

Math 140: Logic: Conditionals

Conditional Statements

The statement “If p , then q .” Symbolized by $p \rightarrow q$ is called a conditional statement. This is also called _____.

p is called the _____

q is called the _____

Example

If I get my work done by 4 pm, then we will go for a walk.

“I get my work done by 4 pm” is the _____.

“We will go for a walk” is the _____.

There are four possibilities: 1. I get my work done by 4 pm; We go for a walk.

2. I get my work done by 4 pm; We don’t go for a walk.

3. I don’t get my work done by 4 pm; We go for a walk.

4. I don’t get my work done by 4 pm; We don’t go for a walk.

When is the promise broke?

Truth Table for the Conditional

p	q	$p \rightarrow q$
T	T	_____
T	F	_____
F	T	_____
F	F	_____

Hidden Conditional Statements

Re-write using the if...then...connective:

1. We will go for a walk if I get my work done by 4 pm.

2. Every picture tells a story.

3. No guinea pigs are scholars.

4. It is difficult to study when you are distracted.

Symbolic Translation

Given that:

p : I drive to work

q : The dog eats my shoes

r : Milk costs \$3.50 per gallon

Translate into symbols:

1. If I do not drive to work, then milk costs \$3.50 per gallon.

2. I drive to work or if the dog does not eat my shoes then milk costs \$3.50 per gallon.

Relationships Between Conditional Statements

For the conditional $p \rightarrow q$:

Converse: $q \rightarrow p$

Inverse: $\sim p \rightarrow \sim q$

Contrapositive: $\sim q \rightarrow \sim p$

Example

Write the following for the conditional statement: "If you build it, he will come."

Converse:

Inverse:

Contrapositive:

Biconditional

p if and only if q (p is necessary and sufficient for q)

Symbol: _____

Truth table for the biconditional:

p	q	$p \leftrightarrow q$
T	T	_____
T	F	_____
F	T	_____
F	F	_____

Construct the truth table for the statement:

$$(p \wedge \sim q) \leftrightarrow [(\sim p \vee q) \rightarrow p]$$

p	q	$\sim p$	$\sim q$	$p \wedge \sim q$	$\sim p \vee q$	$(\sim p \vee q) \rightarrow p$	$(p \wedge \sim q) \leftrightarrow [(\sim p \vee q) \rightarrow p]$
T	T	F	F				
T	F	F	T				
F	T	T	F				
F	F	T	T				