Basic Logical Concepts

Syllogism

> **Definition**
>
> An argument that consists of exactly two premises and a conclusion

Deduction and Induction

- Arguments differ greatly in the amount of support they claim to provide

Deductive Arguments

> **Definition**
>
> Tries to prove conclusions with rigorous, inescapable logic

Patterns

Hypothetical Syllogism

- Contains at least one hypothetical or conditional

Examples

- If the Tigers beat the Yankees, then the Tigers will make the playoffs.
- The Tigers will beat the Yankees.
- So, the Tigers will make the playoffs.

Modus Ponens (valid)

- If A then B
- A
- Therefore, B

Chain Arguments (valid)

- If A then B
- If B then C
- Therefore, if A then C

Modus Tollens (valid)

- If A then B
- Not B
- Therefore, not A

Denying the Antecedent (invalid)

- If A then B
- Not A
- Therefore, not B

Affirming the consequent (invalid)

- If A then B
- B
- Therefore, A

Categorical Syllogism

- Each statement begins with the word *all*, *some*, or *no*

Argument by Elimination

- Seeks to logically rule out various possibilities until only a single possibility remains

Examples

- Either Joe walked to the library or he drove
- But Joe didn’t drive to the library
- Therefore, Joe walked to the library

Argument Based on Mathematics

- Conclusion is claimed to depend largely on mathematical calculations or measurements

Examples

- Eight is greater than four
- Four is greater than two
- Therefore, eight is greater than two

Argument from Definition

- True by definition

Examples

- Janelle is a cardiologist
  - Therefore, Janelle is a doctor
- Bertha is an aunt
  - It follows that she is a woman

Examples

- All humans are mortal
- Socrates is human
- Therefore, Socrates is moral

Deductive Validity

- When it is impossible for all the premises to be true and the conclusion false, the argument is valid
- Must have these conditions
  - If the premises are true, the conclusion must be true
  - The conclusion follows necessarily from the premises
  - The premises provide logically conclusive grounds for the truth of the conclusion
  - It is logically inconsistent to assert all the premises as true and deny the conclusion

Sound Deductive Arguments

- Both valid and true

Invalid Deductive Arguments

- The conclusion does not follow neccesarily from the premises

Inductive Arguments

> **Definition**
>
> Tries to show that that conclusions are plausible or likely given the premise

Patterns

Inductive Generalization

- Argument in which a generalization is claimed to be probably true based on information about some members of a particular class

Predictive Argument

- A prediction is defended with reasons

Argument from Authority

- Asserts a claim and then supports that claim by citing some presumed authority or witness who has said that the claim is true

Causal Argument

- Asserts or denies that something is the cause of something else

Statistical Argument

- Rests on statistical evidence

Argument from Analogy

- Conclusion if claimed to depend on an analogy

Inductive Strength

Weak Inductive Argument

- The conclusion does *not* follow probably from the premises

Strong

Cogent

- If an argument both is inductively strong and all true premises

Uncogent

- If an inductive argument either is weak or has at least one false premise

Examples

- Every ruby so far discovered has been red
- So, probably all rubies are red

Tests

Indicator Word Test

Deduction Words

- Certainly
- Absolutely

- Conclusively

Induction Words

- Probably
- Likely
- It is plausible to suppose that
- It is reasonable to assume that

Strict Necessity Test

- An argument's conclusion either follows with strict logical necessity from its premises or it does not.
- If the argument's conclusion does follow with strict logical necessity from its premises, the argument should always be treated as deductive.
- If the argument's conclusion does not follow with strict logical necessity from its premises, the argument should normally be treated as inductive.

Exceptions (either or)

1. The language or context makes clear that the arguer intended to offer a logically conclusive argument, but the argument, in fact, is not logically conclusive;
2. The argument has a pattern of reasoning that is characteristically deductive, and nothing else about the argument indicates clearly that the argument is meant to be inductive

Common Pattern Test

Deduction

- If *first statement* is true, then *second statement* is true
- If A then B
    - A
        - Therefore, B

Principle of Charity Test

- See Principle of Charity Test

3.5 Swirlies

I

- Valid - modus ponens
- Invalid - denying the antecedent
- Valid - modus tollens

- Valid - modus tollens

II

- Sound - modus ponens & true
- Unsound - affirming the consequent & false
- Unsound - denying the antecedent & true
- Unsound - modus ponens & false

III

- Cogent - predictive argument & true
- Uncogent - argument from analogy & false
- Cogent - predictive argument & true
- Uncogent - inductive generalization & false

IV

- Deductive - valid, chain argument
- Weak - uncogent, weak argument, may be dangerous to grandfather to run for sport
- Strong - cogent, argument from authority
- Strong - cogent, argument from analogy
- Strong - cogent, statistical argument
- Weak - uncogent, unlikely for someone over 100 to be president
- Strong - cogent, argument from authority