# Phi 270 F98 quiz 2 (of 6) in pdf format

1.  Analyze the sentence below in as much detail as possible and express the result in both symbolic and English notation. Be sure that the unanalyzed components of your answer are complete and independent sentences and try to respect any grouping in the original sentence.

    *Bob didn't have both fuel and either a match or a lighter*

    [ answer ]

2.  Synthesize an idiomatic English sentence expressing the proposition which is assigned to the symbolic form below by the intensional interpretation to its right--i.e., give an English sentence whose analysis would be the following:

    $$\neg ((A \land B) \lor (N \land L))$$

    [A: *Carol saw Ann*; B: *Carol saw Bill*; N: *Dave saw Ann*; L: *Dave saw Bill*]

    [ answer ]

Use derivations to check each of the following claims of entailment. You may use the detachment rule MPT but not MTP; although the use of MPT is not necessary, it can shorten a couple of the derivations. If a derivation fails, present a counterexample that divides an open gap.

3.  $B \Rightarrow \neg (A \land \neg B)$
    [ answer ]
4.  $\neg (A \land B) \Rightarrow \neg (C \land \neg B)$
    [ answer ]
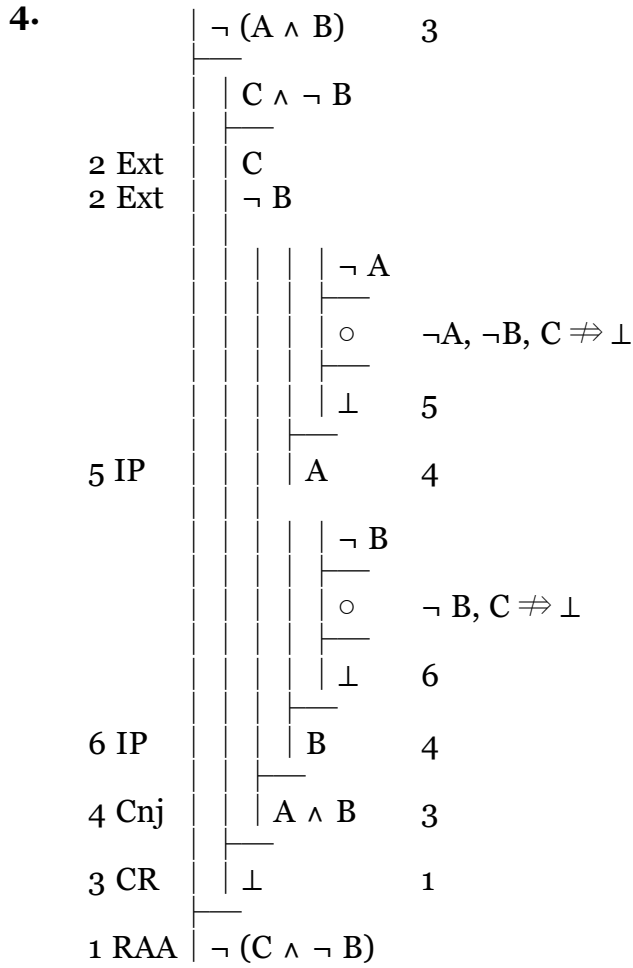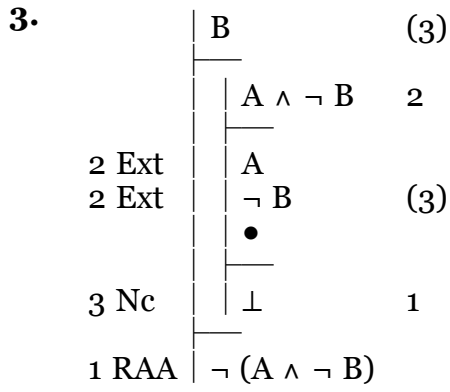5.  $\neg (A \land \neg (B \land C)) \Rightarrow \neg (A \land \neg C)$
    [ answer ]
6.  $A \lor (B \land C) \Rightarrow C \lor A$
    [ answer ]

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## Phi 270 F98 quiz 2 answers

1.  *¬ Bob had both fuel and either a match or a lighter*
    *¬ (Bob had fuel ∧ Bob had either a match or a lighter)*
    *¬ (Bob had fuel ∧ (Bob had a match ∨ Bob had a lighter))*

    $$\neg (F \land (M \lor L))$$

    not both F and either M or L

    [F: *Bob had fuel*; L: *Bob had a lighter*; M: *Bob had a match*]

2.  *¬ ((Carol saw Ann ∧ Carol saw Bill) ∨ (Dave saw Ann ∧ Dave saw Bill))*
    *¬ (Carol saw both Ann and Bill ∨ Dave saw both Ann and Bill)*
    *Neither Carol nor Dave saw both Ann and Bill*

**3.**

| | B | (3) |

| | | A ∧ ¬ B | 2 |
| 2 Ext | | A |
| 2 Ext | | ¬ B | (3) |
| | | • |
| 3 Nc | | ⊥ | 1 |
| 1 RAA | ¬ (A ∧ ¬ B) |

**4.**

| | ¬ (A ∧ B) | 3 |

| | | C ∧ ¬ B |
| 2 Ext | | C |
| 2 Ext | | ¬ B |

| | | ¬ A |
| | | ○ | ¬A, ¬B, C ⇏ ⊥ |
| | | ⊥ | 5 |
| 5 IP | | A | 4 |

| | | ¬ B |
| | | ○ | ¬ B, C ⇏ ⊥ |
| | | ⊥ | 6 |
| 6 IP | | B | 4 |
| 4 Cnj | | A ∧ B | 3 |
| 3 CR | | ⊥ | 1 |
| 1 RAA | ¬ (C ∧ ¬ B) |

| A B C | ¬ (A ∧ B) / ¬ (C ∧ ¬ B) | | | | |
|-------|------|---|----|-----|----|
| T F T | Ⓣ | F | Ⓕ | T T | divides both gaps |
| F F T | Ⓣ | F | Ⓕ | T T | divides the second gap |

**5.**

Left derivation:

| | ¬ (A ∧ ¬ (B ∧ C)) | 3 |
|---|---|---|
| | A ∧ ¬ C | 2 |
| 2 Ext | A | (5) |
| 2 Ext | ¬ C | (8) |
| | • | |
| 5 QED | A | 4 |
| | B ∧ C | 7 |
| 7 Ext | B | |
| 7 Ext | C | (8) |
| | • | |
| 8 Nc | ⊥ | 6 |
| 6 RAA | ¬ (B ∧ C) | 4 |
| 4 Cnj | A ∧ ¬ (B ∧ C) | 3 |
| 3 CR | ⊥ | 1 |
| 1 RAA | ¬ (A ∧ ¬ C) | |

*OR*

Right derivation:

| | ¬ (A ∧ ¬ (B ∧ C)) | 3 |
|---|---|---|
| | A ∧ ¬ C | 2 |
| 2 Ext | A | (3) |
| 2 Ext | ¬ C | (5) |
| 3 MPT | B ∧ C | 4 |
| 4 Ext | B | |
| 4 Ext | C | (5) |
| | • | |
| 5 Nc | ⊥ | 1 |
| 1 RAA | ¬ (A ∧ ¬ C) | |

**6.**

Left derivation:

| | A ∨ (B ∧ C) | 2 |
|---|---|---|
| | ¬ C | (6) |
| | A | (3) |
| | • | |
| 3 QED | A | 2 |
| | B ∧ C | 4 |
| 4 Ext | B | |
| 4 Ext | C | (6) |
| | ¬ A | |
| | • | |
| 6 Nc | ⊥ | 5 |
| 5 IP | A | 2 |
| 2 PC | A | 1 |
| 1 PE | C ∨ A | |

*OR*

Right derivation:

| | A ∨ (B ∧ C) | 2 |
|---|---|---|
| | ¬ A | (2) |
| 2 MTP | B ∧ C | 3 |
| 3 Ext | B | |
| 3 Ext | C | (4) |
| | • | |
| 4 QED | C | 1 |
| 1 PE | C ∨ A | |