

CS 81 Assignment for next Wed., Feb. 2

Exercises in Hein book:

1. Ex. 10 on p 383

2. Ex. 8.d on p 367

3. Ex. 8.f on p 367

4. Which of these are tautologies?

a. $((\neg p) \rightarrow p)$

b. $p \rightarrow ((\neg p) \rightarrow p)$

c. $((\neg p) \rightarrow p) \rightarrow p$

d. $p \vee (\neg p)$

e. $(p \wedge (\neg p)) \rightarrow p$

f. $(p \vee (\neg p)) \rightarrow p$

g. $(p \wedge q) \rightarrow (p \vee q)$

h. $((\neg p) \rightarrow q) \rightarrow (p \vee q)$

i. $(\neg(p \rightarrow q)) \rightarrow ((\neg p) \rightarrow q)$

5. When something is not a tautology, there must be at least one assignment (of truth values to propositions) that induces the value false.

For each non-tautology above, show such an assignment.

6. Logical equivalence is expressed by the connective \equiv , where $A \equiv B$ is viewed as an abbreviation for $(A \rightarrow B)$ and $(B \rightarrow A)$.

Which of the following are tautologies? Justify your answers.

j. $(p \rightarrow q) \equiv ((\neg p) \vee q)$

k. $(\neg(p \wedge q)) \equiv ((\neg p) \wedge (\neg q))$

l. $(\neg(p \vee q)) \equiv ((\neg p) \wedge (\neg q))$

m. $(p \rightarrow (q \rightarrow (r \rightarrow s))) \equiv ((p \wedge (q \wedge r)) \rightarrow s)$

n. $((p \rightarrow q) \rightarrow r) \rightarrow s \equiv (((p \wedge q) \wedge r) \rightarrow s)$

o. $(p \rightarrow q) \equiv ((\neg q) \rightarrow (\neg p))$

7. Devise a natural deduction proof rules for \equiv introduction and elimination.