# Phi 270 F99 test 3  in pdf format

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*.
   [ answer ]
2. *If the power went out, they finished the job only if they had a generator*.
   [ answer ]

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

3. $A \to (\neg B \to C)$ , $C \to D \Rightarrow A \to (\neg D \to B)$
   [ answer ]
4. $(A \land B) \to (C \lor D) \Rightarrow A \to C$
   [ answer ]

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

5. *Adam called Billy's mother and she is the owner of the dog*.
   [ answer ]

[The following question was on a topic not covered in F05] 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. $Rab \to Rbc$
   [ answer ]

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

7. $a = fb$, $Ra(fa) \Rightarrow fb = c \to R(fb)(fc)$
   [ answer ]

# Phi 270 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 ← ¬ the order will go in today*
    *¬ we will have the material by Thursday ← ¬ the order will go in today*

    $$¬ H ← ¬ T \ [or: ¬ T → ¬ H]$$
    if not T then not H

    [H: *we will have the material by Thursday*; T: *the order will go in today*]
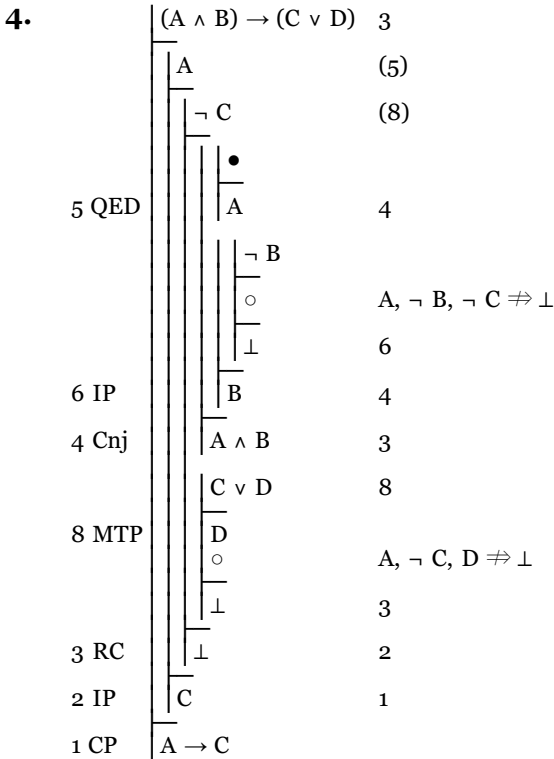
2.  *If the power went out, they finished the job only if they had a generator*
    *the power went out → they finished the job only if they had a generator*
    *the power went out → (¬ they finished the job ← ¬ they had a generator)*

    $$O → (¬ F ← ¬ G) \ [or: O → (¬ G → ¬ F)]$$
    if O then if not G then not F

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

3.

| | | |
|---|---|---|
| | A → (¬ B → C) | 3 |
| | C → D | 4 |
| | A | (3) |
| | ¬ D | (4) |
| 3 MPP | ¬ B → C | 5 |
| 4 MTT | ¬ C | (5) |
| 5 MTT | B | (6) |
| | ● | |
| 6 QED | B | 2 |
| 2 CP | ¬ D → B | 1 |
| 1 CP | A → (¬ D → B) | |

**4.**

$$(A \land B) \to (C \lor D) \quad 3$$

| | A | (5) |
| | ¬ C | (8) |

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5 QED | A | 4

¬ B

○      A, ¬ B, ¬ C ⇏ ⊥

⊥ | 6

6 IP | B | 4

4 Cnj | A ∧ B | 3

C ∨ D | 8

8 MTP | D

○      A, ¬ C, D ⇏ ⊥

⊥ | 3

3 RC | ⊥ | 2

2 IP | C | 1

1 CP | A → C

| A B C D | (A ∧ B) → (C ∨ D) | / | A → C | |
|---|---|---|---|---|
| T F F F | F  Ⓣ  F | | Ⓕ | divides 1st gap |
| T F F T | F  Ⓣ  T | | Ⓕ | divides both gaps |
| T T F T | T  Ⓣ  T | | Ⓕ | divides 2nd gap |

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

*Adam* called *Billy's mother* ∧ *Billy's mother* is *the owner of the dog*

[λxy (x *called* y)] *Adam* *Billy's mother* ∧ *Billy's mother* = *the owner of the dog*

Ca(*Billy's mother*) ∧ *Billy's mother* = *the owner of the dog*

Ca([λx (x*'s mother*)] *Billy*) ∧ [λx (x*'s mother*)] *Billy* = [λx (*the owner of* x)] *the dog*

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

[C: λxy (x *called* y); a: *Adam*; b: *Billy*; d: *the dog*; m: λx (x*'s mother*); o: λx (*the owner of* x)]

**6.** [The following question was on a topic not covered in F05]

[λx (Rxb → Rbc)]a
[λx (Rax → Rbc)]b
[λx (Rab → Rxc)]b
[λx (Rax → Rxc)]b
[λx (Rab → Rbx)]c

**7.**

$$a = fb \qquad\qquad\qquad \text{a-fb, b, c, fa, fc}$$
$$Ra(fa) \qquad\qquad\qquad (2)$$

fb = c          a-fb-c, b, fa-fc

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2 QED=   R(fb)(fc)          1

1 CP     fb = c → R(fb)(fc)