First Midterm Solutions
Philosophy 112
Winter 2003

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. (∃x)(Rxa & (∃y)(Byx ∨ (∃z)Czxa))

Raa & (∃y)(Bya ∨ (∃z)Czaa)

b. (∀w)(∀y)(Vybc ⊃ (∃x)(Pyxw & Pwwa))

(∀y)(Vybc ⊃ (∃x)(Pyxa & Paaa))

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

∼(∀x)(∀y)((∃z)∼Pxz ≡ ∼(Ryc ⊃ Cxya))

∼(∀x)(∀y)((∃z)∼Pxz ≡ ∼(Ryc ⊃ Cxya))
(∀x)(∀y)((∃z)∼Pxz ≡ ∼(Ryc ⊃ Cxya))
(∀y)((∃z)∼Pxz ≡ ∼(Ryc ⊃ Cxya))
(∃z)∼Pxz ≡ ∼(Ryc ⊃ Cxya)
(∃z)∼Pxz
∼Pxz
Pxz
∼(Ryc ⊃ Cxya)
Ryc ⊃ Cxya
Ryc
Cxya

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

UD: Everything
  s: the U.N. Security Council   u: The United States   i: Iraq
  Mxy: x is a member of y   Cx: x is a country   b: Britain
  Vxyz: x would vote in y to invade z   Px: x is a person

a. If any country would vote in the U.N. Security Council to invade Iraq, the United States would.

$(\exists x)$Vxsi $\supset$ Vusi

b. Iraq is not a member of the U.N. Security Council, and so it would not vote in the Security Council to invade itself.

$\sim$Mis & $\sim$Visi

c. Although Britain and the United States would vote in the U.N. Security Council to invade Iraq, no other member of the Security Council would.

(Vbsi & Vusi) & $\sim(\exists x)(\sim(x = u \lor x = b)$ & Vxsi)

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

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

f: four   Pxyz: z is the product of x and y
o: one   Lxy: x is less than y
t: two

a. The positive integer that is less than two is less than four.

$(\exists x)((Lxt \ \& \ (\forall y)(Lyt \supset x = y)) \ \& \ Lxf)$

b. If the product of two positive integers is the same as one of them, then at least one of the two positive integers is the positive integer one.

$(\forall x)(\forall y)((Pxyx \lor Pxyy) \supset (x = o \lor y = o))$

c. At least three positive integers are less than four.

$(\exists x)(\exists y)(\exists z)(((Lxf \ \& \ Lyf) \ \& \ Lzf) \ \& \ ((\sim x = y \ \& \sim y = z) \ \& \sim x = z))$

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

Symbolization key

  UD: Persons
  Wx: x is a wild dreamer   Fx: x is eventually frustrated
  Dx: x dares to dream   Rx: x will be rewarded with great success
  Cx: x is a child   Hx: x wants to be Harry Potter's friend

a. A wild dreamer is eventually frustrated.

$(\forall x)(Wx \supset Fx)$

b. Only someone who dares to dream will be rewarded with great success.

$(\forall x)(Rx \supset Dx)$

c. Children want to be Harry Potter's friend, but they are eventually frustrated.

$(\forall x)(Cx \supset (Hx \,\&\, Fx))$

Note: Because Harry Potter does not exist, he is not in the UD and no constant can refer to him.

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

UD: Everything

d: Gray Davis	Rx: x is a Republican
Ix: x increases its fees	Pxy: x proposes to cut the budget of y
Px: x administers prisons	Ax: x is a state agency

a. (∀x)(Rx ⊃ (∀y)((Ay & ∼Iy) ⊃ Pxy))

Republicans propose to cut the budget of all agencies that do not increase their fees.

b.(∃x)[(Ax & ∼Pdx & (∀y)(Ay & ∼Pdy) ⊃ x = y)) & Px]

The state agency whose fees Gray Davis does not propose to cut administers prisons.