: x is suing y    Axy: x advised y    Ixy: x influenced y

Nxy: x is in y    Px: x is a person

a. If anyone who advised the Bush administration influenced it, it was Enron.

b. Only those who were advised by Enron are being sued by the GAO.

c. Whoever in the Bush administration was advised by Enron was influenced by it.

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4. (7 points each) Symbolize the following sentences in *PLI*, using the symbolization key provided.

UD: Positive integers (1, 2, 3, . . .)

f: four    Gxy: x is greater than y

o: one    Lxy: x is less than y

a. The positive integer that is less than all others is one.

b. No positive integer is greater than every positive integer.

c. Exactly two positive integers are less than four and greater than one.

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5. (7 points each) Symbolize the following sentences in *PLI*, providing your own symbolization key.

Symbolization key

a. Small elephants eat more than large mice.

b. Elephants are afraid of mice, but not of themselves.

c. Every elephant is larger than some animal, but some animal is larger than every elephant.

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6. (7 points each) Give fluent readings of the following sentences of *PLI*, using the symbolization key provided.

UD: Everything

d: Grey Davis            Rx: x is a Republican    Dx: x is a Democrat  
r: Richard Riordan    Cx: x is conservative    Mx: x is a moderate  
Px: x is a person      Bxy: x can beat y

a.  $(\forall x)(\forall y)((Cx \ \& \ Dx) \ \& \ Bxy) \supset (My \ \& \ Ry)$

b.  $(\exists x)[(Px \ \& \ (Rx \ \& \ Bxd)) \ \& \ (\forall y)((Py \ \& \ (Ry \ \& \ Byd)) \supset \ x = y) \ \& \ x = r]$