Math 171 – Discrete Mathematical Structures

Today’s Overview

Homework Expectations

Conditional Statements: \( p \to q \)
Truth Table for \( p \to q \)
Equivalence of \( p \to q \) and \( \sim p \lor q \)
Conditional tautologies (backtracking method)
Negation of the Condition
Contrapositive, Converse, and Inverse of Conditional
If and only if: the bi-conditional;
Necessary and Sufficient Conditions

Homework Expectations

Name, Date, and Assignment Number must appear clearly at top
For each problem write down:
page number and problem number
copy question
show work
"box" the answer (should be correct)
Neatness is important (so I can read it)
Use clean ruled notebook paper; do not rip pages out of spiral bound notebooks

More \( p \to q \) Examples

Which of the following are tautologies?

a. \((p \to q) \to p\)
b. \(p \to (q \to p)\)
c. \(p \lor q \to p\)
d. \(p \land q \to p\)

Backtracking - a method for detecting conditional tautologies:
Assume the conditional form \( p \to q \) is false which implies the expression \( p \) is true but \( q \) is false. Then work backwards assigning \( T \) and \( F \) values to variables to derive a contradiction!

Negation, Contrapositive, Converse, and Inverse

Negation: \(~(p \to q)\) \equiv \((\sim p \lor q)\) \equiv \(\sim p \land \sim q\) \equiv \(p \land \sim q\)
Contrapositive: \(~q \to ~p\)
Converse: \(q \to p\)

Note: \(p \to q \equiv \sim q \to \sim p\)

How would you show this?
Sometimes it’s easier to prove the contrapositive form of a conditional statement.

Inverse: \(~p \to ~q\)
Note: \(p \to \sim q \equiv \sim(p \to q)\)

Bi-conditional: \(p \leftrightarrow q\) if and only if \(q\)

Logical Equivalence of \(p \leftrightarrow q\) and \((p \to q) \land (q \to p)\)

Logical Equivalence and bi-conditional tautologies

Necessary and Sufficient Conditions

\(r\) is sufficient for \(s\) if \(r\) then \(s\)
\(r\) is a necessary condition for \(s\) if not \(r\) then not \(s\)
\(\equiv \sim r \to \sim s\) \equiv \(s \to r\)
Written Homework #4 – Due F 9/6/13

Exercises Set 2.2 (p. 49): #14, #15, #18, #20, #22, #23, #47

- negation
- contrapositive
- converse & inverse