Truth Tables

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Testing arguments: Truth Tables

- One standard way of testing validity is by means of truth tables.
- In practice, the tables record what happens when the conditions hold for the truth and falsity of the premise and conclusion.

The Truth Table for OR

a	b	a V b
T	T	T
T	F	T
F	T	T
F	F	F

The Truth Table for NOT

a	¬ a
T	F
F	T

The Truth Table for AND

a	b	a ∧ b
T	T	T
T	F	F
F	T	F
F	F	F

Conditional Statements

- If ______, Then ____
- The “If” part of the statement is known as the antecedent.
- The “Then” part of the statement is known as the consequent.

The Truth Table for A —> B

a	b	a → b
T	T	T
T	F	F
F	T	T
F	F	T

- A conditional statement indicates that a relationship holds between two ideas.
- Conditional statements make no claims about the truth of the components alone.
- What a conditional says is IF the antecedent is true, THEN the consequent is true.

- Once we understand conditional statements better, we also understand that truth tables represent the truth conditions of statements.

- Indeed, truth tables represent conditionals, in a sense.

- The various tables represent the conditions under which statements are true when organized in various ways.

Counterexample method

- This is the method of isolating the form of an argument and then constructing a substitution instance having true premises and a false conclusion.
- Remember: this method can help us prove if an argument is invalid, but it does not prove that an argument is valid.

- We now want a method that will enable us to isolate the form of the argument, then check to see whether it is valid or not.

Using Truth Tables to Test for Validity

- Symbolize each premise and the conclusion
- List each in a column, and assign the possible truth-values.
- If we can find a row in which the premises are true, and the conclusion is false, then the argument is INVALID. If we cannot find such an instance, the argument is VALID.
- Let's try it! http://www.math.fsu.edu/~wooland/argumentor/TruthTablesandArgs.html

INVALID

- If A, then B
- not A
- Therefore, not B

If A, then B	not A	not B
T	T	T
F	F	T
T	T	F
T	F	F

REMEMBER: DON'T SKIP STEPS!

If A, then B	not A	not B
T	T	T
F	F	T
T	T	F
T	F	F

A	B	If A, then B	not A	not B
T	T	T	F	F
T	F	F	F	T
F	T	T	T	F
F	F	T	T	T

- Ultimately, we want to be able to construct a truth table for any argument that we find.
- For now, let's construct the truth tables for the valid arguments we have seen: MP, MT, DS, HS
- Let's construct the truth tables for the invalid forms we have seen: FP, FT, FDS, FHS

More Practice!

- For more practice, see: http://www.math.fsu.edu/~wooland/argumentor/TruthTablesandArgs.html
- See also Hurley 6.3 and 6.4
- See also PhilHelper's Youtube page:
  - https://www.youtube.com/watch?v=Bkv1p_NTj_I
  - https://www.youtube.com/watch?v=9ToChd_c2aw

- It turns out that we can use the inference rules in a game. This game helps us prove new things.
- (We will learn the game once we complete the next phase)

MODUS PONENS

- A ——-> B
- A
- Therefore, B

Disjunctive Syllogism

- A v B
- ~ B
- Therefore, A

Modus Tollens

"the mode of taking away"

If A, then B

not B

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not A

Hypothetical Syllogism

If A, then B

If B, then C

If A, then C

- Now that we have seen the valid forms, we want to also be able to prove that an argument does not work.

- There are some common mistakes. We can notice these mistakes by looking at deviations from the forms we have seen.

INVALID

- If A, then B
- B
- Therefore, A

INVALID

- If A, then B
- If C, then B
- Therefore, if A then C

INVALID

- If A, then B
- not A
- Therefore, not B

INVALID

- Either A or B
- A
- Therefore, B