Truth Tables

How to Make and Use

Text Chapter 3 – Sections 2, 3

Making a Truth Table

- To determine the number of rows other than the heading row.
  1. Count the number of simple propositions (letters) in the given propositions.
  2. Raise 2 to that power.
- Make a column for each letter in the proposition.
- To determine the number of additional columns needed count the distinct connectives.

No in-class assignment problem

Columns for Component Simple Propositions

- Fill in the first several (depends on the number of letters) columns in the table as indicated below.
  1. Write the letter headings of these columns, p, q, etc.
  2. In the first column enter "T"s for the top half of the rows and "F"s on the bottom half.
  3. In the next column cut the number of "T"s and "F"s in half
  4. In the next column repeat step 3 until all of the letter columns are filled.

In-class Assignment 11 - 1

$\sim (p \vee q) \wedge (p \rightarrow \sim q)$

- 2 letters – a column for each
- $2^2 = 4$ additional rows
- 5 connectives – 5 additional rows.
- Each of the additional column headings must contain a rule and one or more column headings already in table.

No in-class assignment problem

$\sim (p \vee q) \wedge (p \rightarrow \sim q)$ continued

p	q	~q	p ∨ q	~(p ∨ q)	p → ~ q	1 ∧ 2
				1	2	
1. T	T	F		F		
2. T	F	T		F	F	
3. F	T	F		F		
4. F	F	T	F	T		T

In-class Assignment 11 - 1

Conditions Where True

- To determine the conditions where a given proposition is true from its truth table look for T in the final column and read over to see the truth values of the components.
- In our example the only T is the last column is in condition 4 where both p and q are false.
- Any 2 simple propositions that are false when put in the format of our example is true.

In-class Assignment 11 - 2

Tautology

- A tautology is a compound proposition that is true regardless of the truth values of the component propositions.
- In a truth table the last column on the right must have all true entries.

In-class Assignment 11 - 3

Contradiction

- A contradiction is a compound proposition that is always false regardless of the truth value of its component propositions.
- A contradiction is the negation of a tautology.
- De Morgan's Laws are tautologies.

In-class Assignment 11 - 3

Determining the Truth Value by Rules

- To determine the truth value of a given proposition when the truth values of the components are known
  - Translate the proposition into its symbolic logic form
  - Use the rules of logic to determine if the proposition is true or false working within parentheses first.

No in-class assignment problem

Example

- If 4 > 5 and 10 is not even, then 6 < 2 or 7 x 6 = 42.
  - Implication
  - p: 4 > 5; q: 10 is not even; r: 6 < 2 and s: 7 x 6 = 42

$(p \wedge q) \rightarrow (r \vee s)$

F F F T

If F then T . Therefore the proposition is True.

In-class Assignment 11 – 4, 5, 6