

Discrete Structures. CSCI-150. Spring 2014.

Homework 1.

Due Fri. Feb 7, 2014.

Problem 1

Using the following propositions:

p : “Phyllis goes out for a walk”.

r : “The Moon is out”.

s : “It is snowing”.

Formulate these statements in words:

(a) $(r \wedge \neg s) \rightarrow p$

(b) $r \rightarrow (\neg s \rightarrow p)$

(c) $\neg(p \leftrightarrow (s \vee r))$

Problem 2

Write out the truth table for the following propositions:

(a) $\neg q \leftrightarrow (p \vee q)$

(b) $(r \wedge \neg s) \rightarrow p$

Compute one operation at a time, don't skip steps.

Problem 3

Check if the given propositions are equivalent or not:

(a) $\neg(p \leftrightarrow s)$ and $(\neg p) \leftrightarrow (\neg s)$

(b) $p \leftrightarrow s$ and $(\neg p) \leftrightarrow (\neg s)$

(c) $(p \wedge \neg r) \wedge \neg s$ and $\neg(p \rightarrow (r \vee s))$

Problem 4

You are given an argument, but it's incomplete. Finish the work by giving the reasons why each step was correct.

(a) Prove

$$\frac{\begin{array}{c} p \wedge q \\ q \rightarrow (r \wedge s) \end{array}}{r}$$

Complete the argument

- | | | |
|-----|------------------------------|--------|
| (1) | $p \wedge q$ | Given. |
| (2) | $q \rightarrow (r \wedge s)$ | Given. |
| (3) | q | ... |
| (4) | $r \wedge s$ | ... |
| (5) | r | ... |

(b) Prove

$$\frac{\begin{array}{c} p \rightarrow (\neg s \wedge r) \\ s \vee t \\ p \end{array}}{t}$$

Complete the argument

- | | | |
|-----|-----------------------------------|--------|
| (1) | $p \rightarrow (\neg s \wedge r)$ | Given. |
| (2) | $s \vee t$ | Given. |
| (3) | p | Given. |
| (4) | $\neg s \wedge r$ | ... |
| (5) | $\neg s$ | ... |
| (6) | t | ... |

(c) Prove

$$\frac{\begin{array}{c} (\neg p \vee s) \leftrightarrow q \\ \neg q \end{array}}{p}$$

Complete the argument

- | | | |
|-----|--|--------|
| (1) | $(\neg p \vee s) \leftrightarrow q$ | Given. |
| (2) | $\neg q$ | Given. |
| (3) | $((\neg p \vee s) \rightarrow q) \wedge (q \rightarrow (\neg p \vee s))$ | ... |
| (4) | $(\neg p \vee s) \rightarrow q$ | ... |
| (5) | $\neg(\neg p \vee s)$ | ... |
| (6) | $\neg(\neg p) \wedge \neg s$ | ... |
| (7) | $\neg(\neg p)$ | ... |
| (7) | p | ... |