

## 305 Lecture 16 - Building Truth Tables

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Brian Weatherson

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# Plan

This lecture is about how we build truth tables.

## Four Main Connectives

- Building truth tables requires, unfortunately, a small amount of memorization.
- In particular, you just have to memorize the truth tables for each of the connectives.
- Equally unfortunately, justifying yourself using truth tables requires justifying these basic tables.
- And as we'll see, that's not trivial.
- But that's for much down the line - let's learn how to use these first, then we'll get to justifying them.

# Negation Table

A	$\neg$ A
T	F
F	T

You should read it as saying that if A is T then  $\neg A$  is F, and if A is F, then A is T.

# The Conjunction Table

A	B	A $\wedge$ B
T	T	T
T	F	F
F	T	F
F	F	F

## Conjunction in Words

- A conjunction is **T** if both conjuncts are **T**, and is **F** otherwise.

# The Disjunction Table

A	B	A $\vee$ B
T	T	T
T	F	T
F	T	T
F	F	F

## Disjunction in Words

- A disjunction is **T** if either disjunct is **T**, and is **F** otherwise.



# The Conditional Table

A	B	$A \rightarrow B$		
T	T	T	T	T
T	F	T	F	F
F	T	F	T	T
F	F	F	T	F

# Material Implication

Note that these three sentences have exactly the same table.

A B	$A \rightarrow B$	$\neg A \vee B$	$\neg (A \wedge \neg B)$
T T	T T T	F T T T	T T F F T
T F	T F F	F T F F	F T T T F
F T	F T T	T F T T	T F F F T
F F	F T F	T F T F	T F F T F

This conditional is sometimes called **material implication**.

It is certainly an odd interpretation of 'if' that makes these sentences turn out true.

- If I am 200 years old, then Michigan is part of Canada.
- If I am in Los Angeles, then I am in Ann Arbor.

But they are both true on this table.

- It turns out that interpreting the conditional this way makes the most sense of the role of conditionals in certain arguments, in particular to do with disjunctive syllogism.
- There is an allusion to this at the end of chapter 1 of *Boxes and Diamonds*.

## For Next Time

We'll talk about how to use truth tables to check for validity.