# Arguments

Determining Validity

*Chapter 3 – Section 5*

## Definition of a Symbolic Argument

- An argument is an implication (conditional) whose "if" component consists of the conjunction of several propositions called premises (hypotheses) and whose "then" component is a proposition called the conclusion.
- Symbolic notation of an argument: $[P_1 \wedge P_2 \wedge P_3] \rightarrow C$

*In-class Assignment 13 - 1*

## Validity of Arguments

- Arguments are either valid or invalid.
- Ways of determining the validity of an argument.
  1. Truth table
  2. Analysis
  3. Syllogism

*No in-class assignment problem*

## Validity of an Argument by A Truth Table

- Write each premise and the conclusion in symbolic form.
- Enclose each premise and the conclusion that is compound within parentheses.
- Write the conjunction of the several premises.
- Enclose the conjunction in braces.
- Write the conditional of the conjunction and the conclusion.
- Make a truth table for this symbolic implication.
- Only if it is a tautology is the argument valid.

*In-class Assignment 13 - 2*

## Example

- 2 is an even number.
- If 7 is odd then 2 is not even.
- If 7 is not odd then 8 is even.
- ______________
- ∴ 8 is even.

- $P_1$: p
- $P_2$: $(q \rightarrow \sim p)$
- $P_3$: $(\sim q \rightarrow r)$
- ______________
- C : r

Symbolic Argument: $[p \wedge (q \rightarrow \sim p) \wedge (\sim q \rightarrow r)] \rightarrow r$

*In-class Assignment 13 - 2*

## The Truth Table

| p | q | r | ~p | ~q | q→~p | ~q→r | (p∧(q→~p)∧(~q→r) | [(p∧(q→~p) ∧ (~q→r)]→r |
|---|---|---|---|---|---|---|---|---|
| T | T | T | F | F | F | T | F | T |
| T | T | F | F | F | F | T | F | T |
| T | F | T | F | T | T | T | T | T |
| T | F | F | F | T | T | T | T | F |
| F | T | T | T | F | T | F | F | T |
| F | T | F | T | F | T | T | F | T |
| F | F | T | T | T | T | T | F | T |
| F | F | F | T | T | T | F | F | T |

The argument is invalid because the implication is not a tautology

*In-class Assignment 13 - 3*

## Validity by Analysis - Reminder

- A conditional is only false if the "if" component is true and the "then" component is false.
- A conjunction is true only if all components are true. In an argument the conjunction is the "if" component.
- Therefore, all premises must be true.

*No in-class assignment problem*

## Validity by Analysis

- Write the argument in symbolic form.
- Identify the premises.
- Force all premises to be true by using the rules of logic.
- If it is possible for the conclusion to be false then the argument is invalid.

$p \rightarrow \sim q$
$\underline{\sim q \wedge \sim p}$
$\therefore p \leftrightarrow q$

Premises are true

| | |
|---|---|
| F T<br>$p \rightarrow \sim q$ | 2. conditional rule |
| T T<br>$\sim q \wedge \sim p$ | 1.conjunction rule |

Must the conclusion be true?

| | |
|---|---|
| F F<br>$\therefore p \leftrightarrow q$ | 3. conclusion true |

Th argument is valid.

*In-class assignment 13 - 4*

## Syllogisms

From left to right

1. Law of Detachment
2. Fallacy of Inverse
3. Disjunction Law
4. Fallacy of Converse
5. Chain Rule
6. Law of Contraposition

| | |
|---|---|
| $p \rightarrow q$<br>$\underline{\sim q}$<br>$\therefore \sim p$ | $p \rightarrow q$<br>$\underline{p}$<br>$\therefore q$ |
| $p \vee q$<br>$\underline{\sim p}$<br>$\therefore q$ | $p \rightarrow q$<br>$\underline{\sim p}$<br>$\therefore \sim q$ |
| $p \rightarrow q$<br>$\underline{q \rightarrow r}$<br>$\therefore p \rightarrow r$ | $p \rightarrow q$<br>$\underline{q}$<br>$\therefore p$ |

## Recognizing Syllogisms

1. If the sun shines then it will not rain.
   It is raining.
   Therefore, the sun is not shining.
2. All puppies are cute.
   Felix is not a puppy.
   Therefore, Felix is not cute.
3. Sam is wet if he went swimming.
   Sam is wet.
   Therefore, Sam went swimming.
4. If you study hard you get a good grade.
   If you get a good grade then you can transfer.
   Therefore, if you study hard you can transfer.

1. Law of Contraposition
2. Fallacy of converse
3. Law of syllogism (chain rule)
4. Fallacy of inverse

*In-class Assignment 13 – 5*

## Syllogisms Lead to Valid Conclusions

- Mary did not go to school or Tom went to the store.
- Mary went to school.

- A form of $p \rightarrow q$
  $\underline{p}$
- Use the Law of Detachment to write the conclusion.
- $\therefore$ Tom went to the store.

*In-class Assignment 13 - 6*