Phi 270 F04 test 2 | in pdf format |

Analyze each sentence below in as much detail as possible, presenting the result using both in symbols and using English notation (i.e., both … and, etc.). 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 found his wallet but not his keys*
   [answer]
2. *Mike didn't notice the problem, but either Nina or Oscar did*
   [answer]
3. *Neither the house nor the apartment was both cheap and roomy*
   [answer]

Use derivations to check whether each of the entailments below holds. If one fails, present a counterexample by providing a table in which you calculate the truth values of the premises and conclusion on an extensional interpretation (i.e., an assignment of truth values) that divides an open gap.

Do not use attachment or detachment rules in **4-6**. That is, do not use Adj or the rules MTP, MPT, and Wk of §4.3; instead use only the basic rules for exploiting resources, planning for goals, and closing gaps.

4. A ∧ ¬ C ⇒ ¬ (B ∧ C)
   [answer]
5. ¬ (B ∧ C), A ∧ B ⇒ A ∧ ¬ C
   [answer]
6. A ∨ B ⇒ A ∨ C
   [answer]

In **7** you ***may*** use attachment and detachment rules (and their use can simplify the derivation).

7. ¬ (A ∧ B), A ∨ ¬ C ⇒ ¬ (B ∧ C)
   [answer]

Phi 270 F04 test 2 answers

1. *Dan found his wallet but not his keys*
   Dan found his wallet ∧ *Dan didn't find his keys*
   Dan found his wallet ∧ ¬ *Dan found his keys*
   $$W \wedge \neg K$$
   both W and not K
   [K: *Dan found his keys*; W: *Dan found his wallet*]

2. *Mike didn't notice the problem, but either Nina or Oscar did*
   Mike didn't notice the problem ∧ *either Nina or Oscar noticed the problem*
   ¬ *Mike noticed the problem* ∧ (*Nina noticed the problem* ∨ *Oscar noticed the problem*)
   $$\neg M \wedge (N \vee O)$$
   both not M and either N or O
   [M: *Mike noticed the problem*; N: *Nina noticed the problem*; O: *Oscar noticed the problem*]

3. *Neither the house nor the apartment was both cheap and roomy*
   ¬ *either the house or the apartment was both cheap and roomy*
   ¬ (*the house was both cheap and roomy* ∨ *the apartment was both cheap and roomy*)
   ¬ ((*the house was cheap* ∧ *the house was roomy*) ∨ (*the apartment was cheap* ∧ *the apartment was roomy*))
   $$\neg ((C \wedge R) \vee (H \wedge M))$$
   not either both C and R or both H and M
   [C: *the house was cheap*; H: *the apartment was cheap*; R: *the house was roomy*; M: *the apartment was roomy*]

   ¬ (C ∧ R) ∧ ¬ (H ∧ M) and (¬ C ∨ ¬ R) ∧ (¬ H ∨ ¬ M) are also equivalent (though further from the English); however, (¬ C ∧ ¬ R) ∧ (¬ H ∧ ¬ M) is not equivalent to these sentences. The latter is equivalent to ¬ (C ∨ R) ∧ ¬ (H ∨ M) and ¬ ((C ∨ R) ∨ (H ∨ M)), and those sentences say: *neither the house nor the apartment was either cheap or roomy*.

4.

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

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

6.

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              | A ∨ B          2
              |   | ¬ C
              |   |   | A          (3)
              |   |   | •
3 QED  |   | A              2
              |   | B
              |   |   | ¬ A
              |   |   | ○    ¬ A, B, ¬ C ⇏ ⊥
              |   |   | ⊥          4
4 IP     |   | A              2
2 PC    | A                  1
1 PE    | A ∨ C
```

A B C	A ∨ B / A ∨ C
F T F	Ⓣ Ⓕ

7. The first answer below uses detachment rules while the second shows how to construct a derivation in this case without them.

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

```
              | ¬ (A ∧ B)     3
              | A ∨ ¬ C       6
              |   | B ∧ C       2
2 Ext   |   | B              (5)
2 Ext   |   | C              (9)
              |   |   |   | A          (7)
              |   |   |   | •
7 QED  |   |   |   | A          6
              |   |   |   | ¬ C        (9)
              |   |   |   |   | ¬ A
              |   |   |   |   | •
9 Nc    |   |   |   |   | ⊥          8
8 IP     |   |   |   | A          6
6 PC    |   |   | A              4
              |   |   | •
5 QED  |   |   | B              4
4 Cnj  |   | A ∧ B        3
3 CR    |   | ⊥              1
1 RAA | ¬ (B ∧ C)
```