

### Phi 270 FO3 test 5

Analyze the following sentences in as much detail as possible, providing a key to the non-logical vocabulary (upper and lower case letters) appearing in your answer. Notice the additional instructions given for the first.

1. *Tom sent something to Sue*

[ answer ]

2. *Everyone heard a sound.* [This is ambiguous but you need only analyze one interpretation; just choose the one that seems most natural to you.]

[ answer ]

3. *There is someone who knows just one other person.*

[ answer ]

Analyze the sentence below using each of the two ways of analyzing the definite description the package. That is, analyze it using Russell's analysis of definite descriptions as quantifier phrases and then analyze it again using the description operator.

4. *The package rattled.*

[ answer ]

Use derivations to show that the following argument is valid. You may use any rules.

5. 
$$\frac{\exists x Fx \quad \forall x Gx}{\exists x (Fx \wedge Gx)}$$

[ answer ]

Use a derivation to show that the following argument is not valid and use either tables or a diagram to describe a structure dividing an open gap.

6. 
$$\frac{\exists x \forall y Rxy}{\exists x Rax}$$

[ answer ]

Complete the following to give a definition of equivalence in terms of truth values and possible worlds:

7. A sentence  $\phi$  is equivalent to a sentence  $\psi$  (i.e.,  $\phi \Leftrightarrow \psi$ ) if and only if ... Answer the following question and explain your answer in terms of the definitions of the basic concepts it involves.

[ answer ]

8. Suppose you are told that (i)  $\phi \Rightarrow \psi$  and (ii)  $\psi$  is inconsistent with  $\chi$  (i.e., the set formed of the two is inconsistent). What can you conclude about the relation between  $\phi$  and  $\chi$ ? That is, what patterns of truth values for the two are ruled out (if any are); and, if any are ruled out, what logical relation or relations holds as a result.

[ answer ]

Complete the following truth table by calculating the truth value of the sentence on each of the given assignments. In each row, write under each connective the value of the component of which it is the main connective and circle the truth value of the sentence as a whole.

9.	A	B	C	D	$(A \wedge \neg B) \vee \neg (C \rightarrow D)$
	T	T	T	T	
	F	F	T	F	
	[ answer ]				

### Phi 270 F03 test 5 answers

1. *Tom sent something to Sue*

$\exists x$  *Tom sent x to Sue*

$\exists x Ntxs$

[C:  $\lambda xyz$  (x sent y to z); s: *Sue*; t: *Tom*]

2. *Everyone heard a sound*

$(\exists x: x \text{ is a sound})$  *everyone heard x*

$(\exists x: x \text{ is a sound}) (\forall y: y \text{ is a person}) y \text{ heard } x$

$(\exists x: Sx) (\forall y: Py) Hyx$

[H:  $\lambda xy$  (x heard y); P:  $\lambda x$  (x is a person); S:  $\lambda x$  (x is a sound)]

3. *There is someone who knows just one other person*

$\exists x$  *x is a person who knows just one other person*

$\exists x (x \text{ is a person} \wedge x \text{ knows just one other person})$

$\exists x (Px \wedge (\exists y: Py \wedge \neg y = x) x \text{ knows } y \text{ and no other person besides } y)$

$\exists x (Px \wedge (\exists y: Py \wedge \neg y = x) (Kxy \wedge x \text{ knows no other person besides } y))$

$\exists x (Px \wedge (\exists y: Py \wedge \neg y = x) (Kxy \wedge (\forall z: Pz \wedge \neg z = x \wedge \neg z = y) \neg Kxz))$

or:

$\exists x (Px \wedge (\exists y: Py \wedge \neg y = x) (Kxy \wedge (\forall z: Pz \wedge \neg z = x \wedge Kxz) y = z))$

[K:  $\lambda xy$  (x knows y); P:  $\lambda x$  (x is a person)]

4. *using Russell's analysis:*

*The package rattled*

$(\exists x: x \text{ and only } x \text{ is a package}) x \text{ rattled}$

$(\exists x: x \text{ is a package} \wedge (\forall y: \neg y = x) \neg y \text{ is a package}) Rx$

$(\exists x: Px \wedge (\forall y: \neg y = x) \neg Py) Rx$

or:

$(\exists x: Px \wedge (\forall y: Py) x = y) Rx$

[P:  $\lambda x$  (x is a package); r:  $\lambda x$  (x rattled)]

*using the description operator:*

*The package rattled*

$R(\text{the package})$

$R(Ix x \text{ is a package})$

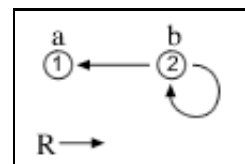
$R(Ix Px)$

5.

	$\exists x Fx$	1
	$\forall x Gx$	a: 2
	(a)	
	Fa	(3)
2 UI	Ga	(3)
3 Adj	$Fa \wedge Ga$	$X, (4)$
4 EG	$\exists x (Fx \wedge Gx)$	$X, (5)$
	•	
5 QED	$\exists x (Fx \wedge Gx)$	1
1 PCh	$\exists x (Fx \wedge Gx)$	

6.

	$\exists x \forall y Rxy$	1
	(b)	
	$\forall y Rby$	a:3, b:4
	(c)	
	$\forall x \neg Rax$	a:5, b:6
3 UI	Rba	
4 UI	Rbb	
5 UI	$\neg Raa$	
6 UI	$\neg Rab$	
	○	$Rba, Rbb, \neg Raa, \neg Rab \Rightarrow \perp$
	$\perp$	2
2 NcP	$\exists x Rax$	1
1 PCh	$\exists x Rax$	



7.  $\phi$  and  $\psi$  are equivalent if and only if there is no possible world in which they have different truth values (or: if and only, in every possible world, each has the same value as the other)
8.  $\phi$  and  $\chi$  are inconsistent. That is,  $\phi$  and  $\chi$  cannot be both true because  $\psi$  will be true when  $\phi$  is, and  $\psi$  and  $\chi$  cannot be both true. Other patterns of values for  $\phi$  and  $\chi$  are possible because they are not ruled out for  $\psi$  and  $\chi$  by the fact that they are inconsistent and, for all we know,  $\phi$  and  $\psi$  may be equivalent.

9.

A B C D	$(A \wedge \neg B) \vee \neg (C \rightarrow D)$			
T T T T	F F	Ⓕ F	T	
F F T F	F T	Ⓓ T	F	