**CSCE476/876** **Spring 2008**

**Homework 8**

**Assigned on:** Monday, April 7, 2008.

**Due:** Friday, Apr 18, 2008.

---

# Contents



This is a pen-and-paper homework, to be returned in class
The whole homework is worth 95 points

---

# 1 Truth Tables 8 points

Use truth tables to show that each of the following is a tautology.

1. $(p \wedge q) \rightarrow \neg(\neg p \vee \neg q)$
2. $[Mary \wedge (Mary \rightarrow Susy)] \rightarrow Susy$
3. $\alpha \rightarrow [\beta \rightarrow (\alpha \wedge \beta)]$
4. $(a \rightarrow b) \rightarrow [(b \rightarrow c) \rightarrow (a \rightarrow c)]$

# 2 AIMA, Exercise 7.2, page 236. 16 points

# 3 AIMA, Exercise 7.8, page 237. 16 points

only c, d, e, f, g and h.

## 4 Logical Equivilences 8 points

Using a method of your choice, verify:

1. $(\alpha \to \beta) \equiv (\neg\beta \to \neg\alpha)$ contraposition
2. $\neg(\alpha \wedge \beta) \equiv (\neg\alpha \vee \neg\beta)$ de Morgan
3. $(\alpha \wedge (\beta \vee \gamma)) \equiv ((\alpha \wedge \gamma) \vee (\alpha \wedge \beta))$ distributivity of $\wedge$ over $\vee$

## 5 Proofs 29 points

Give the explantions of each step if the steps are given, and give both the explanation and step if they are not.

- If $q \wedge (r \wedge p), t \to v, v \to \neg p$, then $\neg t \wedge r$.

  **Proof** **Explanations**

  1. $q \wedge (r \wedge p)$ Given
  2. $t \to v$ Given
  3. $v \to \neg p$ Given
  4. $t \to \neg p$
  5. $(r \wedge p)$
  6. $r$
  7. $p$
  8. $\neg\neg p$
  9. $\neg t$
  10. $\neg t \wedge r$

- If $p \to (q \wedge r), q \to s$, and $r \to t$, then $p \to (s \wedge t)$.

  **Proof** **Explanations**

  1.
  2.
  3.
  4.
  5.
  6.
  7.

- **Prove by contradiction.**

  If $\neg(\neg p \wedge q), p \rightarrow (\neg t \vee r), q$, and $t$, then $r$.

  | **Proof** | **Explanations** |
  |---|---|
  | 1. $\neg(\neg p \wedge q)$ | Given |
  | 2. $p \rightarrow (\neg t \vee r)$ | Given |
  | 3. $q$ | Given |
  | 4. $t$ | Given |
  | 5. $\neg r$ | Negation of Conclusion |
  | 6. | |
  | 7. | |
  | 8. | |
  | 9. | |
  | 10. | |
  | 11. | |
  | 12. | |

# 6 AIMA, Exercise 7.11, page 238. 18 points + 20 bonus

Parts a, b, and c are required. Parts d, e, and f are bonus.