

Phi 270 F11 test 3

F11 test 3 topics

The following are the topics to be covered. The proportion of the test covering each will approximate the proportion of the classes so far that have been devoted to that topic. Your homework and the collection of old tests will provide specific examples of the kinds of questions I might ask.

- *Analysis*. Two sorts of questions are possible here corresponding to the sorts of analyses you have done in chs. 5 and 6: (i) analysis by truth-functional connectives only, with atomic sentences as the ultimate components (the focus would, of course, be on conditionals—i.e., on the symbolic representation of **if**, **only if**, and **unless**) and (ii) analysis using, in addition to truth-functional connectives, the ideas of predicates, individual terms, and functors.

In the case of the latter sort of analysis, you might be asked to preserve pronouns, representing them using abstracts and variables. (You will find questions of this sort only in the last 5 years or so of exams, but your homework on this topic and exercise 2 for 6.2 provide further examples.)

- *Synthesis*. Again this might take two forms, depending on whether the expressions abbreviated by letters were complete sentences or were terms, predicates, and functors—i.e., depending on whether the question is directed at ch. 5 or ch. 6.
- *Derivations*. Be able to construct derivations to show that entailments hold and to show that they fail. I may tell you in advance whether an entailment holds or leave it to you to check that using derivations. There will be some derivations where detachment and attachment rules may be used and where they will shorten the proof. But there may be others where you must rely on other rules, either because detachment and attachment rules do not apply or because I tell you not to use them. In particular, be ready to use the rule RC (Rejecting a Conditional) from ch. 5.

In the case of a derivation that includes forms involving predicates and functors, you won't be asked to present a counterexample if the derivation fails (though you will still need to be able to recognize that such a derivation has failed). In short, the test won't cover the new material introduced in 6.4.

F11 test 3 questions

Analyze the sentences below in as much detail as possible *using only connectives*; that is, the unanalyzed components should all be sentences (rather than individual terms, predicates, or functors). Present the result in *both symbolic and English notation*, rewriting if necessary to make all symbolic conditionals point from left to right. Be sure that the unanalyzed components of your answer are complete and independent sentences; also try to respect any grouping in the English.

1. **If the snow continues to accumulate, then there will be flooding if the thaw comes quickly.**
2. **The problem was handled by Al unless he was out, and he was out only if there was an emergency at another site.**

Use derivations to check whether each of the entailments below holds. You may use detachment and attachment rules. If an entailment fails, confirm a counterexample that lurks in an open gap. (Your truth-table for a counterexample should show the truth-value of each compound component of sentence under the main connective of that component, and it should indicate the final truth-value of each sentence.)

3. $A \rightarrow (B \rightarrow \neg D), C \rightarrow D \models A \rightarrow (B \rightarrow \neg C)$
4. $A \rightarrow B, C \rightarrow (D \wedge E) \models A \rightarrow D$

Analyze the sentence below in as much detail as possible, giving a key to your abbreviations of unanalyzed expressions. In this case you *should* identify components that are individual terms, predicates, or functors; however, you do *not* need to present the result in English notation (i.e., symbolic notation is enough). Your analysis should be in reduced form (i.e., you *should not* use abstracts and variables), so be sure that the unanalyzed components of your answer are independent—in particular, that none contains a pronoun whose antecedent is in another—and that they are completely specified. In particular, the expressions letters stand for should be complete sentences or individual terms except for blanks marking the places of predicates and functors (so, in particular, no letter should stand for a bare common nouns like **dog** since they are not complete individual terms).

5. **Al discovered his enemy, and it was his boss.**

Analyze the sentence below using abstracts and variables to represent pronominal cross reference (instead of replacing pronouns by their antecedents). That is, use expanded form to the extent necessary so that each individual term in your analysis appears only as often as it appears in the original sentence. In other respects, your analysis should be as described for 5.

6. **Dave hated the book, but he liked the movie that was made from it.**

Use a derivation to show that the entailment below holds. You may use detachment and attachment rules. Be sure to indicate the alias sets whenever an equation is added to the resources.

7. $fa = gc, fb = gd, Kc(fa) \models c = d \rightarrow (fa = fb \wedge Kd(gd))$

F11 test 3 answers

1. If the snow continues to accumulate, then there will be flooding if the thaw comes quickly
 the snow will continue to accumulate \rightarrow there will be flooding if the thaw comes quickly
 the snow will continue to accumulate \rightarrow (there will be flooding \leftarrow the thaw will come quickly)

$$S \rightarrow (F \leftarrow T)$$

$$S \rightarrow (T \rightarrow F)$$

if S then if T then F

F: there will be flooding; S: the snow will continue to accumulate; T: the thaw will come quickly

2. The problem was handled by AI unless he was out, and he was out only if there was an emergency at another site.
 the problem was handled by AI unless he was out \wedge AI was out only if there was an emergency at another site
 (the problem was handled by AI $\leftarrow \neg$ AI was out) \wedge (\neg AI was out $\leftarrow \neg$ there was an emergency at another site)

$$(H \leftarrow \neg O) \wedge (\neg O \leftarrow \neg E)$$

$$(\neg O \rightarrow H) \wedge (\neg E \rightarrow \neg O)$$

both if not O then H and if not E then not O

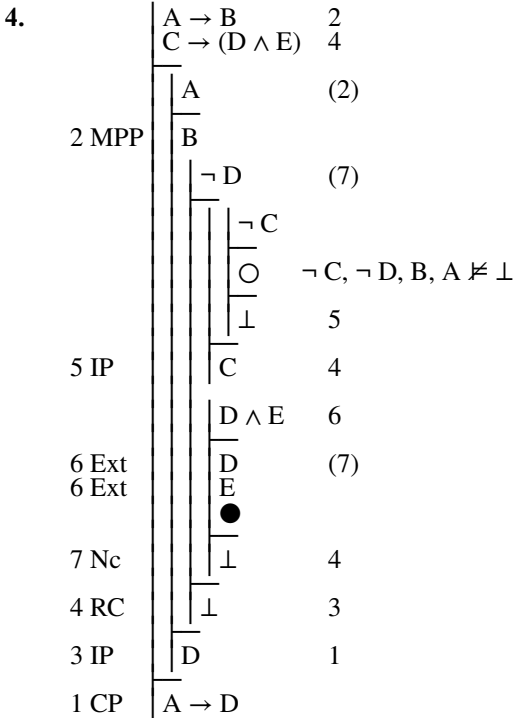
E: there was an emergency at another site; H: the problem was handled by AI; O: AI was out

| | | |
|-------|--|-----|
| | A \rightarrow (B \rightarrow \neg D) | 4 |
| | C \rightarrow D | 5 |
| | A | (4) |
| | B | (6) |
| | C | (5) |
| 4 MPP | B \rightarrow \neg D | 6 |
| 5 MPP | D | (7) |
| 6 MPP | \neg D | (7) |
| | ● | |
| 7 Nc | \perp | 3 |
| 3 RAA | \neg C | 2 |
| 2 CP | B \rightarrow \neg C | 1 |
| 1 CP | A \rightarrow (B \rightarrow \neg C) | |

OR

| | | |
|-------|--|-----|
| | A \rightarrow (B \rightarrow \neg D) | 2 |
| | C \rightarrow D | 5 |
| | A | (2) |
| 2 MPP | B \rightarrow \neg D | 4 |
| | B | (4) |
| 4 MPP | \neg D | (5) |
| 5 MTT | \neg C | (6) |
| | ● | |
| 6 QED | \neg C | 3 |
| 3 CP | B \rightarrow \neg C | 1 |
| 1 CP | A \rightarrow (B \rightarrow \neg C) | |

And there are many other possible derivations



| A | B | C | D | E | $A \rightarrow B, C \rightarrow (D \wedge E) / A \rightarrow D$ |
|---|---|---|---|---|---|
| T | T | F | F | T | ⊕ ⊕ F ⊕ |
| T | T | F | F | F | ⊕ ⊕ F ⊕ |

Either counterexample will do; both lurk in the open gap since E does not appear in its proximate argument.

5. **Al discovered his enemy, and it was his boss**
Al discovered his enemy ∧ Al's enemy was his boss
Al discovered his enemy ∧ Al's enemy was his boss
 [_ discovered _] Al Al's enemy ∧ Al's enemy = Al's boss
 D a ([_ 's enemy] Al) ∧ [_ 's enemy] Al = [_ 's boss] Al
 $Da(ea) \wedge ea = ba$
 D: [_ discovered _]; b: [_ 's boss]; e: [_ 's enemy]; a: Al

6. Dave hated the book, but he liked the movie that was made from it
 Dave and the book are such that (he hated it, but he liked the movie that was made from it)

$[x \text{ hated } y, \text{ but } x \text{ liked the movie that was made from } y]_{xy} \underline{\text{Dave the book}}$

$[x \text{ hated } y \wedge x \text{ liked the movie that was made from } y]_{xy} \underline{\text{Dave the book}}$

$[[_ \text{ hated } _] x y \wedge [_ \text{ liked } _] x ([\text{the movie that was made from } _] y)]_{xy} db$

$[Hxy \wedge Lx(my)]_{xy} db$

H: $[_ \text{ hated } _]$; L: $[_ \text{ liked } _]$; m: $[\text{the movie that was made from } _]$; b: the book; d: Dave

7.

| | | |
|--------|---|--------------------------|
| | fa = gc | |
| | fb = gd | fa-gc, a, c, fb-gd, b, d |
| | Kc(fa) | (4) |
| | c = d | fa-gc-fb-gd, a, c-d, b |
| 3 EC | <div style="border-left: 1px solid black; padding-left: 5px; margin-left: 5px;">●</div> | 2 |
| | fa = fb | |
| | <div style="border-left: 1px solid black; padding-left: 5px; margin-left: 5px;">●</div> | |
| 4 QED= | Kd(gd) | 2 |
| 2 Cnj | fa = fb \wedge Kd(gd) | 1 |
| 1 CP | c = d \rightarrow (fa = fb \wedge Kd(gd)) | |

Phi 270 F10 test 3

F10 test 3 topics

The following are the topics to be covered. The proportion of the test covering each will approximate the proportion of the classes so far that have been devoted to that topic. Your homework and the collection of old tests will provide specific examples of the kinds of questions I might ask.

- *Analysis*. Two sorts of questions are possible here corresponding to the sorts of analyses you have done in chs. 5 and 6: (i) analysis by truth-functional connectives only, with atomic sentences as the ultimate components (the focus would, of course, be on conditionals—i.e., on the symbolic representation of **if**, **only if**, and **unless**) and (ii) analysis using truth-functional connectives and the ideas of predicates, individual terms, and functors.

In the case of the latter sort of analysis, you might be asked to preserve pronouns, representing them using abstracts and variables. (You will not find questions of this sort in the exams before 2006, but your homework on this topic and exercise 2 for 6.2 provide further examples.)

- *Synthesis*. Again this might take two forms, depending on whether the expressions abbreviated by letters were complete sentences or were terms, predicates, and functors—i.e., depending on whether the question is directed at ch. 5 or ch. 6.
- *Derivations*. Be able to construct derivations to show that entailments hold and to show that they fail. I may tell you in advance whether an entailment holds or leave it to you to check that using derivations. There will be some derivations where detachment and attachment rules may be used and where they will shorten the proof. But there may be others where you must rely on other rules, either because detachment and attachment rules do not apply or because I tell you not to use them. In particular, be ready to use the rule RC (Rejecting a Conditional) from ch. 5.

In the case of a derivation that includes forms involving predicates and functors, you won't be asked to present a counterexample if the derivation fails (though you will still need to be able to recognize that such a derivation has failed). In short, the test won't cover the new material introduced in 6.4.

F10 test 3 questions

Analyze the sentences below in as much detail as possible *using only connectives*; that is, the unanalyzed components should all be sentences (rather than individual terms, predicates, or functors). Present the result in *both symbolic and English notation*, rewriting if necessary to make all symbolic conditionals point from left to right. 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 won't get home early if they go through the city during rush hour.
2. Unless it was raining, the picnic was postponed only if it was unusually cold.

Use derivations to check whether each of the entailments below holds. You may use detachment and attachment rules. If an entailment fails, confirm a counterexample that lurks in an open gap. (Your truth-table for a counterexample should show the truth-value of each compound component of sentence under the main connective of that component, and it should indicate the final truth-value of each sentence.)

3. $B \rightarrow (A \rightarrow C) \models (A \wedge B) \rightarrow C$
4. $A \rightarrow \neg C, C \rightarrow B \models \neg B \rightarrow A$

Analyze the sentence below in as much detail as possible, giving a key to your abbreviations of unanalyzed expressions. In this case you *should* identify components that are individual terms, predicates, or functors; however, you do *not* need to present the result in English notation (i.e., symbolic notation is enough). Your analysis should be in reduced form (i.e., you *should not* use abstracts and variables), so be sure that the unanalyzed components of your answer are independent—in particular, that none contains a pronoun whose antecedent is in another. (Also be sure also that the individual terms you identify really are individual terms and are not quantifier phrases or general terms like simple common nouns.)

5. **If Al went through Phoenix, he stayed with Barb's family.**

Analyze the sentence below using abstracts and variables to represent pronominal cross reference (instead of replacing pronouns by their antecedents). That is, use expanded form to the extent necessary so that each individual term in your analysis appears only as often as it appears in the original sentence. In other respects, your analysis should be as described for 5.

6. **Ann spoke to Bill, and he introduced himself to Carol.**

Use a derivation to show that the entailment below holds. You may use detachment and attachment rules. Be sure to indicate the alias sets whenever an equation is added to the resources.

7. $Ga \rightarrow a = c, Rb(fa) \models b = c \rightarrow (Ga \rightarrow Ra(fb))$

F10 test 3 answers

1. **they won't get home early if they go through the city during rush hour**
they won't get home early ← **they will go through the city during rush hour**
¬ they will get home early ← **they will go through the city during rush hour**

$$\neg E \leftarrow R$$

$$R \rightarrow \neg E$$

if R then not E

E: they will get home early; R: they will go through the city during rush hour

2. unless it was raining, the picnic was postponed only if it was unusually cold
 \neg it was raining \rightarrow the picnic was postponed only if it was unusually cold
 \neg it was raining \rightarrow (\neg the picnic was postponed \leftarrow \neg it was unusually cold)

$$\neg R \rightarrow (\neg P \leftarrow \neg C)$$

$$\neg R \rightarrow (\neg C \rightarrow \neg P)$$

if not R then if not C then not P

C: it was unusually cold; P: the picnic was postponed; R: it was raining

3.

| | | |
|-------|-----------------------------------|-----|
| | $B \rightarrow (A \rightarrow C)$ | 3 |
| | $A \wedge B$ | 2 |
| 2 Ext | A | (4) |
| 2 Ext | B | (3) |
| 3 MPP | $A \rightarrow C$ | 4 |
| 4 MPP | C | (5) |
| | ● | |
| 5 QED | C | 1 |
| 1 CP | $(A \wedge B) \rightarrow C$ | |

4.

| | | |
|-------|--|-----|
| | $A \rightarrow \neg C$ | 4 |
| | $C \rightarrow B$ | 2 |
| 2 MTT | $\neg B$ | (2) |
| | $\neg C$ | |
| | $\neg A$ | |
| | $\neg A$ | |
| | \perp | 5 |
| 5 IP | A | 4 |
| | $\neg C$ | |
| | \perp | 4 |
| 4 RC | \perp | 3 |
| 3 IP | A | 1 |
| 1 CP | $\neg B \rightarrow A$ | |
| | $A \ B \ C \mid A \rightarrow \neg C, C \rightarrow B / \neg B \rightarrow A$ | |
| | $F \ F \ F \mid \textcircled{\oplus} \ T \ \textcircled{\ominus} \ T \ \textcircled{\omin�}$ | |

5. if Al went through Phoenix, he stayed with Barb's family
Al went through Phoenix → Al stayed with Barb's family
 [_ went through _] Al Phoenix → [_ stayed with _] Al (Barb's family)

Wap → Sa([_'s family] Barb)

Wap → Sa(fb)

S: [_ stayed with _]; W: [_ went through _ to _]; a: Al; b: Barb; p: Phoenix; f: [_'s family]

6. Ann spoke to Bill, and he introduced himself to Carol
 Bill is such that (Ann spoke to him, and he introduced himself to Carol)

[Ann spoke to x, and x introduced x to Carol]_x Bill

[Ann spoke to x ∧ x introduced x to Carol]_xb

[[_ spoke to _] Ann x ∧ [_ introduced _ to _] x x Carol]_xb

[Sax ∧ Ixxc]_xb

I: [_ introduced _ to _]; S: [_ spoke to _]; a: Ann; b: Bill; c: Carol

| | | |
|--------|--|----------------|
| 7. | $Ga \rightarrow a = c$ $Rb(fa)$ | 3 (4) |
| | $b = c$ | a, b-c, fa, fb |
| | Ga | (3) |
| 3 MPP | $a = c$ | a-b-c, fa-fb |
| | $Ra(fb)$ | 2 |
| 4 QED= | $Ga \rightarrow Ra(fb)$ | 1 |
| 2 CP | $b = c \rightarrow (Ga \rightarrow Ra(fb))$ | |
| 1 CP | | |

Phi 270 F09 test 3

F09 test 3 topics

The following are the topics to be covered. The proportion of the test covering each will approximate the proportion of the classes so far that have been devoted to that topic. Your homework and the collection of old tests will provide specific examples of the kinds of questions I might ask.

- *Analysis*. Two sorts of questions are possible here corresponding to the sorts of analyses you have done in chs. 5 and 6: (i) analysis by truth-functional connectives only, with atomic sentences as the ultimate components (the focus would, of course, be on conditionals—i.e., on the symbolic representation of **if**, **only if**, and **unless**) and (ii) analysis using truth-functional connectives and the ideas of predicates, individual terms, and functors.

In the case of the latter sort of analysis, you might be asked to preserve pronouns, representing them using abstracts and variables. (You will not find questions of this sort in the exams before 2006, but your homework on this topic and exercise 2 for 6.2 provide further examples.)

- *Synthesis*. Again this might take two forms, depending on whether the expressions abbreviated by letters were complete sentences or were terms, predicates, and functors—i.e., depending on whether the question is directed at ch. 5 or ch. 6.
- *Derivations*. Be able to construct derivations to show that entailments hold and to show that they fail. I may tell you in advance whether an entailment holds or leave it to you to check that using derivations. There will be some derivations where detachment and attachment rules may be used and where they will shorten the proof. But there may be others where you must rely on other rules, either because detachment and attachment rules do not apply or because I tell you not to use them. In particular be ready to use the rule RC (Rejecting a Conditional) from ch. 5.

In the case of a derivation that includes forms involving predicates and functors, you won't be asked to present a counterexample if the derivation fails (though you will still need to be able to recognize that such a derivation has failed). In short, the test won't cover the new material introduced in 6.4.

F09 test 3 questions

Analyze the sentences below in as much detail as possible *using only connectives*; that is, the unanalyzed components should all be sentences (rather than individual terms, 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. **If the package was sent, then it was lost.**
2. **All finished the project only if he had help; but he started it unless there was a rush order.**

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

3. $A \rightarrow C, B \rightarrow \neg C \vDash A \rightarrow \neg B$

4. $B \rightarrow (A \rightarrow C) \vDash (B \wedge C) \rightarrow D$

Analyze the sentence below in as much detail as possible, giving a key to your abbreviations of unanalyzed expressions. In this case you *should* identify components that are individual terms, predicates, or functors; however, you do *not* need to present the result in English notation (i.e., symbolic notation is enough). Your analysis should be in reduced form (i.e., you *should not* use abstracts and variables), so be sure that the unanalyzed components of your answer are independent—in particular, that none contains a pronoun whose antecedent is in another. (Also be sure also that the individual terms you identify really are individual terms and are not quantifier phrases or general terms, like simple common nouns.)

5. **Al sold his car to the first caller, and he bought Dave's truck.**

Analyze the sentence below using abstracts and variables to represent pronominal cross reference (instead of replacing pronouns by their antecedents). That is, use expanded form to the extent necessary so that each individual term in your analysis appears only as often as it appears in the original sentence. In other respects, your analysis should be as described for 5.

6. **If Bill went to Chicago, then Ann didn't reach him.**

Use a derivation to show that the entailment below holds. You may use detachment and attachment rules. Be sure to indicate the alias sets whenever an equation is added to the resources.

7. $a = fb, fc = d \vDash (b = c \wedge \neg Fc) \rightarrow (a = d \wedge \neg Fb)$

F09 test 3 answers

1. **If the package was sent, then it was lost.**

the package was sent \rightarrow the package was lost

S \rightarrow L

if S then L

L: the package was lost; S: the package was sent

2. AI finished the project only if he had help; but he started it unless there was a rush order

AI finished the project only if he had help

\wedge AI started the project unless there was a rush order

$(\neg$ AI finished the project $\leftarrow \neg$ AI had help)

\wedge (AI started the project $\leftarrow \neg$ there was a rush order)

$(\neg F \leftarrow \neg H) \wedge (S \leftarrow \neg R)$

$(\neg H \rightarrow \neg F) \wedge (\neg R \rightarrow S)$

both if not H then not F and if not R then S

F: AI finished the project; H: AI had help; R: there was a rush order; S: AI started the project

- 3.

| | | |
|-------|------------------------|-----|
| | $A \rightarrow C$ | 2 |
| | $B \rightarrow \neg C$ | 3 |
| | A | (2) |
| 2 MPP | C | (3) |
| 3 MTT | $\neg B$ | (4) |
| | ● | |
| 4 QED | $\neg B$ | 1 |
| 1 CP | $A \rightarrow \neg B$ | |

- 4.

| | | |
|-------|-----------------------------------|-----------------------------------|
| | $B \rightarrow (A \rightarrow C)$ | 3 |
| | $B \wedge C$ | 2 |
| 2 Ext | B | (3) |
| 2 Ext | C | |
| 3 MPP | $A \rightarrow C$ | 5 |
| | $\neg D$ | |
| | $\neg A$ | |
| | \perp | $\neg A, \neg D, B, C \neq \perp$ |
| 6 IP | A | 6 |
| | C | |
| | \perp | $C, \neg D, B \neq \perp$ |
| 5 RC | \perp | 5 |
| 4 IP | D | 4 |
| 1 CP | $(B \wedge C) \rightarrow D$ | 1 |

| A | B | C | D | $B \rightarrow (A \rightarrow C)$ | / | $(B \wedge C) \rightarrow D$ |
|---|---|---|---|-----------------------------------|---|------------------------------|
| F | T | T | F | ⊕ | T | T |
| T | T | T | F | ⊕ | T | ⊕ |

The first interpretation lurks in the first gap and the second in both. It is enough to reach one of the two dead ends and to confirm one counterexample that lurks in that

gap.

5. **Al sold his car to the first caller, and he bought Dave's truck**
Al sold his car to the first caller \wedge Al bought Dave's truck
 [_ sold _ to _] Al Al's car the first caller \wedge [_ bought _] Al Dave's truck

S a (Al's car) f \wedge B a (Dave's truck)

S a ([_ 's car] Al) f \wedge B a ([_ 's truck] Dave)

Sa(ca)f \wedge Ba(td)

B: [_ bought _]; S: [_ sold _ to _]; c: [_ 's car]; t: [_ 's truck]; a: Al;
 d: Dave

6. **If Bill went to Chicago, then Ann didn't reach him**
Bill is such that (if he went to Chicago, then Ann didn't reach him)
 [if x went to Chicago, then Ann didn't reach x]_x Bill

[x went to Chicago \rightarrow Ann didn't reach x]_x b

[x went to Chicago \rightarrow \neg Ann reached x]_x b

[[_ went to _] x Chicago \rightarrow \neg [_ reached _] Ann x]_x b

[Wxc \rightarrow \neg Rax]_x b

R: [_ reached _]; W: [_ went to _]; a: Ann; b: Bill; c: Chicago

| | | |
|-------|---|------------------|
| 7. | $a = fb$ $fc = d$ | a-fb, b, fc-d, c |
| | $b = c \wedge \neg Fc$ | 2 |
| 2 Ext | $b = c$ | a-fb-fc-d, b-c |
| 2 Ext | $\neg Fc$ | (6) |
| | <div style="text-align: center;">●</div> | |
| 4 EC | $a = d$ | 3 |
| | Fb | (6) |
| | <div style="text-align: center;">●</div> | |
| 6 Nc= | \perp | |
| 5 RAA | $\neg Fb$ | 3 |
| 3 Cnj | $a = d \wedge \neg Fb$ | 1 |
| 1 CP | $(b = c \wedge \neg Fc) \rightarrow (a = d \wedge \neg Fb)$ | |

It is also possible to close the second gap at stage 5 using QED=.

Phi 270 F08 test 3

F08 test 3 topics

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In the case of the latter sort of analysis, you might be asked to preserve pronouns, representing them using abstracts and variables. (You will not find questions of this sort in the exams before 2006, but your homework on this topic and exercise 2 for 6.2 provide further examples.)

- *Synthesis*. Again this might take two forms, depending on whether the expressions abbreviated by letters were complete sentences or were terms, predicates, and functors—i.e., depending on whether the question is directed at ch. 5 or ch. 6.
- *Derivations*. Be able to construct derivations to show that entailments hold and to show that they fail. I may tell you in advance whether an entailment holds or leave it to you to check that using derivations. There will be some derivations where detachment and attachment rules may be used and where they will shorten the proof. But there will be others where you must rely on other rules, either because detachment and attachment rules do not apply or because I tell you not to use them. In particular be ready to use the rule RC (Rejecting a Conditional) from ch. 5.

In the case of a derivation that includes forms involving predicates and functors, you won't be asked to present a counterexample if the derivation fails (though you will still need to be able to recognize that such a derivation has failed). In short, the test won't cover the new material introduced in 6.4.

F08 test 3 questions

Analyze the sentences below in as much detail as possible *using only connectives*; that is, the unanalyzed components should all be sentences (rather than individual terms, 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. **If John was invited, then he attended if he was free.**
2. **Unless we find the key, we'll get in only if we break the lock.**

Use derivations to check whether each of the entailments below holds. You

may use detachment and attachment rules. If an entailment fails, confirm a counterexample that lurks in an open gap.

3. $B \rightarrow C \models (A \wedge B) \rightarrow C$

4. $\neg (C \rightarrow D) \rightarrow (A \rightarrow B) \models A \rightarrow D$

Analyze the sentence below in as much detail as possible, giving a key to your abbreviations of unanalyzed expressions. In this case you *should* identify components that are individual terms, predicates, or functors; however, you do *not* need to present the result in English notation (i.e., symbolic notation is enough). Your analysis should be in reduced form (i.e., you *should not* use abstracts and variables), so be sure that the unanalyzed components of your answer are independent—in particular, that none contains a pronoun whose antecedent is in another. (Also be sure also that the individual terms you identify really are individual terms and are not quantifier phrases or general terms, like simple common nouns.)

5. **Sam wrote to Linda, and she sent his book to him.**

Analyze the sentence below using abstracts and variables to represent pronominal cross reference (instead of replacing pronouns by their antecedents). That is, use expanded form to the extent necessary so that each individual term in your analysis appears only as often as it appears in the original sentence. In other respects, your analysis should be as described for 5.

6. **The rock hit the road, but it didn't hit Oscar.**

Use a derivation to show that the entailment below holds. You may use detachment and attachment rules. Be sure to indicate the alias sets whenever an equation is added to the resources.

7. $Ra(fb), fa = gb \models a = b \rightarrow (Rb(ga) \wedge fb = gb)$

F08 test 3 answers

1. **If John was invited, then he attended if he was free**

John was invited \rightarrow John attended if he was free

John was invited \rightarrow (John attended \leftarrow John was free)

$$I \rightarrow (A \leftarrow F)$$

$$I \rightarrow (F \rightarrow A)$$

if I then if F then A

A: John attended; F: John was free; I: John was invited

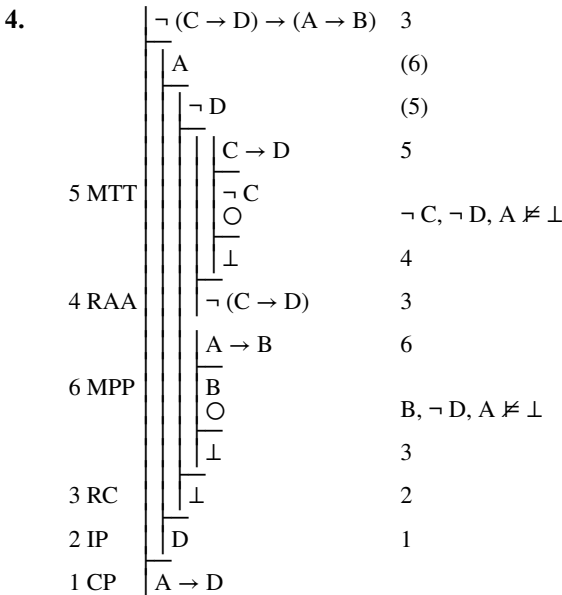
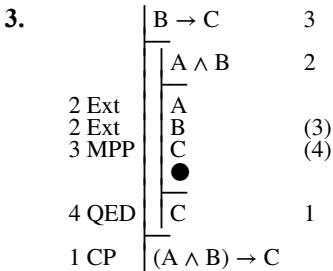
2. Unless we find the key, we'll get in only if we break the lock
 - we will find the key → we'll get in only if we break the lock
 - we will find the key → (¬ we'll get in ← ¬ we'll break the lock)

$$\neg F \rightarrow (\neg G \leftarrow \neg B)$$

$$\neg F \rightarrow (\neg B \rightarrow \neg G)$$

if not F then if not B then not G

B: we'll break the lock; F: we will find the key; G: we'll get in



| A | B | C | D | ¬ (C → D) | → | (A → B) | / | A → D |
|---|---|---|---|-----------|---|---------|---|-------|
| T | F | F | F | F | T | ⊕ | F | ⊕ |
| T | T | F | F | F | T | ⊕ | T | ⊕ |
| T | T | T | F | T | F | ⊕ | T | ⊕ |

The first interpretation lurks in the first gap and the last lurks in the second gap; middle interpretation lurks in both. It is enough to reach one of the two dead ends and to confirm one of the two counterexamples that lurk in that gap.

5. Sam wrote to Linda, and she sent his book to him
 Sam wrote to Linda \wedge Linda sent Sam's book to him
Sam wrote to Linda \wedge Linda sent Sam's book to Sam
 $[_ \text{ wrote to } _] \underline{\text{Sam Linda}} \wedge [_ \text{ sent } _ \text{ to } _] \underline{\text{Linda Sam's book Sam}}$
 $Wsl \wedge Sl([_ \text{'s book}] \underline{\text{Sam}})s$

$$Wsl \wedge Sl(bs)s$$

S: [$_ \text{ sent } _ \text{ to } _$]; W: [$_ \text{ wrote to } _$]; b: [$_ \text{'s book}$]; l: Linda; s: Sam

6. The rock hit the road, but it didn't hit Oscar
 The rock is such that (it hit the road, but it didn't hit Oscar)
 $[x \text{ hit the road, but } x \text{ didn't hit Oscar}]_x \text{ the rock}$
 $[x \text{ hit the road} \wedge x \text{ didn't hit Oscar}]_x \text{ the rock}$
 $[x \text{ hit the road} \wedge \neg x \text{ hit Oscar}]_x \text{ the rock}$

$$[Hxr \wedge \neg Hxo]_x k$$

H: [$_ \text{ hit } _$]; k: the rock; o: Oscar; r: the road

| | | |
|--------|--|--------------------|
| 7. | $Ra(fb)$ $fa = gb$ | (3) |
| | $a = b$ | $a-b, fb-fa-gb-ga$ |
| 3 QED= | <div style="border-left: 1px solid black; padding-left: 5px;"> \bullet $Rb(ga)$ </div> | 2 |
| 4 EC | <div style="border-left: 1px solid black; padding-left: 5px;"> \bullet $fb = gb$ </div> | 2 |
| 2 Cnj | $Rb(ga) \wedge fb = gb$ | 1 |
| 1 CP | $a = b \rightarrow (Rb(ga) \wedge fb = gb)$ | |

Phi 270 F06 test 3

F06 test 3 topics

The following are the topics to be covered. The proportion of the test covering each will approximate the proportion of the classes so far that have been devoted to that topic. Your homework and the collection of old tests will provide specific examples of the kinds of questions I might ask.

- *Analysis*. Two sorts of questions are possible here corresponding to the sorts of analyses you have done in chs. 5 and 6: (i) analysis by truth-functional connectives only, with atomic sentences as the ultimate components (the focus would, of course, be on conditionals—i.e., on the symbolic representation of if, only if, and unless) and (ii) analysis using truth-functional connectives and the ideas of predicates, individual terms, and functors.

In the case of the latter sort of analysis, you might be asked to represent pronouns using abstracts and variables. (You will not find questions of this sort in the old exams, but your homework on this topic and exercise 2 for 6.2 provide examples.)

- *Synthesis*. Again this might take two forms, depending on whether the expressions abbreviated by letters were complete sentences or were terms, predicates, and functors.
- *Derivations*. Be able to construct derivations to show that entailments hold and to show that they fail. I may tell you in advance whether an entailment holds or leave it to you to check that using derivations. There will be some derivations where detachment and attachment rules may be used and where they will shorten the proof. But there will be others where you must rely on other rules, either because detachment and attachment rules do not apply or because I tell you not to use them. In particular be ready to use the rule RC (Rejecting a Conditional) from ch. 5.

Remember that, if a derivation includes forms involving predicates and functors, presenting a counterexample will require the description of a structure and not merely an assignment of truth values. You will be allowed to use either tables or diagrams to describe structures.

F06 test 3 questions

Analyze the sentences below in as much detail as possible *using only connectives*; that is, the unanalyzed components should all be sentences (rather than individual terms, 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. **There was an audience if there was food.**
2. **Sam went unless he had to work, but he enjoyed the ride only if the weather was good.**

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

3. $C \rightarrow (B \rightarrow A), C \rightarrow B \models C \rightarrow A$
 4. $A \rightarrow B, C \rightarrow D \models C \rightarrow (E \rightarrow \neg B)$

Analyze the sentence below in as much detail as possible, giving a key to your abbreviations of unanalyzed expressions. In this case you *should* identify components that are individual terms, predicates, or functors; however, you do *not* need to present the result in English notation (i.e., symbolic notation is enough). Your analysis should be in reduced form (i.e., you *should not* use abstracts and variables), so be sure that the unanalyzed components of your answer are independent—in particular, that none contains a pronoun whose antecedent is in another. (Also be sure also that the individual terms you identify really are individual terms and are not quantifier phrases or general terms, like simple common nouns.)

5. **Nancy phoned Oliver and told him about his promotion.**

Analyze the following sentence using abstracts and variables to represent pronominal cross reference (instead of replacing pronouns by their antecedents). That is, each individual term in your analysis should appear only as often as it appears in the original sentence. In other respects, your analysis should be as described for 5.

6. **Spot finished chewing his bone, and he buried it in a flowerbed.**

Use a derivation to show that the entailment below holds. You may use detachment and attachment rules. Be sure to indicate the alias sets whenever an equation is added to the resources.

7. $Ra(fb) \wedge \neg Rc(fd), fb = fc \models \neg (a = c \wedge b = d)$

F06 test 3 answers

1. **There was an audience if there was food**
there was an audience \leftarrow there was food

$$\begin{array}{l} A \leftarrow F \\ F \rightarrow A \\ \text{if } F \text{ then } A \end{array}$$

A: **there was an audience**; F: **there was food**

2. **Sam went unless he had to work, but he enjoyed the ride only if the weather was good**

Sam went unless he had to work \wedge Sam enjoyed the ride only if the weather was good

(Sam went \leftarrow \neg Sam had to work) \wedge (\neg Sam enjoyed the ride \leftarrow \neg the weather was good)

$$(N \leftarrow \neg R) \wedge (\neg E \leftarrow \neg G)$$

$$(\neg R \rightarrow N) \wedge (\neg G \leftarrow \neg E)$$

both if not R then N and if not G then not E

E: Sam enjoyed the ride; G: the weather was good; N: Sam went; R: Sam had to work

3.

| | | |
|-------|-----------------------------------|----------|
| | $C \rightarrow (B \rightarrow A)$ | 2 |
| | $C \rightarrow B$ | 3 |
| | C | (2), (3) |
| 2 MPP | $B \rightarrow A$ | 4 |
| 3 MPP | B | (4) |
| 4 MPP | A | (5) |
| | ● | |
| 5 QED | A | 1 |
| 1 CP | $C \rightarrow A$ | |

4.

| | | |
|-------|--|---------------------------------|
| | $A \rightarrow B$ | 5 |
| | $C \rightarrow D$ | 2 |
| | C | (2) |
| 2 MPP | D | |
| | E | |
| | B | |
| | $\neg A$ | |
| | ○ | $\neg A, B, C, D, E \neq \perp$ |
| | \perp | 6 |
| 6 IP | A | 5 |
| | B | |
| | ○ | $B, C, D, E \neq \perp$ |
| | \perp | 5 |
| 5 RC | \perp | 4 |
| 4 RAA | $\neg B$ | 3 |
| 3 CP | $E \rightarrow \neg B$ | 1 |
| 1 CP | $C \rightarrow (E \rightarrow \neg B)$ | |

| A | B | C | D | E | $A \rightarrow B$ | $C \rightarrow D$ | $C \rightarrow (E \rightarrow \neg B)$ |
|---|---|---|---|---|-------------------|-------------------|--|
| T | T | T | T | T | Ⓣ | Ⓣ | Ⓣ F |
| F | T | T | T | T | Ⓣ | Ⓣ | Ⓣ F |

The first interpretation lurks in the second gap while the second lurks in both

5. Nancy phoned Oliver and told him about his promotion
 Nancy phoned Oliver \wedge Nancy told Oliver about his promotion
Nancy phoned Oliver \wedge Nancy told Oliver about his promotion
 [_ phoned _] Nancy Oliver \wedge [_ told _ about _] Nancy Oliver
Oliver's promotion

Pno \wedge Tno([_ 's promotion] Oliver)

Pno \wedge Tno(po)

P: [_ phoned _]; T: [_ told _ about _]; n: Nancy; o: Oliver; p: [_ 's promotion]

6. Spot finished chewing his bone, and he buried it in a flowerbed
 Spot is such that (he finished chewing his bone, and he buried it in a flowerbed)

[x finished chewing x's bone, and x buried it in a flowerbed]_x Spot
 [x's bone is such that (x finished chewing it, and x buried it in a flowerbed)]_xs

[[x finished chewing y, and x buried y in a flowerbed]_y x's bone]_xs

[[x finished chewing y \wedge x buried y in a flowerbed]_y ([_ 's bone] x)]_xs

[[Cxy \wedge Bxy]_y(bx)]_xs

or: [[Cxy \wedge Bxy]_{xy}z(bz)]_zs

B: [_ buried _ in a flowerbed]; C: [_ finished chewing _]; b: [_ 's bone]; s: Spot

(Note: a flowerbed is not an individual term so it must remain unanalyzed as part of a predicate)

- 7.
- | | | |
|-------------------------------|-------------------------------|----------------------|
| Ra(fb) \wedge \neg Rc(fd) | 1 | |
| fb = fc | a, b, c, d, fb—fc, fd | |
| 1 Ext | Ra(fb) | (4) |
| 1 Ext | \neg Rc(fd) | (4) |
| | a = c \wedge b = d | 3 |
| 3 Ext | a = c | a—c, b, d, fb—fc, fd |
| 3 Ext | b = d | a—c, b—d, fc—fb—fd |
| | ● | |
| 4 Nc= | ⊥ | 2 |
| 2 RAA | \neg (a = c \wedge b = d) | |

Phi 270 F05 test 3

F05 test 3 topics

The following are the topics to be covered. The proportion of the test covering each will approximate the proportion of the classes so far that have been devoted to that topic. Your homework and the collection of old tests will provide specific examples of the kinds of questions I might ask.

- *Analysis*. Two sorts of questions are possible here corresponding to the sorts of analyses you have done in chs. 5 and 6: (i) analysis by truth-functional connectives alone, with atomic sentences as the ultimate components (the emphasis will, of course, be on conditionals—i.e., on the symbolic representation of **if**, **only if**, and **unless**) and (ii) analysis using not only truth-functional connectives but also predicates, individual terms, and functors.
- *Derivations*. Be able to construct derivations to show that entailments hold and to show that they fail. I may tell you in advance whether an entailment holds or leave it to you to check that using derivations. There may be some derivations where detachment and attachment rules may be used and where they will shorten the proof. But there will be others where you must rely on other rules, either because detachment and attachment rules do not apply or because I tell you not to use them. In particular, be ready to use the rule RC (Rejecting a Conditional) from ch. 5.

Remember that, if a derivation involves predicates and functors, presenting a counterexample will require the description of a structure and not merely an assignment of truth values. You will be allowed to use either tables or diagrams to describe structures.

F05 test 3 questions

Analyze the sentences below in as much detail as possible *using only connectives*; that is, the unanalyzed components should all be sentences (rather than individual terms, 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. **If the part was fixed, it broke again.**
2. **Unless Tom was early, he got in only if he paid extra.**

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

3. $A \rightarrow (B \rightarrow C), C \rightarrow D \models B \rightarrow (A \rightarrow D)$
4. $(C \wedge A) \rightarrow B \models (A \wedge B) \rightarrow C$

Analyze the sentence below in as much detail as possible, giving a key to your abbreviations of unanalyzed expressions. In this case you *should* identify components that are individual terms, predicates, or functors; however, you do not

need to present the result in English notation (i.e., symbolic notation is enough). (Be sure that the unanalyzed components of your answer are independent—in particular, that none contains a pronoun whose antecedent is in another—and be sure also that the individual terms you identify really are individual terms rather than general terms or quantifier phrases.)

5. **Either Fred is the manager or he owns the business.**
6. **Sam received a recall notice from the manufacturer of his car.**

Use a derivation to show that the entailment below holds. You may use detachment and attachment rules. (Be sure to indicate the alias sets whenever an equation is added to the resources.)

7. $Rb(fa), fb = gc, c = fb, d = gc \models c = d \wedge (a = b \rightarrow Ra(gd))$

F05 test 3 answers

1. **If the part was fixed, it broke again**
the part was fixed \rightarrow the part broke again

$$F \rightarrow B$$

if F then B

B: the part broke again; F: the part was fixed

2. **Unless Tom was early, he got in only if he paid extra**
 \neg Tom was early \rightarrow Tom got in only if he paid extra
 \neg Tom was early $\rightarrow (\neg$ Tom got in $\leftarrow \neg$ Tom paid extra)

$$\neg T \rightarrow (\neg G \leftarrow \neg P)$$

$$\neg T \rightarrow (\neg P \rightarrow \neg G)$$

if not T then if not P then not G

G: Tom got in; P: Tom paid extra; T: Tom was early

| | | |
|-------|-------------------------------------|-----|
| 3. | A \rightarrow (B \rightarrow C) | 3 |
| | C \rightarrow D | 5 |
| | B | (4) |
| | A | (3) |
| 3 MPP | B \rightarrow C | 4 |
| 4 MPP | C | (5) |
| 5 MPP | D | (6) |
| | ● | |
| 6 QED | D | 2 |
| 2 CP | A \rightarrow D | 1 |
| 1 CP | B \rightarrow (A \rightarrow D) | |

| | | | |
|----|-------|------------------------------|---|
| 4. | | $(C \wedge A) \rightarrow B$ | 4 |
| | | $A \wedge B$ | 2 |
| | 2 Ext | A | (7) |
| | 2 Ext | B | |
| | | $\neg C$ | |
| | | $\neg C$ | |
| | | \perp | 6 |
| | 6 IP | C | 5 |
| | | \bullet | |
| | 7 QED | A | 5 |
| | 5 Cnj | $C \wedge A$ | 4 |
| | | B | |
| | | \perp | 4 |
| | 4 RC | \perp | 3 |
| | 3 IP | C | 1 |
| | 1 CP | $(A \wedge B) \rightarrow C$ | |
| | | $A \ B \ C$ | $(C \wedge A) \rightarrow B$ / $(A \wedge B) \rightarrow C$ |
| | | $T \ T \ F$ | $F \quad \textcircled{\oplus} \quad T \quad \textcircled{\oplus}$ |

5. **Either Fred is the manager or he owns the business**
Fred is the manager \vee Fred owns the business
Fred = the manager \vee [_ owns _] Fred the business

$$f = m \vee Ofb$$

O: [_ owns _]; b: the business; f: Fred; m: the manager

6. Sam received a recall notice from the manufacturer of his car
 Sam received a recall notice from the manufacturer of his car
 [_ received a recall notice from _] Sam the manufacturer of
Sam's car

R s (the manufacturer of Sam's car)

R s ([the manufacturer of _]) Sam's car)

R s (m (Sam's car))

R s (m ([_ 's car] Sam))

Rs(m(cs))

R: [_ received a recall notice from _]; c: [_ 's car]; m: [the manufacturer of _]; s: Sam

| | | |
|--------|--|--|
| 7. | $Rb(fa)$ $fb = gc$ $c = fb$ $d = gc$ | (4) $fb-gc, a, b, c, d, fa, gd$ $c-fb-gc, a, b, d, fa, gd$ $c-fb-gc-d-gd, a, b, fa$ |
| 2 EC | <div style="text-align: center;">●</div> $c = d$ | 1 |
| 4 QED= | <div style="text-align: center;">●</div> $a = b$ $Ra(gd)$ | $c-fb-gc-d-gd-fa, a-b$ 3 |
| 3 CP | $a = b \rightarrow Ra(gd)$ | 1 |
| 1 Cnj | $c = d \wedge (a = b \rightarrow Ra(gd))$ | |

Phi 270 F04 test 3

F04 test 3 topics

The following are the topics to be covered. The proportion of the test covering each will approximate the proportion of the classes so far that have been devoted to that topic. Your homework and the collection of old tests will provide specific examples of the kinds of questions I might ask.

- *Analysis*. Two sorts of questions are possible here corresponding to the sorts of analyses you have done in chs. 5 and 6: (i) analysis by truth-functional connectives only with atomic sentences as the ultimate components (the focus would, of course, be on conditionals—i.e., on the symbolic representation of **if**, **only if**, and **unless**) and (ii) analysis using truth-functional connectives and the ideas of predicates, individual terms, and functors.
- *Synthesis*. You may be given a symbolic form and an interpretation of its non-logical vocabulary and asked to express the sentence in English. This form might be either a truth-functional compound of unanalyzed component sentences or a form built using predicates, individual terms, and functors as well as connectives.
- *Derivations*. Be able to construct derivations to show that entailments hold and to show that they fail. I may tell you in advance whether an entailment holds or leave it to you to check that using derivations. There will be some derivations where detachment and attachment rules may be used and where they will shorten the proof. But there will be others where you must rely on others rules, either because detachment and attachment rules do not apply or because I tell you not to use them. In particular be ready to use the rule RC (Rejecting a Conditional) from ch. 5.

Remember that, if a derivation includes forms involving predicates and functors, presenting a counterexample will require the description of a structure and not merely an assignment of truth values. You will be allowed to use either tables or diagrams to describe structures.

F04 test 3 questions

Analyze the sentences below in as much detail as possible *using only connectives*; that is, the unanalyzed components should all be sentences (rather than individual terms, 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. **Dan wasn't home unless it was a holiday.**
2. **If ten days had passed, then the return was accepted only if the item was damaged.**

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

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

4. $A \rightarrow B \models B \rightarrow C$

Analyze the sentence below in as much detail as possible, giving a key to your abbreviations of unanalyzed expressions. In this case you *should* identify components that are individual terms, predicates, or functors; however, you do not need to present the result in English notation (i.e., symbolic notation is enough). (Be sure that the unanalyzed components of your answer are independent—in particular, that none contains a pronoun whose antecedent is in another—and be sure also that the individual terms you identify really are individual terms rather than general terms or quantifier phrases.)

5. *Ann called Bill and he picked her up at the garage.*

6. *If Carol's father is Dave's boss, then she has either met Dave or heard her father speak of him.*

Use a derivation to show that the entailment below holds. You may use detachment and attachment rules. (Be sure to indicate the alias sets at each stage when they change.)

7. $a = fc, b = fd, Rac \models c = d \rightarrow Rbd$

F04 test 3 answers

1. *Dan wasn't home unless it was a holiday*

Dan wasn't home \leftarrow *it was a holiday*

\neg *Dan was home* \leftarrow \neg *it was a holiday*

$\neg H \leftarrow \neg D$

$\neg D \rightarrow \neg H$

if not D then not H

H: *Dan was home*; D: *it was a holiday*

2. *If ten days had passed, then the return was accepted only if the item was damaged*

ten days had passed \rightarrow *the return was accepted only if the item was damaged*

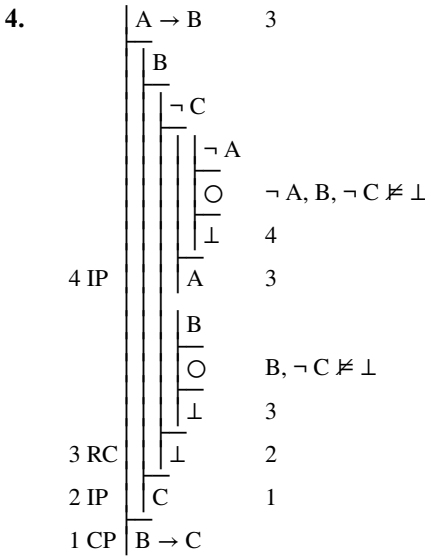
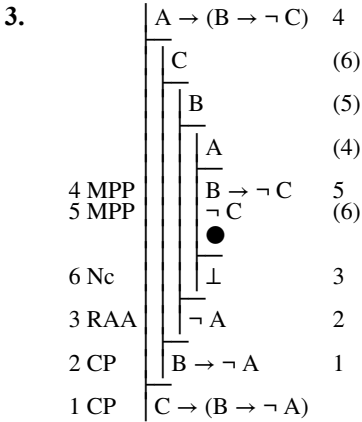
ten days had passed \rightarrow (\neg *the return was accepted* \leftarrow \neg *the item was damaged*)

$T \rightarrow (\neg A \leftarrow \neg D)$

$T \rightarrow (\neg D \rightarrow \neg A)$

if T then if not D then not A

T: *ten days had passed*; D: *the item was damaged*; A: *the return was accepted*



| A | B | C | $A \rightarrow B$ | $B \rightarrow C$ |
|---|---|---|-------------------|-------------------|
| T | T | F | ⊕ | ⊖ |
| F | T | F | ⊕ | ⊖ |

The first counterexample lurks in the second gap and the second one lurks in both

5. Ann called Bill and he picked her up at the garage
Ann called Bill \wedge Bill picked Ann up at the garage
 [_ called _] Ann Bill \wedge [_ picked _ up at _] Bill Ann the garage

$Cab \wedge Pbag$

C: [_ called _]; P: [_ picked _ up at _]; a: Ann; b: Bill; g: the garage

6. If Carol's father is Dave's boss, then she has either met Dave or heard her father speak of him

Carol's father is Dave's boss → Carol has either met Dave or heard her father speak of him

Carol's father = Dave's boss → (Carol has met Dave ∨ Carol has heard her father speak of Dave)

[_'s father] Carol = [_'s boss] Dave → (Carol has met Dave ∨ Carol has heard Carol's father speak of Dave)

fc = bd → ([_ has met _] Carol Dave ∨ [_ has heard _ speak of _] Carol Carol's father Dave)

$$fc = bd \rightarrow (Mcd \vee Hc(fc)d)$$

M: [_ has met _]; H: [_ has heard _ speak of _]; f: [_'s father];

b: [_'s boss]; c: Carol; d: Dave

7.

| | |
|--------------------|------------------|
| a = fc | |
| b = fd | a-fc, b-fd, c, d |
| Rac | (2) |
| | |
| c = d | a-fc-b-fd, c-d |
| ● | |
| 2 QED= Rbd | 1 |
| 1 CP c = d → Rbd | |

Phi 270 F03 test 3

F03 test 3 topics

The following are the topics to be covered. The proportion of the test covering each will approximate the proportion of the classes so far that have been devoted to that topic. Your homework and the collection of old tests will provide specific examples of the kinds of questions I might ask.

- *Analysis*. Two sorts of questions are possible here corresponding to the sorts of analyses you have done in chs. 5 and 6: (i) analysis by truth-functional connectives only with atomic sentences as the ultimate components (the focus would, of course, be on conditionals--i.e., on the symbolic representation of **if**, **only if**, and **unless**), (ii) analysis using truth-functional connectives *and* the ideas of predicates, individual terms, and functors.
- *Synthesis*. You may be given a symbolic form and an interpretation of its non-logical vocabulary and asked to express the sentence in English. This form might be either a truth-functional compound of unanalyzed component sentences or a form built from predicates, individual terms, and functors.
- *Derivations*. Be able to construct derivations to show that entailments hold and to show that they fail. I may tell you in advance whether an entailment holds or leave it to you to check that using derivations. There will be some derivations where detachment and attachment rules may be used and where they will shorten the proof. But there will be others where you must rely on others rules, either because detachment and attachment rules do not apply or because I tell you not to use them. In particular be ready to use the rule RC (Rejecting a Conditional) from ch. 5.

Remember that, if a derivation, includes forms built using predicates presenting a counterexample will require the description of a structure and not merely an assignment of truth values.

F03 test 3 questions

Analyze the sentences below in as much detail as possible *using only 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. **If it was cloudy, Bob didn't see the eclipse**
2. **Unless the lock is broken, you can get in only if you have a key**

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

3. $A \rightarrow \neg C, B \rightarrow C \models A \rightarrow \neg B$
4. $(A \wedge B) \rightarrow C \models B \rightarrow (\neg C \rightarrow A)$

Analyze the sentences 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. If Sam asked Tom to drive him to the meeting, then he is the person who called earlier
6. Dave's father called the mother of the child who hit him

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

7. $a = b \wedge Rac \models fa = c \rightarrow Rb(fb)$

F03 test 3 answers

1. If it was cloudy, Bob didn't see the eclipse
 it was cloudy \rightarrow Bob didn't see the eclipse
 it was cloudy $\rightarrow \neg$ Bob saw the eclipse
 $C \rightarrow \neg S$

if C then not S

C: it was cloudy; S: Bob saw the eclipse

2. Unless the lock is broken, you can get in only if you have a key
 \neg the lock is broken \rightarrow you can get in only if you have a key
 \neg the lock is broken $\rightarrow (\neg$ you can get in $\leftarrow \neg$ you have a key)
 $\neg B \rightarrow (\neg G \leftarrow \neg K)$
 $\neg B \rightarrow (\neg K \rightarrow \neg G)$

if not B then if not K then not G

B: the lock is broken; G: you can get in; K: you have a key

| | | |
|-------|------------------------|-----|
| 3. | A $\rightarrow \neg C$ | 2 |
| | B $\rightarrow C$ | 3 |
| | A | (2) |
| 2 MPP | $\neg C$ | (3) |
| 3 MTT | $\neg B$ | (4) |
| | ● | |
| | $\neg B$ | 1 |
| 4 QED | A $\rightarrow \neg B$ | |
| 1 CP | A $\rightarrow \neg B$ | |

Phi 270 F02 test 3

F02 test 3 questions

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

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

3. $A \rightarrow (\neg B \rightarrow C) \vDash \neg C \rightarrow (A \rightarrow B)$
4. $A \rightarrow (\neg B \rightarrow C) \vDash C \rightarrow (A \rightarrow B)$

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

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]

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

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

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 $\neq \perp$ |
| | \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 ⊕ 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. $S \underline{Al} ([_ 's \text{ mother}] \underline{Bob}) \rightarrow \neg S ([_ 's \text{ mother}] \underline{Al}) \underline{Bob}$
 $[_ \text{ went to school with } _] \underline{Al} \underline{Bob's \text{ mother}} \rightarrow \neg [_ \text{ went to school with } _] \underline{Al's \text{ mother}} \underline{Bob}$
 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 | |

Phi 270 F00 test 3

F00 test 3 questions

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. If it rains, you will get wet if you're outside

2. Al missed breakfast only if he overslept

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

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

4. $A \rightarrow B \models \neg A \wedge B$

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. Unless Al is the file's owner, the system didn't let him open it

Expand the following sentence in all possible ways on each of the terms appearing in it (i.e., you need not use vacuous abstraction).

6. Tabc

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

7. $A \rightarrow \text{Ra}(\text{fb}), \text{Rb}(\text{fa}) \rightarrow \text{Ga} \models A \rightarrow (\neg \text{Gb} \rightarrow \neg a = b)$

F00 test 3 answers

1. $\text{it will rain} \rightarrow \text{you will get wet if you're outside}$

$\text{it will rain} \rightarrow (\text{you will get wet} \leftarrow \text{you will be outside})$

$R \rightarrow (W \leftarrow O) \text{ [or: } R \rightarrow (O \rightarrow W)]$

if R then if O then W

O: you will be outside; R: it will rain; W: you will get wet

2. $\neg \text{Al missed breakfast} \leftarrow \neg \text{Al overslept}$

$\neg M \leftarrow \neg O \text{ [or: } \neg O \rightarrow \neg M]$

if not O then not M

M: Al missed breakfast; O: Al overslept

| | | |
|-------|---|---------|
| 3. | $A \rightarrow (B \rightarrow C)$ | 3 |
| | $A \rightarrow \neg C$ | 4 |
| | A | (3),(4) |
| 3 MPP | $B \rightarrow C$ | 5 |
| 4 MPP | $\neg C$ | (5) |
| 5 MTT | $\neg B$ | (6) |
| | ● | |
| 6 QED | $\neg B$ | 2 |
| 2 CP | $A \rightarrow \neg B$ | 1 |
| 1 CP | $(A \rightarrow \neg C) \rightarrow (A \rightarrow \neg B)$ | |

| | | |
|-------|-------------------|-----------------------------------|
| 4. | $A \rightarrow B$ | 3,5 |
| | A | (3) |
| 3 MPP | B | |
| | ○ | $A, B \not\vdash \perp$ |
| | \perp | 2 |
| 2 RAA | $\neg A$ | 1 |
| | $\neg B$ | (5) |
| 5 MTT | $\neg A$ | |
| | ○ | $\neg A, \neg B \not\vdash \perp$ |
| | \perp | 4 |
| 4 IP | B | 1 |
| 1 Cnj | $\neg A \wedge B$ | |

| | | | | |
|---|---|----------------|---|---|
| A | B | A → B / ¬A ∧ B | | |
| T | T | ⊗ | F | ⊕ |
| F | F | ⊗ | T | ⊕ |

The counterexample in the first row lurks in the first gap and the one in the second row lurks in the second gap.

5. $\neg Al$ is the file's owner \rightarrow the system didn't let Al open the file
 \neg Al is the file's owner $\rightarrow \neg$ the system let Al open the file
 $\neg Al =$ the file's owner $\rightarrow \neg$ [_ let _ open _] the system Al the file
 $\neg a =$ [_ 's owner] the file $\rightarrow \neg$ Lsaf

$$\neg a = of \rightarrow \neg Lsaf$$

L: [_ let _ open _]; a: Al; f: the file; o: [_ 's owner]; s: the system

6. $[Txbc]_x a$
 $[Taxc]_x b$
 $[Tabx]_x c$

7.

| | | |
|--------|---|------------|
| | $A \rightarrow Ra(fb)$ $Rb(fa) \rightarrow Ga$ | 4 |
| | A | |
| | $Ra(fb)$ | (5) |
| | $\neg Gb$ | (6) |
| | $a=b$ | a-b, fa-fb |
| | \bullet | |
| 5 QED= | $Rb(fa)$ | 4 |
| | Ga | (6) |
| | \bullet | |
| 6 Nc= | \perp | 4 |
| 4 RC | \perp | 3 |
| 3 RAA | $\neg a=b$ | 2 |
| 2 CP | $\neg Gb \rightarrow \neg a=b$ | 1 |
| 1 CP | $A \rightarrow (\neg Gb \rightarrow \neg a=b)$ | |

Phi 270 F99 test 3

F99 test 3 questions

Analyze the sentences below in as much detail as possible *using connectives*; that is, you need 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. *We won't have the material by Thursday unless the order goes in today.*
2. *If the power went out, they finished the job only if they had a generator.*

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

3. $A \rightarrow (\neg B \rightarrow C), C \rightarrow D \models A \rightarrow (\neg D \rightarrow B)$
4. $(A \wedge B) \rightarrow (C \vee D) \models A \rightarrow C$

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. *Adam called Billy's mother and she is the owner of the dog.*

Expand the following sentence in all possible ways on each of the terms appearing in it (i.e., you need not use vacuous abstraction).

6. $Rab \rightarrow Rbc$

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

7. $a = fb, Ra(fa) \models fb = c \rightarrow R(fb)(fc)$

F99 test 3 answers

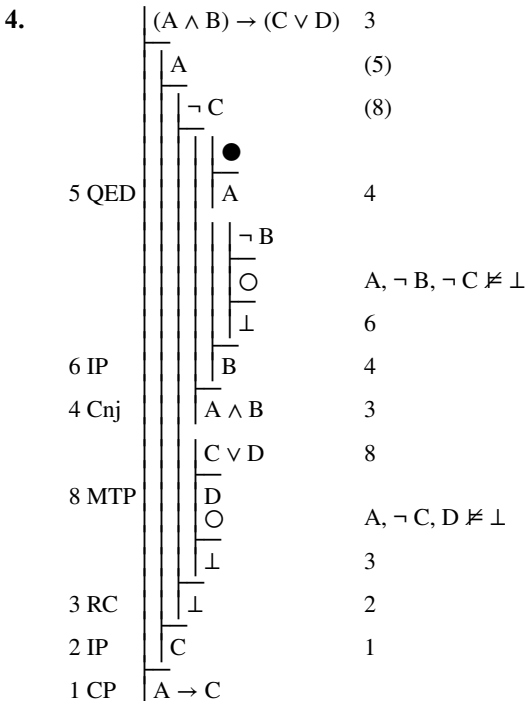
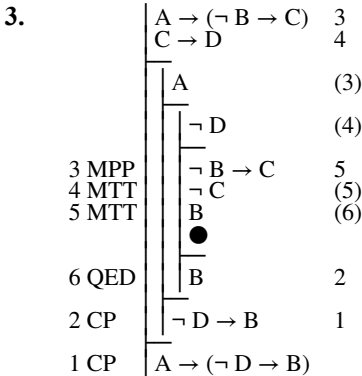
1. *We won't have the material by Thursday unless the order goes in today*
we won't have the material by Thursday \leftarrow \neg *the order will go in today*
 \neg *we will have the material by Thursday* \leftarrow \neg *the order will go in today*
 $\neg H \leftarrow \neg T$ [or: $\neg T \rightarrow \neg H$]
if not T then not H
H: *we will have the material by Thursday*; T: *the order will go in today*

2. If the power went out, they finished the job only if they had a generator
 the power went out \rightarrow they finished the job only if they had a generator
 the power went out \rightarrow (\neg they finished the job \leftarrow \neg they had a generator)

$$O \rightarrow (\neg F \leftarrow \neg G) \text{ [or: } O \rightarrow (\neg G \rightarrow \neg F)]$$

if O then if not G then not F

F: they finished the job; G: they had a generator; O: the power went out



| A | B | C | D | $(A \wedge B) \rightarrow (C \vee D)$ | $A \rightarrow C$ | |
|---|---|---|---|---------------------------------------|-------------------|---|
| T | F | F | F | F | ⊕ | F |
| T | F | F | T | F | ⊕ | T |
| T | T | F | T | T | ⊕ | T |

⊕ lurks in 1st gap
 ⊕ lurks in both gaps
 ⊕ lurks in 2nd gaps

5. Adam called Billy's mother and she is the owner of the dog
Adam called Billy's mother \wedge Billy's mother is the owner of the dog
 [_ called _] Adam Billy's mother \wedge Billy's mother = the owner of the dog
 Ca(Billy's mother) \wedge Billy's mother = the owner of the dog
 Ca([_'s mother] Billy) \wedge [_'s mother] Billy = [the owner of _] the dog

$$Ca(mb) \wedge mb = od$$

C: [_ called _]; a: Adam; b: Billy; d: the dog; m: [_'s mother]; o: [the owner of _]

6. Apart from the choice of the bound variable, the following are all the possibilities:

$$[Rxb \rightarrow Rbc]_x a \quad [Rax \rightarrow Rbc]_x b \quad [Rab \rightarrow Rbx]_x c$$

$$[Rab \rightarrow Rxc]_x b$$

$$[Rax \rightarrow Rxc]_x b$$

- 7.
- | | |
|---------------------------------------|--------------------|
| a = fb | a-fb, b, c, fa, fc |
| Ra(fa) | (2) |
| | |
| fb = c | a-fb-c, b, fa-fc |
| ● | |
| | |
| 2 QED= R(fb)(fc) | 1 |
| 1 CP fb = c \rightarrow R(fb)(fc) | |

Phi 270 F98 test 3

F98 test 3 questions

(Questions 1-6 are from quiz 3 and 7-10 are from quiz 4 out of 6 quizzes—these two quizzes addressed the part of the course your test is designed to cover.)

Analyze the sentences below in as much detail as possible *without* going below the level of sentences (i.e., without recognizing individual terms and predicates). Be sure that the unanalyzed components of your answer are complete and independent sentences and that you respect any grouping in the English. You may use right-to-left arrows to reflect English word order but you should then also restate your symbolic analysis with arrows running left to right and, in any case, you should restate it using English notation.

1. **If our message got there, they should be on their way**
2. **Unless we make reservations, we'll get a table only if it is a slow night**
3. Check the following for validity using derivations; you *may use* attachment rules and detachment rules. If the derivation fails, confirm a counterexample that lurks in an open gap.

$$\frac{A \rightarrow (B \rightarrow (C \vee D))}{\neg C \rightarrow (A \rightarrow \neg B)}$$

4. [This question was on a topic not covered this year]
5. Analyze the sentence below in as much detail as possible, continuing the analysis when there are no more connectives by identifying predicates, functors, and individual terms. Be sure that the unanalyzed expressions in your answer are independent and that you respect any grouping in the English. (You need not state the result in English notation.)

If Sam is the winner of the trip, then the winner of the grand prize presented it to him

6. Give two different expansions (using predicate abstracts) of the sentence below as a one-place predicate applied to a term:

$$Pb \wedge Rab$$

7. Draw a diagram which presents the same interpretation as the following tables:

range: 1, 2, 3

| a | c | g | τ | F τ | τ | G τ | R | 1 | 2 | 3 |
|---|---|---|--------|----------|--------|----------|---|---|---|---|
| 2 | 3 | 2 | 1 | T | 1 | F | 1 | T | F | T |
| | | | 2 | F | 2 | T | 2 | T | F | F |
| | | | 3 | T | 3 | T | 3 | F | T | T |

8. Describe a structure (i.e., an assignment of extensions to the non-logical

vocabulary) which makes the following sentences all true. (You may present the structure either using tables or using diagrams.)

$$fa = b, b = c, Pb, \neg Pa, Ra(fa), R(fb)(fc), \neg Rbc$$

Check each of the arguments below for validity using derivations. You need *not* present counterexamples to gaps that reach dead ends.

9.
$$\frac{fa = c \quad Rbc}{a = b \rightarrow Ra(fa)}$$

10.
$$\frac{Rab \vee Rcb \quad a = b \wedge gb = gc}{Rbc \rightarrow Rcb}$$

F98 test 3 answers

1. If our message got there, they should be on their way
our message got there \rightarrow they should be on their way

$$M \rightarrow W$$

if M then W

M: our message got there; W: they should be on their way

2. \neg we will make reservations \rightarrow we'll get a table only if it is a slow night

\neg we will make reservations \rightarrow (\neg we'll get a table \leftarrow \neg it will be a slow night)

$$\neg R \rightarrow (\neg T \leftarrow \neg S) \text{ or: } \neg R \rightarrow (\neg S \rightarrow \neg T)$$

if not R then if not S then not T

R: we will make reservations; S: it will be a slow night; T: we'll get a table

3.

| | |
|--|----------------------------------|
| A \rightarrow (B \rightarrow (C \vee D)) | 4 |
| \neg C | (6) |
| A | (4) |
| B | (5) |
| 4 MPP B \rightarrow (C \vee D) | 5 |
| 5 MPP C \vee D | 6 |
| 6 MTP D | |
| O | A, B, \neg C, D \neq \perp |
| \perp | |
| 3 RAA \neg B | 2 |
| 2 CP A \rightarrow \neg B | 1 |
| 1 CP \neg C \rightarrow (A \rightarrow \neg B) | |

| | | | | | | | | | | |
|---|---|---|---|--|---|---|---|---|---|---|
| A | B | C | D | A \rightarrow (B \rightarrow (C \vee D)) / \neg C \rightarrow (A \rightarrow \neg B) | | | | | | |
| T | T | F | T | ⊕ | T | T | T | ⊕ | F | F |

4. [This question was on a topic not covered this year]
5. If Sam is the winner of the trip, then the winner of the grand prize presented it to him

Sam is the winner of the trip → the winner of the grand prize presented the trip to Sam

s = the winner of the trip → [_ presented _ to _] the winner of the grand prize the trip Sam

s = [the winner of _] the trip → P(the winner of the grand prize)ts

s = nt → P([the winner of _] the grand prize)ts

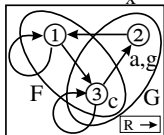
s = nt → P(ng)ts

P: [_ presented _ to _]; g: the grand prize; n: [the winner of _]; s: Sam; t: the trip

6. The following are the possibilities; in the last, τ may be any term:

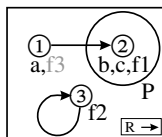
[Pb \wedge Rxb]_x, [Px \wedge Rab]_x, [Pb \wedge Rax]_x, [Px \wedge Rax]_x, [Pb \wedge Rab]_x τ

7.



8. range: 1, 2, 3

| a | b | c | τ | f τ | τ | P τ | R | 1 | 2 | 3 |
|---|---|---|--------|----------|--------|----------|---|---|---|---|
| 1 | 2 | 2 | 1 | 2 | 1 | F | 1 | F | T | F |
| | | | 2 | 3 | 2 | T | 2 | F | F | F |
| | | | 3 | 1 | 3 | F | 3 | F | F | T |



(The diagram above provides a complete answer, and so do the tables to its left. The tables below show a way of arriving at these answers.)

| alias sets | IDs | values | resources | values |
|------------|-----|--------|------------|--------|
| a | 1 | a: 1 | Pb | P2: T |
| fa | 2 | f1: 2 | \neg Pa | P1: F |
| b | | b: 2 | Ra(fa) | R12: T |
| c | | c: 2 | R(fb)(fc) | R33: T |
| fb | 3 | f2: 3 | \neg Rbc | R22: F |
| fc | | f2: 3 | | |

9.

| | | |
|--------|----------------|----------------|
| 2 QED= | fa = c | a, b, fa—c, fb |
| | Rbc | (2) |
| 1 CP | a = b | a—b, fa—fb—c |
| | ● | |
| | Ra(fa) | 1 |
| | a = b → Ra(fa) | |

10.

| | | |
|-------|------------------------|---|
| | $Rab \vee Rcb$ | 4 |
| | $a = b \wedge gb = gc$ | 2 |
| | Rbc | |
| 2 Ext | $a = b$ | $a-b, c, gb, gc$ |
| 2 Ext | $gb = gc$ | $a-b, c, gb-gc$ |
| | $\neg Rcb$ | (4) |
| 4 MTP | Rab | |
| | \circ | $a=b, gb=gc, Rbc, \neg Rcb, Rab \neq \perp$ |
| | \perp | 3 |
| 3 CP | Rcb | 1 |
| 1 CP | $Rbc \rightarrow Rcb$ | |

Phi 270 F97 test 3

F97 test 3 questions

(Questions 1-6 are from quiz 3 and 7-9 are from quiz 4 out of 6 quizzes—these two quizzes addressed the part of the course your test is designed to cover.)

Analyze the sentences below in as much detail as possible *without* going below the level of sentences (i.e., without recognizing individual terms and predicates). Be sure that the unanalyzed components of your answer are complete and independent sentences and that you respect any grouping in the English.

1. **The creek will be high enough only if it rains.**
2. **Unless you object, Al will show the letter to Barb if she asks to see it.**

Check each of the following for validity using the basic system of derivations (i.e., *do not use* attachment rules but *you may use* detachment rules). If a derivation fails, confirm a counterexample that lurks in an open gap.

3.
$$\frac{A \rightarrow (B \vee C)}{\neg C \rightarrow (A \rightarrow B)}$$

4.
$$\frac{A \rightarrow (B \rightarrow C)}{(C \wedge A) \rightarrow B}$$

5. Analyze the sentence below in as much detail as possible, continuing the analysis when there are no more connectives by identifying predicates, functors, and individual terms. Be sure that the unanalyzed expressions in your answer are independent and that you respect any grouping in the English.

If Dan's wife received the message, she is the person who called.

6. a. Give two different expansions (using predicate abstracts) of the sentence: Raba.
b. Put the following into reduced form: $[Pxa \wedge Qbx]_x a$.
7. Describe a structure (i.e., an assignment of extensions to the non-logical vocabulary) which makes the following sentences all true. (You may present the structure either using tables or, were possible, using diagrams.)

$$a = fb, fa = fb, b = c, Fa, \neg F(gc), Rb(fa), \neg Ra(fb), R(gc)c$$

Use derivations to check each of the claims of entailment below. You need *not* present counterexamples to dead-end gaps.

8. $Fa \wedge \neg Fb \models b = c \rightarrow \neg a = c$

9. $fa = c, fb = c, Rc(fa) \rightarrow Ra(fa) \models R(fa)(fb) \rightarrow Rb(fb)$

F97 test 3 answers

1. the creek will be high enough only if it rains
 ¬ the creek will be high enough ← ¬ it will rain

$$\neg H \leftarrow \neg R \text{ or } \neg R \rightarrow \neg H$$

if not R then not H

H: the creek will be high enough; R: it will rain

2. ¬ you will object → Al will show the letter to Barb if she asks to see it
 ¬ you will object → (Al will show the letter to Barb ← Barb will ask to see the letter)

$$\neg O \rightarrow (S \leftarrow A) \text{ or } \neg O \rightarrow (A \rightarrow S)$$

if not O then if A then S

A: Barb will ask to see the letter; O: you will object; S: Al will show the letter to Barb

3.

| | | |
|---|--|----------------------------|
| 3 MPP 4 MTP 5 QED 2 CP 1 CP | $A \rightarrow (B \vee C)$ $\neg C$ A $B \vee C$ B B $A \rightarrow B$ $\neg C \rightarrow (A \rightarrow B)$ | 3 4 3 4 2 1 |
|---|--|----------------------------|

4.

| | | |
|---|--|---|
| 2 Ext 2 Ext 3 MPP 6 IP 5 RC 4 IP 1 CP | $A \rightarrow (B \rightarrow C)$ $C \wedge A$ C A $B \rightarrow C$ $\neg B$ $\neg B$ O \perp B C O \perp \perp B $(C \wedge A) \rightarrow B$ | 3 2 3 5 A, ¬B, C ≠ ⊥ 6 5 A, ¬B, C ≠ ⊥ 5 4 1 |
|---|--|---|

| | | | |
|---|---|---|---------------------------|
| A | B | C | A → (B → C) / (C ∧ A) → B |
| T | F | T | ⊕ T T ⊕ |

5. Dan's wife received the message → Dan's wife is the person who called

[_ received _] Dan's wife the message → Dan's wife = the person who called

R(Dan's wife)_m → ['s wife] Dan = p

R(fd)_m → fd = p

R: [_ received _]; d: Dan; f: ['s wife]; m: the message; p: the person who called

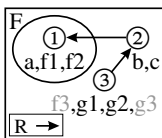
6. a. The following are the possibilities; in the last, τ may be any term:

[Rxbx]_xa, [Rxba]_xa, [Rabx]_xa, [Raxa]_xb, [Raba]_x τ

b. Paa \wedge Qba

7. range: 1, 2, 3

| | a | b | c | τ | f τ | τ | g τ | τ | F τ | R | 1 | 2 | 3 |
|---|---|---|---|--------|----------|--------|----------|--------|----------|---|---|---|---|
| 1 | 2 | 2 | | 1 | 1 | 1 | 3 | 1 | T | 1 | F | F | F |
| 2 | | 1 | 2 | 2 | 1 | 2 | 3 | 2 | F | 2 | T | F | F |
| 3 | | 3 | 3 | 3 | 3 | 3 | 3 | 3 | F | 3 | T | T | F |



(The diagram at the left provides a complete answer, and so do the tables above. The tables below show a way of arriving at these answers.)

| alias sets | IDs | values | resources | values |
|------------|-----|--------|---------------|--------|
| a | 1 | a: 1 | Fa | F1: T |
| fa | | f1: 1 | $\neg F(gc)$ | F3: F |
| fb | | f2: 1 | Rb(fa) | R21: T |
| b | 2 | b: 2 | $\neg Ra(fb)$ | R11: F |
| c | | c: 2 | R(gc)c | R32: T |
| gc | 3 | g2: 3 | | |

8.

| | | |
|-------|--------------------------------|--------|
| | $Fa \wedge \neg Fb$ | 1 |
| 1 Ext | Fa | (4) |
| 1 Ext | $\neg Fb$ | (4) |
| | $b = c$ | a, b-c |
| | $a = c$ | a-b-c |
| | ● | |
| 4 Nc= | \perp | 3 |
| 3 RAA | $\neg a = c$ | 2 |
| 2 CP | $b = c \rightarrow \neg a = c$ | |

9.

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|--|------------------------|--|---|---------------|----------|--|--|---------|----------|--|----------|---|---|--|---------|---|--|---------|---|--|--------|--|--|--|----------|---|------|--|--|------|--|--|------|--------------------------------|--|
| | $fa = c$ $fb = c$ $Rc(fa) \rightarrow Ra(fa)$ | a, b, c, fa, fb 3 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | <table border="0" style="width: 100%;"> <tr> <td style="border-left: 1px solid black; padding-left: 5px;">$R(fa)(fb)$</td> <td style="padding-left: 20px;">(4)</td> </tr> <tr> <td style="border-left: 1px solid black; padding-left: 5px;"> <table border="0" style="width: 100%;"> <tr> <td style="border-left: 1px solid black; padding-left: 5px;">$\neg Rb(fb)$</td> <td></td> </tr> <tr> <td style="border-left: 1px solid black; padding-left: 5px;"> <table border="0" style="width: 100%;"> <tr> <td style="border-left: 1px solid black; padding-left: 5px;">●</td> <td></td> </tr> <tr> <td style="border-left: 1px solid black; padding-left: 5px;">$Rc(fa)$</td> <td style="padding-left: 20px;">3</td> </tr> <tr> <td style="border-left: 1px solid black; padding-left: 5px;">$Ra(fa)$</td> <td></td> </tr> <tr> <td style="border-left: 1px solid black; padding-left: 5px;">○</td> <td style="padding-left: 20px;"> $fa=c, fb=c, R(fa)(fb),$ $\neg Rb(fb), Ra(fa) \not\equiv \perp$ </td> </tr> <tr> <td style="border-left: 1px solid black; padding-left: 5px;">\perp</td> <td style="padding-left: 20px;">3</td> </tr> </table> </td> <td></td> </tr> <tr> <td style="border-left: 1px solid black; padding-left: 5px;">\perp</td> <td style="padding-left: 20px;">2</td> </tr> </table> </td> <td></td> </tr> <tr> <td style="padding-right: 10px;">4 QED=</td> <td></td> <td></td> </tr> <tr> <td></td> <td style="border-left: 1px solid black; padding-left: 5px;">$Rb(fb)$</td> <td style="padding-left: 20px;">1</td> </tr> <tr> <td style="padding-right: 10px;">3 RC</td> <td></td> <td></td> </tr> <tr> <td style="padding-right: 10px;">2 IP</td> <td></td> <td></td> </tr> <tr> <td style="padding-right: 10px;">1 CP</td> <td style="border-left: 1px solid black; padding-left: 5px;">$R(fa)(fb) \rightarrow Rb(fb)$</td> <td></td> </tr> </table> | $R(fa)(fb)$ | (4) | <table border="0" style="width: 100%;"> <tr> <td style="border-left: 1px solid black; padding-left: 5px;">$\neg Rb(fb)$</td> <td></td> </tr> <tr> <td style="border-left: 1px solid black; padding-left: 5px;"> <table border="0" style="width: 100%;"> <tr> <td style="border-left: 1px solid black; padding-left: 5px;">●</td> <td></td> </tr> <tr> <td style="border-left: 1px solid black; padding-left: 5px;">$Rc(fa)$</td> <td style="padding-left: 20px;">3</td> </tr> <tr> <td style="border-left: 1px solid black; padding-left: 5px;">$Ra(fa)$</td> <td></td> </tr> <tr> <td style="border-left: 1px solid black; padding-left: 5px;">○</td> <td style="padding-left: 20px;"> $fa=c, fb=c, R(fa)(fb),$ $\neg Rb(fb), Ra(fa) \not\equiv \perp$ </td> </tr> <tr> <td style="border-left: 1px solid black; padding-left: 5px;">\perp</td> <td style="padding-left: 20px;">3</td> </tr> </table> </td> <td></td> </tr> <tr> <td style="border-left: 1px solid black; padding-left: 5px;">\perp</td> <td style="padding-left: 20px;">2</td> </tr> </table> | $\neg Rb(fb)$ | | <table border="0" style="width: 100%;"> <tr> <td style="border-left: 1px solid black; padding-left: 5px;">●</td> <td></td> </tr> <tr> <td style="border-left: 1px solid black; padding-left: 5px;">$Rc(fa)$</td> <td style="padding-left: 20px;">3</td> </tr> <tr> <td style="border-left: 1px solid black; padding-left: 5px;">$Ra(fa)$</td> <td></td> </tr> <tr> <td style="border-left: 1px solid black; padding-left: 5px;">○</td> <td style="padding-left: 20px;"> $fa=c, fb=c, R(fa)(fb),$ $\neg Rb(fb), Ra(fa) \not\equiv \perp$ </td> </tr> <tr> <td style="border-left: 1px solid black; padding-left: 5px;">\perp</td> <td style="padding-left: 20px;">3</td> </tr> </table> | ● | | $Rc(fa)$ | 3 | $Ra(fa)$ | | ○ | $fa=c, fb=c, R(fa)(fb),$ $\neg Rb(fb), Ra(fa) \not\equiv \perp$ | \perp | 3 | | \perp | 2 | | 4 QED= | | | | $Rb(fb)$ | 1 | 3 RC | | | 2 IP | | | 1 CP | $R(fa)(fb) \rightarrow Rb(fb)$ | |
| $R(fa)(fb)$ | (4) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <table border="0" style="width: 100%;"> <tr> <td style="border-left: 1px solid black; padding-left: 5px;">$\neg Rb(fb)$</td> <td></td> </tr> <tr> <td style="border-left: 1px solid black; padding-left: 5px;"> <table border="0" style="width: 100%;"> <tr> <td style="border-left: 1px solid black; padding-left: 5px;">●</td> <td></td> </tr> <tr> <td style="border-left: 1px solid black; padding-left: 5px;">$Rc(fa)$</td> <td style="padding-left: 20px;">3</td> </tr> <tr> <td style="border-left: 1px solid black; padding-left: 5px;">$Ra(fa)$</td> <td></td> </tr> <tr> <td style="border-left: 1px solid black; padding-left: 5px;">○</td> <td style="padding-left: 20px;"> $fa=c, fb=c, R(fa)(fb),$ $\neg Rb(fb), Ra(fa) \not\equiv \perp$ </td> </tr> <tr> <td style="border-left: 1px solid black; padding-left: 5px;">\perp</td> <td style="padding-left: 20px;">3</td> </tr> </table> </td> <td></td> </tr> <tr> <td style="border-left: 1px solid black; padding-left: 5px;">\perp</td> <td style="padding-left: 20px;">2</td> </tr> </table> | $\neg Rb(fb)$ | | <table border="0" style="width: 100%;"> <tr> <td style="border-left: 1px solid black; padding-left: 5px;">●</td> <td></td> </tr> <tr> <td style="border-left: 1px solid black; padding-left: 5px;">$Rc(fa)$</td> <td style="padding-left: 20px;">3</td> </tr> <tr> <td style="border-left: 1px solid black; padding-left: 5px;">$Ra(fa)$</td> <td></td> </tr> <tr> <td style="border-left: 1px solid black; padding-left: 5px;">○</td> <td style="padding-left: 20px;"> $fa=c, fb=c, R(fa)(fb),$ $\neg Rb(fb), Ra(fa) \not\equiv \perp$ </td> </tr> <tr> <td style="border-left: 1px solid black; padding-left: 5px;">\perp</td> <td style="padding-left: 20px;">3</td> </tr> </table> | ● | | $Rc(fa)$ | 3 | $Ra(fa)$ | | ○ | $fa=c, fb=c, R(fa)(fb),$ $\neg Rb(fb), Ra(fa) \not\equiv \perp$ | \perp | 3 | | \perp | 2 | | | | | | | | | | | | | | | | | | | | |
| $\neg Rb(fb)$ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <table border="0" style="width: 100%;"> <tr> <td style="border-left: 1px solid black; padding-left: 5px;">●</td> <td></td> </tr> <tr> <td style="border-left: 1px solid black; padding-left: 5px;">$Rc(fa)$</td> <td style="padding-left: 20px;">3</td> </tr> <tr> <td style="border-left: 1px solid black; padding-left: 5px;">$Ra(fa)$</td> <td></td> </tr> <tr> <td style="border-left: 1px solid black; padding-left: 5px;">○</td> <td style="padding-left: 20px;"> $fa=c, fb=c, R(fa)(fb),$ $\neg Rb(fb), Ra(fa) \not\equiv \perp$ </td> </tr> <tr> <td style="border-left: 1px solid black; padding-left: 5px;">\perp</td> <td style="padding-left: 20px;">3</td> </tr> </table> | ● | | $Rc(fa)$ | 3 | $Ra(fa)$ | | ○ | $fa=c, fb=c, R(fa)(fb),$ $\neg Rb(fb), Ra(fa) \not\equiv \perp$ | \perp | 3 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ● | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| $Rc(fa)$ | 3 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| $Ra(fa)$ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ○ | $fa=c, fb=c, R(fa)(fb),$ $\neg Rb(fb), Ra(fa) \not\equiv \perp$ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| \perp | 3 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| \perp | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 QED= | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | $Rb(fb)$ | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 RC | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 IP | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 CP | $R(fa)(fb) \rightarrow Rb(fb)$ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Phi 270 F96 test 3

F96 test 3 questions

(Questions 1-6 are from quiz 3 and 7-9 are from quiz 4 out of 6 quizzes—these two quizzes addressed the part of the course your test is designed to cover.)

Analyze the sentences below in as much detail as possible *without* going below the level of sentences (i.e., without recognizing individual terms and predicates). Be sure that the unanalyzed components of your answer are complete and independent sentences and that you respect any grouping in the English.

1. You won't succeed unless you try.
2. If it was after 5, Sam got in only if he had a key.

Check each of the following claims of entailment using the basic system of derivations (i.e., *do not use* attachment rules but *you may use* detachment rules). If a derivation fails, confirm a counterexample that lurks in an open gap.

3. $(A \wedge B) \rightarrow C \models A \rightarrow C$
4. $C \rightarrow (A \rightarrow B) \models (A \wedge \neg B) \rightarrow \neg C$
5. Analyze the sentence below in as much detail as possible, continuing the analysis when there are no more connectives by identifying predicates, functors, and individual terms. Be sure that the unanalyzed expressions in your answer are independent and that you respect any grouping in the English.

If Ann's car is the one you saw, she wasn't driving it.

6. a. Give two different expansions (using predicate abstracts) of the reduced form: Raa .
b. Put the following into reduced form: $[Fx \wedge Pxb]_x c$.
7. Describe a structure (i.e., an assignment of extensions to the non-logical vocabulary) which makes the following sentences all true. (You may present the structure either using tables or, where possible, using diagrams.)

$$a = c, ga = gb, Pa, \neg P(ga), Rab, Rbc, \neg Rc(ga)$$

Check each of the claims of entailment below using derivations. You need *not* describe counterexample lurking in gaps you leave open.

8. $Ha \wedge c = d, G(fd) \models G(fc) \wedge (a = b \rightarrow Hb)$
9. $Ra(fa) \wedge Rb(fb), fa = b \models Ra(f(fa))$

F96 test 3 answers

1. You won't succeed unless you try
 you won't succeed $\leftarrow \neg$ you will try
 \neg you will succeed $\leftarrow \neg$ you will try

$$\neg S \leftarrow \neg T \text{ or } \neg T \rightarrow \neg S$$

if not T then not S

S: you will succeed; T: you will try

2. If it was after 5, Sam got in only if he had a key
 it was after 5 \rightarrow Sam got in only if he had a key
 it was after 5 \rightarrow (\neg Sam got in $\leftarrow \neg$ Sam had a key)

$$A \rightarrow (\neg G \leftarrow \neg K) \text{ or } A \rightarrow (\neg K \rightarrow \neg G)$$

if A then if not K then not G

A: it was after 5; G: Sam got in; K: Sam had a key

3.

| | | |
|-------|--|--------------------------------------|
| | $(A \wedge B) \rightarrow C$ | 3 |
| | A | (4) |
| | $\neg C$ | (3) |
| 3 MTT | $\neg(A \wedge B)$ | 4 |
| 4 MPT | $\neg B$ | |
| | \circ | $A, \neg B, \neg C \not\equiv \perp$ |
| | \perp | 2 |
| 2 IP | C | 1 |
| 1 CP | A \rightarrow C | |
| A B C | $(A \wedge B) \rightarrow C / A \rightarrow C$ | |
| T F F | F $\textcircled{1}$ $\textcircled{2}$ | |

4.

| | | |
|-------|--|-----|
| | $C \rightarrow (A \rightarrow B)$ | 4 |
| | A \wedge \neg B | 2 |
| 2 Ext | A | (5) |
| 2 Ext | \neg B | (6) |
| | C | (4) |
| 4 MPP | A \rightarrow B | 5 |
| 5 MPP | B | (6) |
| | \bullet | |
| 6 Nc | \perp | 3 |
| 3 RAA | \neg C | 1 |
| 1 CP | (A \wedge \neg B) \rightarrow \neg C | |

5. If Ann's car is the one you saw, she wasn't driving it

Ann's car is the one you saw $\rightarrow \neg$ Ann was driving Ann's car

Ann's car = the car you saw $\rightarrow \neg$ [_ was driving _] Ann (Ann's car)
[_ 's car] Ann = [the car _ saw] you $\rightarrow \neg$ Da([_ 's car] Ann)

$$ca = ro \rightarrow \neg Da(ca)$$

D: [_ was driving _]; a: Ann; c: ['s car]; o: you; r: [the car _ saw]

[ca = ro $\rightarrow \neg$ Da(ro) is also a possible interpretation of the pronoun's reference; the analysis is equivalent to the analysis one but would probably have different implicatures]

6. a. The following are the possibilities; in the last, τ may be any term:

$$[Rxx]_x a, [Rxa]_x a, [Rax]_x a, [Raa]_x \tau$$

b. $Fc \wedge Pcb$

7. range: 1, 2, 3

| | | | | | | | | | | |
|---|---|---|--------|----------|--------|----------|---|---|---|---|
| a | b | c | τ | g τ | τ | P τ | R | 1 | 2 | 3 |
| 1 | 2 | 1 | 1 | 3 | 1 | T | 1 | F | T | F |
| | | | 2 | 3 | 2 | F | 2 | T | F | F |
| | | | 3 | 1 | 3 | F | 3 | F | F | F |

P

(The diagram provides a complete answer, and so do the tables to its left. The tables below show a way of arriving at these answers.)

| <i>alias sets</i> | <i>IDs</i> | <i>values</i> | <i>resources</i> | <i>values</i> |
|-------------------|------------|---------------|------------------|---------------|
| a | 1 | a: 1 | Pa | P1: T |
| c | | c: 1 | $\neg P(ga)$ | P3: F |
| b | 2 | b: 2 | Rab | R12: T |
| ga | 3 | g1: 3 | Rbc | R21: T |
| gb | | g2: 3 | $\neg Rc(ga)$ | R13: F |

8.

| | | |
|--------|---------------------------------------|---------------|
| | $Ha \wedge c = d$ | |
| | $G(fd)$ | (3) |
| 1 Ext | Ha | (5) |
| 1 Ext | $c = d$ | a,b,c-d,fc-fd |
| | ● | |
| 3 QED= | $G(fc)$ | 2 |
| | | |
| | a = b | a-b,c-d,fc-fd |
| | | |
| | ● | |
| 5 QED= | Hb | 4 |
| 4 CP | $a = b \rightarrow Hb$ | 2 |
| 2 Cnj | $G(fc) \wedge (a = b \rightarrow Hb)$ | |

9.

| | | |
|-------|------------------------|---|
| | $Ra(fa) \wedge Rb(fb)$ | 1 |
| | $fa = b$ | $a, b-fa, fb-f(fa)$ |
| 1 Ext | $Ra(fa)$ | |
| 1 Ext | $Rb(fb)$ | |
| | $\neg Ra(f(fa))$ | |
| | \circ | $fa=b, Ra(fa), Rb(fb), \neg Ra(f(fa)) \not\vdash \perp$ |
| | \perp | 2 |
| 2 IP | $Ra(f(fa))$ | |