



PHI2LOG LOGIC

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Topic 1

Validity & Argument Forms



Summary

We will start doing logical by learning some basic concepts:

1. **Statement** (sentence capable of being true or false, but not both).
2. **Argument** (set of statements, some of which are put forward as reasons to support one other).
3. **Valid Argument** (an argument whose premises logically necessitate its conclusion).
4. **Valid Argument Form**
5. Examples of some **well-known** valid argument forms.

Part 1. Statement

Statement =_{df} Sentence capable of being either true or false (but not both).

Remarks

- Some sentences (e.g., questions, commands, greetings) are incapable of being true or false, and therefore are not statements.
- Sometimes the term “**proposition**” is used as a synonym of “statement”.

Examples

	Is it a statement?
1. “Some people have blue eyes.”	YES
2. “Do some people have blue eyes?”	NO
3. “No one in Australia has blue eyes.”	YES
4. “Please open the door.”	NO
5. “If it is a rainy day, then it is a cold day.”	YES
6. “Take Care.”	NO

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Part 2. Argument

Argument =_{df} A set of statements, some of which (the **premises**) are put forward as **reasons to support** one other (**conclusion**).

Example: The following passage contains an argument.

“The **reason why** today is Thursday **is** that yesterday is Wednesday and tomorrow is Friday.”

Question: Which statement is being put forward (i.e., **intended by the author**) as the conclusion and which statements being put forward as the premises?

Answer: We look for **inference indicators** (i.e., words or phrases – e.g., “since”, “because”, “so”, “reason why ... is ...” – which indicate the author’s intention regarding what is a reason to support what).

Standard Form

P1. Yesterday is Wednesday.

P2. Tomorrow is Friday.

C. Today is Thursday. (from P1 & P2)

Question: Do the following passages **contain arguments**?

- “**Since** it is not raining, the grass is not wet.” **YES**
- “It is not raining **and** the grass is not wet.” **NO**
- “It is not raining. The grass is not wet.” **NO**
- “**If** it is not raining **then** the grass is not wet.” **NO**

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Part 3. Valid Argument

An argument is **valid** =_{df} The truth of the premises **logically (i.e., 100%) guarantees** the truth of the conclusion. (intuitive idea)

= It is logically **impossible** for all the premises to be **true and** at the same time the conclusion be **false**.

= It is logically **necessary** that **if** all the premises are **true then** the conclusion is also **true**.

An argument is **invalid** = It is logically **possible** for all the premises to be **true and** at the same time the conclusion be **false**.

= It is logically **not necessary** that **if** all the premises are **true then** the conclusion is also **true**.

(1) **All** crows have black beaks.
 (2) Andrew's bird is a crow.

 (3) Andrew's bird has a black beak.

valid

(1)* **Most** crows have black beaks.
 (2) Andrew's bird is a crow.

 (3) Andrew's bird has a black beak.

invalid

(1) Uma has a boyfriend or a husband or both.
 (2) Uma has no boyfriend.

 (3) Uma has a husband.

valid

(1) Uma has a boyfriend or a husband or both.
 (3) Uma has a husband.

 (2) Uma has no boyfriend.

invalid

Part 4. Valid Argument Forms

Argument #1
If it is rainy, then it is wet.
It is rainy.

It is wet.

Logical Form

If **A** then **B**
A

B

- All three arguments have the same logical form.
- There are infinitely many other arguments that having the same logical form.
- In formal logic, we are interested in finding out whether some abstract argument FORMS are valid or not.

Argument #2
If God exists, then Satan exists.
God exists.

Satan exists.

An **argument FORM** is **valid**
 =_{df} ALL individual arguments having the form are valid.

An **argument form** is **invalid**
 =_{df} NOT ALL individual arguments having the form are valid.

Argument #3
If 3 = 1, then time travel is possible.
3 = 1.

Time travel is possible.

Ways of speaking: When the argument from p to q is valid, we can say:

- p entails q.
- p implies q.
- p necessitates q.
- q logically follows from p.

p
 ----- (valid)
 q

Part 5. Examples of some well-known VALID argument forms

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1. Modus Ponens (MP)

If A then B A ----- B

2. Modus Tollens (MT)

If A then B Not B ----- Not A
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3. Hypothetical Syllogism (HS)

If A then B If B then C ----- If A then C
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4. Disjunctive Syllogism (DS)

A or B Not A ----- B	A or B Not B ----- A
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5. Constructive Dilemma (CD)

A or B If A then C If B then D ----- C or D

6. Conjunction (Conj.)

A B ----- A and B	A B ----- B and A
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7. Simplification (Simp.)

A and B ----- A	A and B ----- B
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8. Addition (Add.)

A ----- A or B	A ----- B or A
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9. De Morgan's Law (DM)

"Not (A and B)" is logically equivalent to "not A or not B"

Not (A and B) ----- Not A or not B	Not A or not B ----- Not (A and B)
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"Not (A or B)" is logically equivalent to "not A and not B"

Not (A or B) ----- Not A and not B	Not A and not B ----- Not (A or B)
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How do we know that these argument FORMS are really valid? **We are going to prove that !**

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Summary

We have done some logical by learning some basic concepts:

1. **Statement** (sentence capable of being true or false, but not both).
2. **Argument** (set of statements, some of which are put forward as reasons to support one other).
3. **Valid Argument** (an argument is valid if and only if it is logically impossible for all the premises to be true and at the same time the conclusion be false).
4. **Valid Argument Form** (an argument form is valid if and only if all arguments sharing that form are valid).
5. Examples of some **well-known** valid argument forms:
MP, MT, HS, DS, CD, Conj., Simp., Add., DM.

NOTE: The "... or ..." is taken **inclusively** to mean "... or ... (or both)" – unless otherwise indicated.

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