

### Phi 270 F02 test 3

Analyze the sentences below in as much detail as possible *using connectives*; that is, you *should not* identify components that are individual terms (or predicates or functors). Present the result in *both symbolic and English notation*. Be sure that the unanalyzed components of your answer are complete and independent sentences; also try to respect any grouping in the English.

1. They'll be here soon unless they had car trouble

answer

2. If it snowed, then the schools were open only if the plows got out early.

answer

Use derivations to check whether each of the entailments below holds. You may use detachment and attachment rules. If an entailment fails, present a counterexample that divides an open gap.

3.  $A \rightarrow (\neg B \rightarrow C) \Rightarrow \neg C \rightarrow (A \rightarrow B)$

answer

4.  $A \rightarrow (\neg B \rightarrow C) \Rightarrow C \rightarrow (A \rightarrow B)$

answer

Analyze the sentence below in as much detail as possible. In this case you *should* identify components that are individual terms, predicates, or functors. Be sure that the unanalyzed components of your answer are independent (in particular, that none contains a pronoun whose antecedent is in another).

5. Al is Bob's father and Bob works for him

answer

Synthesize an English sentence with the following logical form:

6.  $Sa(mb) \rightarrow \neg S(ma)b$

S: [ \_ went to school with \_ ]; a: Al; b: Bob; m: [ \_'s mother ]

answer

Use a derivation to show that the entailment below holds. You may use detachment and attachment rules.

7.  $Fa \rightarrow C, Fb \Rightarrow a = b \rightarrow C$

answer

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### Phi 270 F02 test 3 answers

1. They'll be here soon unless they had car trouble  
They'll be here soon  $\leftarrow \neg$  they had car trouble

$S \leftarrow \neg T$  [or:  $\neg T \rightarrow S$ ]

if not T then S

S: they'll be here soon; T: they had car trouble

2. If it snowed, then the schools were open only if the plows got out early

it snowed  $\rightarrow$  the schools were open only if the plows got out early

it snowed  $\rightarrow (\neg \text{the schools were open} \leftarrow \neg \text{the plows got out early})$

$$S \rightarrow (\neg O \leftarrow \neg E) \text{ [or: } S \rightarrow (\neg E \rightarrow \neg O)\text{]}$$

if S then if not E then not O

E: the plows got out early; O: the schools were open; S: it snowed

3.

	$A \rightarrow (\neg B \rightarrow C)$	3
	$\neg C$	(4)
	$A$	(3)
3 MPP	$\neg B \rightarrow C$	4
4 MTT	$B$	(5)
	•	
5 QED	$B$	2
2 CP	$A \rightarrow B$	1
1 CP	$\neg C \rightarrow (A \rightarrow B)$	

4.

	$A \rightarrow (\neg B \rightarrow C)$	3
	$C$	
	$A$	(3)
3 MPP	$\neg B \rightarrow C$	5
	$\neg B$	(5)
5 MPP	$C$	
	o	$A, \neg B, C \not\Rightarrow \perp$
	$\perp$	4
4 IP	$B$	2
2 CP	$A \rightarrow B$	1
1 CP	$C \rightarrow (A \rightarrow B)$	

A B C	$A \rightarrow (\neg B \rightarrow C) / C \rightarrow (A \rightarrow B)$		
T F T	(T) T T	(F)	F

5. Al is Bob's father and Bob works for him

Al is Bob's father  $\wedge$  Bob works for Al

Al = Bob's father  $\wedge$  [ works for ] Bob Al

a = ['s father] Bob  $\wedge$  Wba

a = fb  $\wedge$  Wba

W: [ works for ]; a: Al; b: Bob; f: ['s father]

6. S Al (['s mother] Bob)  $\rightarrow \neg$  S (['s mother] Al) Bob

[ went to school with ] Al Bob's mother  $\rightarrow \neg$  [ went to school with ] Al's mother Bob

Al went to school with Bob's mother  $\rightarrow \neg$  Al's mother went to school with Bob

Al went to school with Bob's mother  $\rightarrow$  Al's mother didn't go to school with Bob

If Al went to school with Bob's mother, then Al's mother didn't go to school with Bob

7.

	Fa $\rightarrow$ C	3
	Fb	(4)
	a = b	a-b
	$\neg$ C	(3)
3 MTT	$\neg$ Fa	(4)
	•	
4 Nc=	$\perp$	2
2 IP	C	1
1 CP	a = b $\rightarrow$ C	