

The background of the slide features several intricate, glowing blue fractal-like patterns. These patterns consist of many fine, intersecting lines that form complex, star-like or floral shapes. They are set against a solid black background, which makes the blue lines stand out prominently. The patterns are distributed across the slide, with some appearing more concentrated on the left side and others more spread out towards the right.

# Semantics in Sentential Logic

Unit 2 Part 2: Truth-Tables

"There are 400 students in this class"



How do we know when a  
**molecular** statement is **true**?

“If the Raptors win then I’ll be happy”



The truth will  
**depend** on its **parts**

# Logical Connectives are TRUTH FUNCTIONAL

The truth value of any molecular statement is entirely determined by (a function of) the truth value of its parts

We use a TRUTH-TABLE  
to make this clear

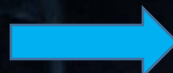
# Negation $\sim$

P	$\sim P$
T	F
F	T


The truth of a negation statement is entirely determined by what it is negating

# Conjunction $\wedge$

Sometimes written & or •



P	Q	$P \wedge Q$
T	T	T
T	F	F
F	T	F
F	F	F

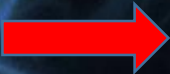


$P \wedge Q$  is true only when  
both **CONJUNCTS** are true




# Disjunction $\vee$

Or in logic is the **INCLUSIVE** sense



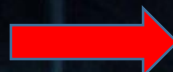
P	Q	$P \vee Q$
T	T	T
T	F	T
F	T	T
F	F	F




$P \vee Q$  is true when one, the other,  
or both **DISJUNCTS** are true

# Conditional →

Also known as “if, then” and can be written  $\supset$



P	Q	$P \rightarrow Q$
T	T	T
T	F	F
F	T	T
F	F	T



The front part (P) is called the **ANTECEDENT**  
The back part (Q) is called the **CONSEQUENT**



Why is the conditional true  
when the antecedent is false?



If I clap a sound will be made.

1. I clap and a sound is made
2. I clap and a sound isn't made
3. I don't clap and a sound is made
4. I don't clap and a sound isn't made

Case 2 is the only one that violates my claim

# Biconditional $\leftrightarrow$

“if and only if” and can be written  $\equiv$

P	Q	$P \leftrightarrow Q$
T	T	T
T	F	F
F	T	F
F	F	T

$P \leftrightarrow Q$  is true only when P and Q have the **same** truth value