

Introduction to Logic and Critical Thinking

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Study guide – concise, organized, and easy to read

1. What Is Logic?

Aspect	Description
Definition	The systematic study of valid reasoning and inference.
Goal	Distinguish good arguments (those that guarantee their conclusions) from bad ones.
Scope	Formal (symbolic) logic, informal logic, and applied reasoning in everyday contexts.
Key Terms	Proposition, premise, conclusion, inference, validity, soundness.

1.1 Types of Logic

Type	Main Features
Deductive	Reasoning from general premises to a specific conclusion. Truth of premises guarantees truth of conclusion (if valid).
Inductive	Reasoning from specific observations to a general claim. Conclusions are probable, not certain.
Abductive	Inference to the best explanation. Chooses the most plausible hypothesis that accounts for the data.
Formal	Uses symbolic notation and strict rules (e.g., propositional, predicate logic).
Informal	Analyzes everyday language, arguments, and fallacies without symbols.

2. Structure of an Argument

1. **Premises** – Statements that provide support.
2. **Conclusion** – The claim being supported.

Example

- Premise 1: All mammals are warm-blooded.
- Premise 2: Whales are mammals.

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- **Conclusion:** Therefore, whales are warm-blooded.

2.1 Evaluating Arguments

Criterion	What to Check
Validity (deductive)	Does the conclusion follow logically from the premises?
Soundness (deductive)	Are the premises true <i>and</i> is the argument valid?
Strength (inductive)	How probable is the conclusion given the premises?
Cogency (inductive)	Are the premises credible and the argument strong?

3. Common Logical Forms

Form	Symbolic Pattern	Example (English)
Modus Ponens	$(P \rightarrow Q, P \therefore Q)$	If it rains, the ground gets wet. It is raining. ? The ground is wet.
Modus Tollens	$(P \rightarrow Q, \neg Q \therefore \neg P)$	If the alarm is set, it will ring. It did not ring. ? The alarm was not set.
Hypothetical Syllogism	$(P \rightarrow Q, Q \rightarrow R \therefore P \rightarrow R)$	If I study, I will pass. If I pass, I will graduate. ? If I study, I will graduate.
Disjunctive Syllogism	$(P \vee Q, \neg P \therefore Q)$	Either the light is on or the switch is broken. The light is not on. ? The switch is broken.
Universal Instantiation	$(\forall x, P(x) \therefore P(a))$	All birds have feathers. ? A sparrow has feathers.
Existential Generalization	$(P(a) \therefore \exists x, P(x))$	This apple is red. ? Some fruit is red.

4. Informal Logic &