CSCI 301 - Logic 3: Iff, Equivalence, Quantifiers
(Lecture 7)

Biconditional Statements

"P if and only if Q"

$$P \Leftrightarrow Q$$

P	Q	$P \Rightarrow Q$
T	T	T
T	F	F
F	T	T
F	F	T

Do Exercises Pt A → B

Logical Equivalence

$$P \equiv Q$$

if and only if

Statements are equivalent iff their truth tables match exactly.

Example: Does $\wedge$ distribute over $\vee$?

That is,

$$\underbrace{A \wedge (B \vee C)}_{P} \overset{?}{\equiv} \underbrace{(A \wedge B) \vee (A \wedge C)}_{Q}$$

A	B	C	P	Q
T	T	T	T	T
T	T	F	T	T
T	F	T	T	T
T	F	F	F	F
F	T	T	F	F
F	T	F	F	F
F	F	T	F	F
F	F	F	F	F

Do Exercises Pt. C

Quantifiers: $\forall$, $\exists$

\forall

"for every"

$\forall x$ means "for all x"

universal quantifier

"for each"

For every integer x, $2x$ is also an integer.

$$\forall x \in \mathbb{Z},\ 2x \in \mathbb{Z}$$

$\exists x$ means "there exists a"

"there is a"

existential quantifier

There is an integer that is even.

$$\exists x \in \mathbb{Z},\ \overset{\text{(such that)}}{\wedge}\ x \text{ is even}$$