

# Unit 1: Introduction to Logic

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- What is an argument?
- Deduction and induction
  - Truth and validity
- The form of an argument

# Reasoning and Arguments

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- **Reasoning** or **inferring**: A mental process, in which appropriate conclusions (new knowledge) are drawn from given evidence (knowledge already had).
- The verbal expression of reasoning is an **argument**.
- An **argument** is a set of sentences, in which one or more sentences (called **premises**) are provided as evidence or reasons for accepting another one (called **conclusion**).

# Assertions and Arguments: Examples

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1) Jane makes less than \$10 an hour, which is not enough to pay both her rent and her tuition.

This is just an assertion.

2) Jane works at Casey's Diner, and they don't pay anyone as much as \$10 an hour, so Jane makes less than \$10 an hour.

This is an argument.

Reasons are given to support a certain claim.

# Premises and Conclusions

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- **Premises:** The statements containing reasons or evidence. They support the conclusion.
- **Conclusion:** The claim that is supported by the premises.

Example:

Premise 1      (1) Jane works at Casey's Diner

Premise 2      (2) They don't pay more than \$10 an hour

Therefore,

Conclusion      (3) Jane makes less than \$10 an hour

# Some Common Premise and Conclusion Indicators

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- Premise indicators:
- "Because", "since", "for", "as", "given that".
  
- Conclusion indicators:
- "Therefore", "then", "so", "thus", "hence", "consequently", "it follows that", "in conclusion", "as a result", "accordingly", "we might infer that".

# Deductive and Inductive Arguments

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- **Deductive arguments:** The truth of the premises **guarantees** the truth of the conclusion.

(1) All men must die.

(2) Robert is a man.

Therefore,

(3) Robert must die.

# Deductive and Inductive Arguments

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- **Inductive arguments:** The premises **only provide a degree of support** to the conclusion.
- The conclusion might be false, even though the premises are true.

(1) Most planes land safely.

Therefore,

(2) This plane will land safely.

- Some inductive argument indicators: "Probably", "most likely", "almost certainly", "possibly"

# Validity for Deductive Arguments

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- **Validity** is a property of deductive arguments.
- In order to be **valid**, an argument must meet one condition:
- **If the premises are true, the conclusion must be true as well.**
- An argument is **invalid** when it has true premises and a false conclusion.

Example:

(1) If Clinton was president IN 1999, then Gore was vice-president in 1999.... TRUE

(2) Gore was president in 1999.....TRUE

Therefore,

(3) Clinton was president in 1999.....FALSE

# Validity and Form

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- The validity of an argument depends on its **form**.
- Valid arguments have valid forms; invalid arguments have invalid forms.
  
- **Form:** The bare structure of an argument.
- It abstracts from any specific subject matter or content.
- It is given by the **logical constants or operators** in the argument [more on this on Unit 2].
  
- An argument form has **instances**, that is, **particular examples** of arguments that have that form.

# Argument Forms: An Example

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## Argument A

(1) **If** the dinosaur is herbivore,  
**(then)** we are safe.

(2) We are **not** safe.

Therefore,

(3) The dinosaur is **not** herbivore.

## Argument B

(1) **If** she finishes her work, **(then)**  
she will go to the party.

(2) She did **not** go to the party.

Therefore,

(3) She did **not** finish her work

# Argument Forms: An Example

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- Arguments A and B have the following form:

(1) If P, then Q

(1)  $P \supset Q$

(2) Not Q

(2)  $\sim Q$

Therefore,

$\therefore$  (3)  $\sim P$

(3) Not P

[This form is called *Modus Tollens*; more on Unit 7]

- Hence, arguments A and B are **instances** of this form.

# Validity for Argument Forms

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- An **argument form** is **valid** if and only if it meets one condition:
- **No instances of it have true premises and a false conclusion.**
  
- An **argument form** is **invalid** if there is an instance of that form with true premises and a false conclusion.
  
- An instance that invalidates a form is called a **counterexample**.

# Invalidity for Argument Forms: An Example

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(1) **If Clinton was president in 1999, then Gore was vice-president in 1999 (True)**

(2) Gore was vice-president in 1999  
**(True)**

Therefore,

(3) Clinton was president in 1999 **(True)**

- The form of this argument is:

(1) **If P, then Q.**

(2) Q

Therefore,

(3) P

# Invalidity for Argument Forms: An Example

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- The form we are evaluating is:

(1) **If P, then Q.**

(2) Q

Therefore,

(3) P

- Counterexample:

(1) **If it is raining, then the streets are wet. (True)**

(2) The streets are wet. **(True)**

Therefore,

(3) It is raining **(FALSE)**

# Soundness

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- An argument is **sound** when it has a **valid form**, and **both its premises and conclusion are true**.
- The following arguments are valid, but not sound:

(1) All cats are green.....FALSE

(2) All green things are immortal.....FALSE

Therefore,

(3) All cats are immortal.....FALSE

(1) If dogs don't bark, then cats meow... TRUE

(2) Cats do not meow..... FALSE

Therefore,

(3) Dogs bark.....TRUE