

What is a logical argument?
What is deductive reasoning?

Fundamentals of Academic Writing

Logical relations

- Deductive logic
 - Claims to provide conclusive support for the truth of a conclusion
- Inductive logic
 - Arguments support a conclusion, but do not claim to show that it is necessarily true

Deductive logic

- Categorical propositions
 - Deductive arguments are either valid or invalid.
 - Premises are either true or not true.

 - If the argument is valid and the premises are true, then the conclusion is true.

Deductive logic

- Categorical propositions have a truth value.
 - All dogs are mammals. (All S is P)
 - No dogs are fish. (No S is P)
 - Some mammals are carnivores. (Some S is P)
 - Some mammals are not carnivores. (Some S is *not*- P)

The truth of a proposition is determined by its “fit” with the world.

- “Some mammals are carnivores” is true if and only if there are some mammals that eat meat.

Deductive logic

- Categorical propositions

- “Physicians licensed to practice in Japan must pass the National Medical Licensing Board Exam.”

→

- All physicians licensed to practice in Japan are people who pass the Licensing Board Exam.

- All S is P.

Implication

- A set of two facts (propositions)
- The first implies the second.
 - If the first is true, then the second must be true.
- *If the river is narrow, we can cross easily.*
- *If anyone walks by, the dog will bark.*

Implication

- If the first is true, then the second must be true.
- If the river is narrow, we can cross easily.
 - I know that the river is narrow.
 - Therefore, I know we can cross easily.

Implication

- If the first is true, then the second must be true.
- If second is not true, then the first must not be true (assuming the implication is valid).
- *If anyone walks by, the dog will bark.*
 - *I know that the dog did not bark yesterday.*
 - *Therefore, I know no one walked by yesterday.*

Implication

- **BE CAREFUL:** the order matters.
- If first is not true, we can't conclude whether the second is true.
- If anyone walks by, the dog will bark.
 - I know that no one walked by yesterday.
 - But I can't conclude about what the dog did.
(The dog sometimes barks even though no one walks by.)

Syllogisms

- Syllogism: A conclusion inferred from two premises

All liars are dishonest.

All Cretans are liars.

∴ All Cretans are dishonest.

Syllogisms

All liars are dishonest.

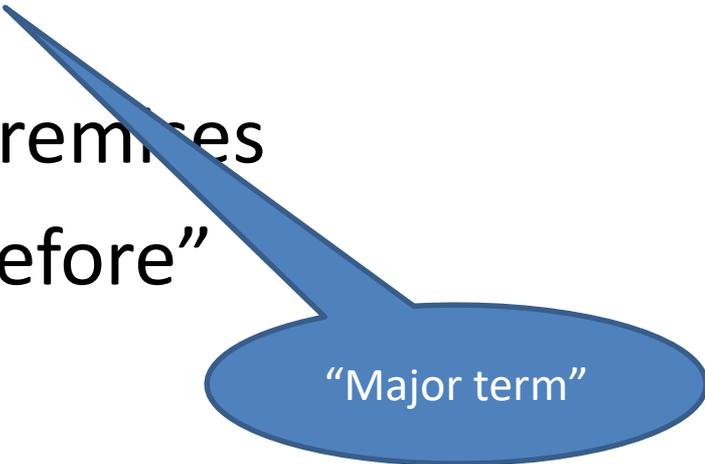
All Cretans are liars.

∴ All Cretans are dishonest.

- Middle term is in both premises
- ∴ “Ergo”, Latin for “therefore”



“Minor term”



“Major term”

Syllogisms

All enzymes are proteins.

All proteins are organic compounds.

∴ All enzymes are organic compounds.

Syllogisms

Some plankton is algae.

All algae consume CO_2 .

Therefore, some plankton consume CO_2 .

“Plankton helps reduce levels of CO_2 , since the algae in plankton consume CO_2 from the environment.”

Deductive logic

- If the argument is valid and the premises are true, then the conclusion is true.
 - Valid: The argument (relation of the premises) *necessarily entails* the conclusion.
 - True: The premises accurately reflect the world.
- Deductive logic is used to prove that the conclusion must be true (if the premises are true).

Deductive logic

- If the **argument is valid** and the premises are true, then the conclusion is true.
 - Valid (but not true)

Humans are animals.

All animals live under water.

Therefore, humans live under water.

Deductive logic

- If the argument is valid and the **premises are true**, then the conclusion is true.
 - True (but not valid)

Humans are animals.

Some animals live under water.

Therefore, some humans live under water.

Deductive logic

- If the argument is valid and the premises are true, then the **conclusion is true**.

Humans are animals.

All animals breathe.

Therefore, humans breathe.

- Deductive logic is used to prove that the conclusion must be true (if the premises are true).

Deductive logic

- Let's look at how to turn a syllogism into an academic paper.

Logic in writing

Our business has a reputation for poor service.

Premise

Businesses with a reputation for poor service have few customers.

Premise

Therefore, our business has few customers.

Conclusion

- If the argument is valid and the premises are true, then the conclusion is true.

Logic in writing

✓ Valid

Our business has a reputation for poor service.

Businesses with a reputation for poor service
have few customers.

Therefore, *our business* has few customers.

- If the argument is valid and the premises are true, then the conclusion is true.

Logic in writing

- The paper will need one section showing that “Our business has a bad reputation” is true.
- The next section will show “Businesses with bad reputations have few customers” is true.
- The conclusion will summarize how the true premises and the valid argument show the truth of the author’s conclusion.

Logic in reading

- When you read, ask yourself:
 - What is the conclusion?
 - What is the argument? (In other words, what premises lead to the conclusion?)
 - Is the argument valid?
 - Are the premises true?

Logic in reading

"I do not believe that we can have any freedom in the philosophical sense, for we act not only under external compulsion but also by inner necessity."

- Albert Einstein

Logic in reading

"I do not believe that we can have any freedom in the philosophical sense, for we act not only under external compulsion but also by inner necessity."

– Albert Einstein

- **What is the conclusion?**
 - People cannot be free. (All people are not free.)

Logic in reading

"I do not believe that we can have any freedom in the philosophical sense, for we act not only under external compulsion but also by inner necessity."

– Albert Einstein

- **What are the premises?**
 - People act under compulsion and necessity.
 - (The other premise is not stated, but implied.)
Things acting under compulsion are not free.

Logic in reading

- Is the logic valid?
 - No one under compulsion and necessity is free.
 - All people are under compulsion and necessity.
 - Therefore, no people are free.



✓ Valid

Logic in reading

“I do not believe that we can have any freedom in the philosophical sense, for we act not only under external compulsion but also by inner necessity.”

– Albert Einstein

- Are the premises true?
 - I’m not sure. It’s more a matter of “belief” than “fit with the world”.

Logical relations

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Next time...

- Few papers prove a truth.
- Many support a likely conclusion.