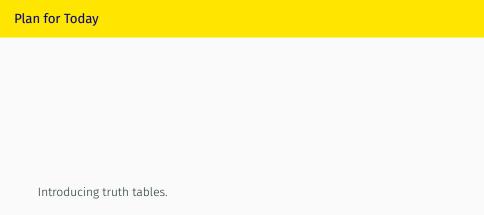
# 305 Lecture 15 - Truth Tables

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Carnap book, chapter 10, first half.

# Conceptual Idea

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- For each possible combination, evaluate the truth of every part of every sentence in an argument.
- See if it is possible for the premises to be true and the conclusion false.



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# **Truth Tables and Validity**

- If an argument is invalid, there will be one combination of values where the premises are true and the conclusion false.
- · If there is no such combination, mark the argument valid.
- If there is such a combination, tentatively mark the argument invalid.
- · We'll come back to why 'tentatively'.

#### Structure

- · We list each of the combinations in separate rows.
- In each column we list the truth value of the sentence such that the symbol at the top of that column is the main connective.
- That's I think a lot easier to understand in practice than in theory, so let's start with some examples.

## A Truth Table

### **One Sentence**

This is a truth table for a single sentence, not an argument. We'll get to arguments in a bit.

# Understanding

We will also get (even sooner) to how to build these monsters. What I first want to talk about is how to read them.

#### **Four Rows**

Each of the four rows represent a way things could be. For instance, the second row (bolded here) represents how things are if *P* is true and *Q* is false.

#### **Four Rows**

There are four rows because there are 2 sentence letters - P and Q - each of which could take 2 values, so there are  $2\times 2=4$  combinations of values.

### More Rows!

- · If there had been three sentence letters, there would be eight rows.
- · Four sentence letters would mean 16 rows, etc.

#### The Columns

- The columns under the letters reflect the value of the atomic sentences in each row.
- · As you can see, they are just cut-and-paste from the left hand side.

## **Atomic Columns**

I've bolded all the truth values for *P*, which as you can see were just copied and pasted from the columns on the far left.

## **Intermediate Sentences**

The surprising thing (or at least the thing that surprised me as a student) was what we mean by the column under the  $\rightarrow$ , which I've bolded.

### **Intermediate Sentences**

Each letter here is giving the truth value of the sentence that has that first  $\rightarrow$  as its main connective. That is,  $P \rightarrow Q$ .

### **Intermediate Sentences**

And this column gives the truth values for  $Q \rightarrow P$ .

### Conditionals

Don't worry for now about why we write those letters down; we'll get to that in the next lecture. For now I just want to go over how to read these tables.

# The Big Red Column

- And the column that I've put in red gives the truth value of the sentence whose main connective is V.
- · That is, in this case, the whole sentence.

# The Big Red Column

Ultimately the red column is all we really care about - the others are essentially scaffolding.

# Logical Truth

- There is something distinctive about this table the red column is all T.
- · That means the sentence is a logical truth.
- We'll have more to say about this presently in future lectures.



We'll talk about how to build truth tables.