**Philosophical Method Day 7: Evaluating Validity Using Truth Tables**

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| **Content:**  1. Truth tables for Arguments (25 minutes)  2. Practice using truth tables to evaluate validity (25 minutes) | **Method:**  1. Interactive lecture  2. Class exercise (video clip and activity) |

***Instructor’s Introduction***: This lesson demonstrates precisely how to create and use truth tables to evaluate the validity of arguments.

# *Goals and Key Concepts*

1. Students should understand how to properly create a truth table for an argument.
2. Students should understand how to use the information in a truth table to evaluate the validity of an argument.
3. Key concepts: no new concepts

**1. Truth Tables for Arguments**

Let’s revisit how to create truth tables for arguments. First we have to have a column for each atomic sentence that appears in the argument. We also need a column for every premise, one for the conclusion, and one for each time we need to add a connective to create a building block for a premise or the conclusion (the latter will become more apparent in the examples below). We need 2n rows, where n is the number of atomic sentences that appear in the argument. For two atomic sentences we need four rows, for three atomic sentences we need eight rows, etc. The columns for the atomic sentences should be grouped together to the left. To make sure we include every possible permutation of truth values (all cases that could happen), begin with the rightmost atomic sentence column and alternate T then F going down the column. Move one column to the left and alternate groups of two T’s then two F’s. Go to the next column to the left and alternate groups of four T’s and four F’s, and so on. Now fill in the rest of the columns by putting in the appropriate truth value in each cell based on the truth values for the atomic sentences on that row and the definitions (truth tables) of the connectives. When you’ve done all that, indicate which columns are premises and which is the conclusion. Then see if there are any rows in which all the premises are T but the conclusion is F. If not, the argument is valid. If one or more such rows exist, then the argument is invalid.

Let’s create truth tables for the latter two arguments we just translated in lesson 6 to see if they are valid.

Example 1:

P ∨ ¬Q

¬P

¬Q

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **P** | **Q** | **¬P** | **¬Q** | **P ∨ ¬Q** |
| T | T | F | F | T |
| T | F | F | T | T |
| F | T | T | F | F |
| F | F | T | T | T |

To make it easier to see, the columns shaded in yellow are the premises and the column shaded in green is the conclusion. (The columns were added to the table in an order determined by attaching one connective at a time as we create premises and the conclusion. Since ¬Q is needed in order to create P ∨ ¬Q, it appears to the left of that premise. But it also happens to be the conclusion.)

Is this argument valid? Both premises are true only on the bottom row, on which the conclusion is true as well.

Verdict: valid

Example 2:

P ↔ ¬Q

¬Q

P

|  |  |  |  |
| --- | --- | --- | --- |
| **P** | **Q** | **¬Q** | **P ↔ ¬Q** |
| T | T | F | F |
| T | F | T | T |
| F | T | F | T |
| F | F | T | F |

Is this argument valid? Both premises are true only on the second row, on which the conclusion is true as well.

Verdict: valid

Let’s look at a few more examples.

Example 3:

P ∨ Q

Q → R

P

R

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **P** | **Q** | **R** | **P ∨ Q** | **Q → R** |
| T | T | T | T | T |
| T | T | F | T | F |
| T | F | T | T | T |
| T | F | F | T | T |
| F | T | T | T | T |
| F | T | F | T | F |
| F | F | T | F | T |
| F | F | F | F | T |

Is this argument valid? All three premises are true on rows one, three, and four. However, the conclusion is false on row four. So there is at least case in which all the premises are true but the conclusion is false.

Verdict: invalid

Example 4:

P ∧ Q

P ∨ R

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **P** | **Q** | **R** | **P ∧ Q** | **P ∨ R** |
| T | T | T | T | T |
| T | T | F | T | T |
| T | F | T | F | T |
| T | F | F | F | T |
| F | T | T | F | T |
| F | T | F | F | F |
| F | F | T | F | T |
| F | F | F | F | F |

Is this argument valid? The premise is true on rows one and two, and the conclusion is also true on those rows.

Verdict: valid

**2. Practice Using Truth Tables to Evaluate Validity**

Show the witch’s trial scene from Monty Python’s Holy Grail, which is available here: <http://www.youtube.com/watch?v=UTdDN_MRe64>

After showing the video clip, break students up into small groups. Ask each group to translate the main argument from the clip. They’ll need to use some judgment to determine what the premises and conclusion are; you’ll likely need to replay the clip while they take some notes. Ask the groups to report back to the whole class, perhaps by writing their answers at the board. As a class, decide which answer(s) seem to best represent the argument. Either as a whole class or meeting again in small groups, create the truth table for the argument and use it to determine whether the argument is valid or invalid.

ASSIGNMENT: Valid or Invalid worksheet.