

CHAPTER TWO

BASIC CONCEPTS OF LOGIC



Lesson 1: Basic Concepts of Logic: Arguments, Premises and Conclusions

Logic

the word **logic** comes from **Greek** word *logos*, which means:

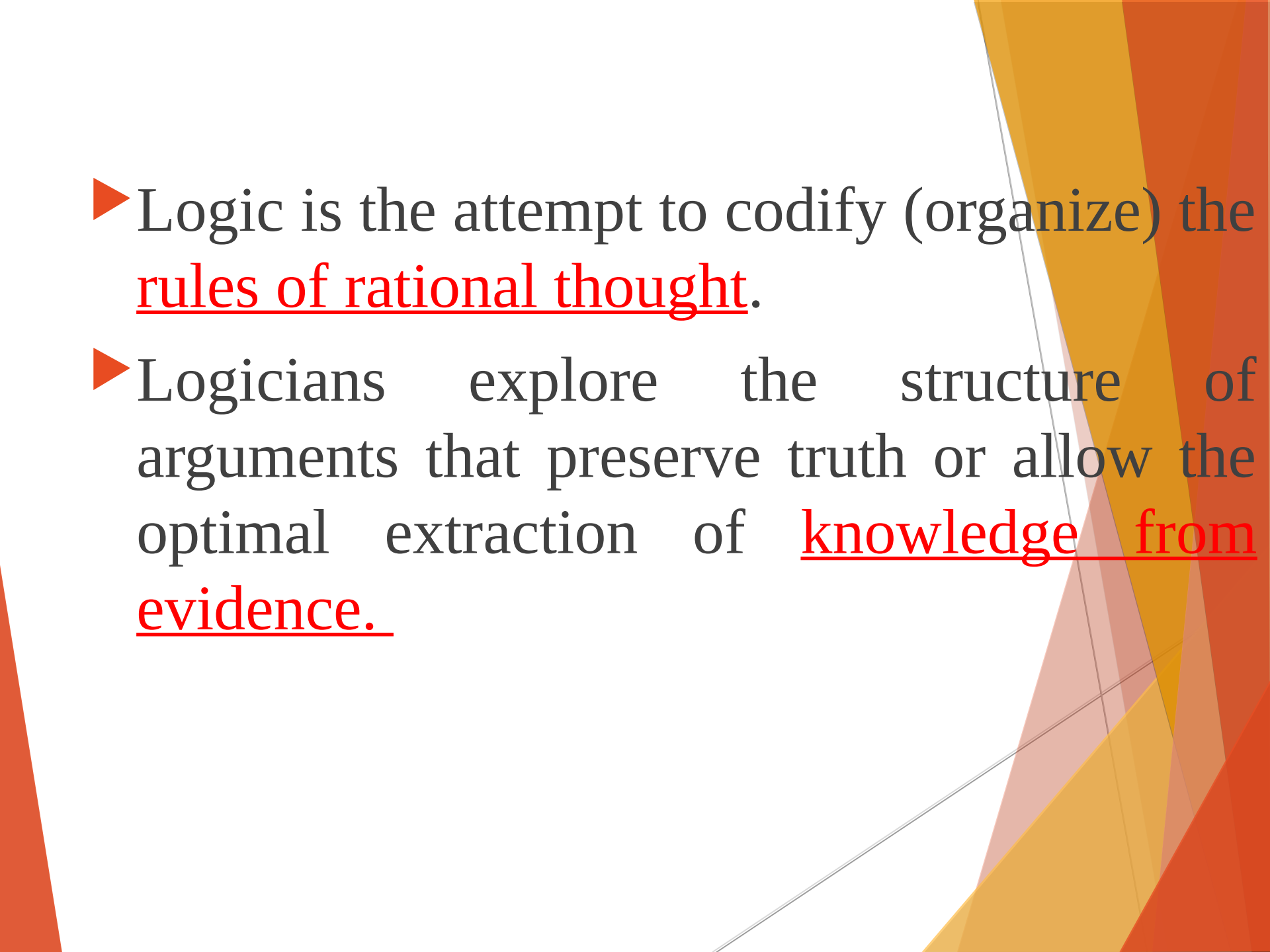


sentence,

- ▶ discourse,
- ▶ reason,
- ▶ truth and
- ▶ Rule

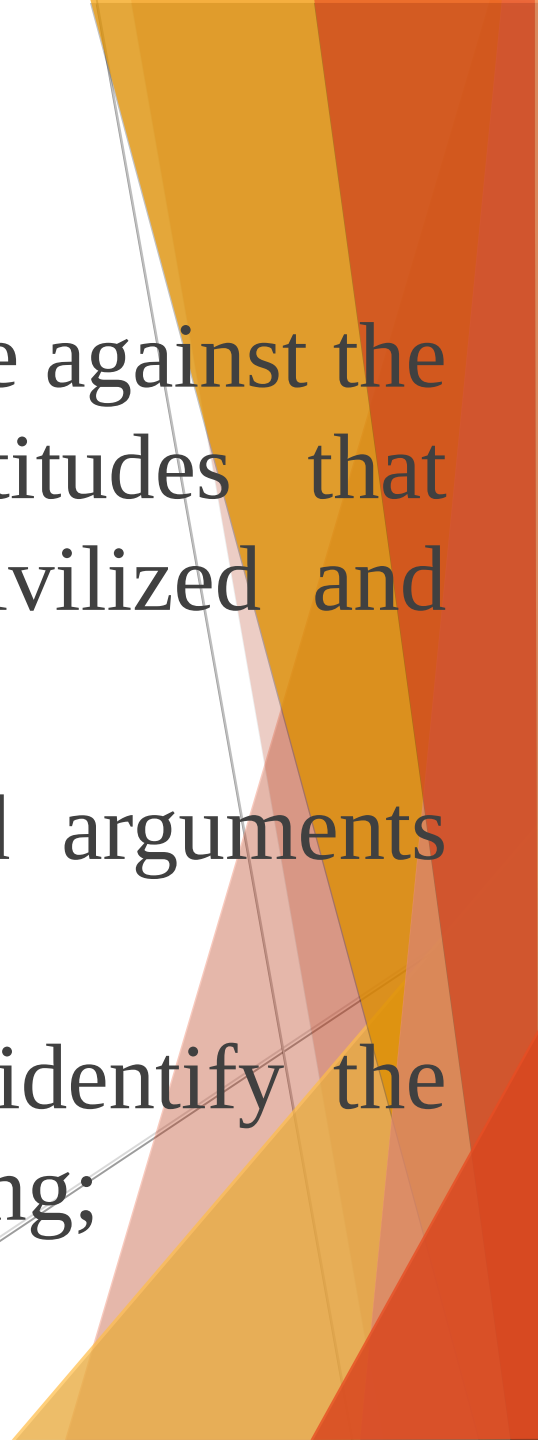
is generally be defined as a
philosophical science that evaluates
arguments.

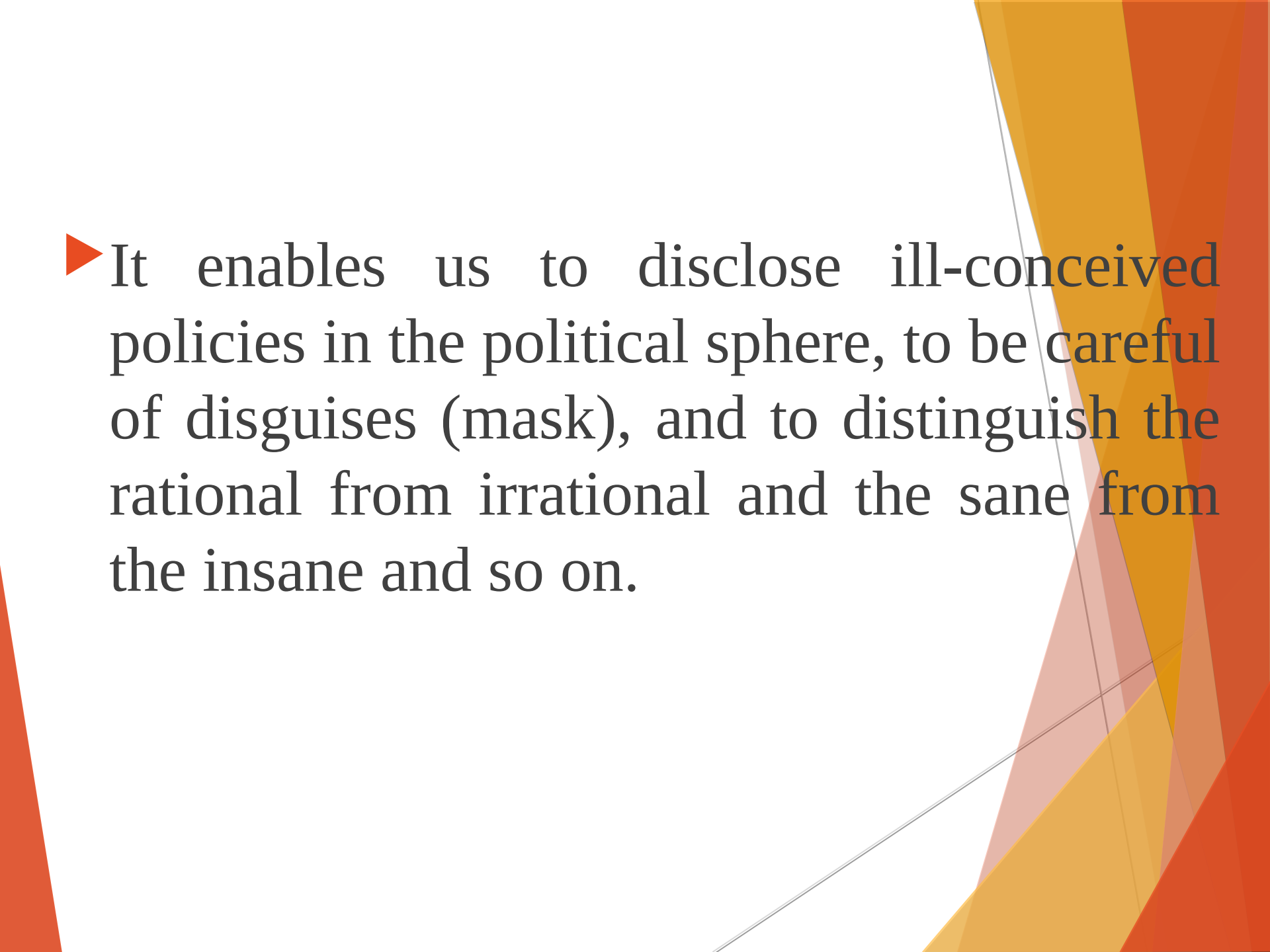
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- ▶ Logic is the study of methods for evaluating arguments. More precisely, logic is the study of methods for evaluating whether the premises of arguments adequately support or provide a good evidence for the conclusions.

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- ▶ Logic is the attempt to codify (organize) the rules of rational thought.
 - ▶ Logicians explore the structure of arguments that preserve truth or allow the optimal extraction of knowledge from evidence.

What is the Benefit of Studying Logic?

- ▶ *Logic sharpens and refines our natural gifts to think, reason and argue.*
- ▶ It helps us to develop the skill needed to construct sound (good) and fallacy-free arguments of one's own and to evaluate the arguments of others;

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- ▶ It provides a fundamental defense against the prejudiced and uncivilized attitudes that threaten the foundation of a civilized and democratic society;
 - ▶ It helps us to distinguish good arguments from bad arguments;
 - ▶ It helps us to understand and identify the common logical errors in reasoning;

- 
- ▶ It enables us to disclose ill-conceived policies in the political sphere, to be careful of disguises (mask), and to distinguish the rational from irrational and the sane from the insane and so on.

What is an Argument?

- ▶ Is the chief concern of logic
- ▶ it is a group of statements, one or more of which (the premise) are claimed to provide support for, or reason to believe, one of the other, the (conclusion).
- ▶ *is a group of statements* (combine two or more statements)

A statement

- ▶ is a declarative sentence that has a truth-value of either true or false.
- ▶ Hence, truth and falsity are the two possible truth values of a statement.

Examples:

- 
- ▶ Chocolate truffles are loaded with calories.
(true)
 - ▶ Melatonin helps relieve jet lag. (true)
 - ▶ No wives ever cheat on their husbands.
(false)

- ▶ Tiger Woods plays golf and Maria Sharapova plays tennis.(false)
- ▶ Thus, the truth value of the first two statements is true, the truth value of the second two is false,

There are sentences that are not statements.

- ▶ Questions, Where is Khartoum?
- ▶ proposals, Let's go to a movie tonight.
- ▶ suggestions, I suggest you get contact lenses.
- ▶ Commands:- Turn off the TV right now
- ▶ exclamations:- Fantastic!usually cannot, and

- ▶ so are not usually classified as statements.
- ▶ **NB:** The statements that make up an argument are divided into one or more premises and exactly one conclusion.

premises

- ▶ are the statements that set forth the reasons or evidence,
- ▶ It is claimed evidence

Conclusion

- ▶ is a statement, which is claimed to follow from the given evidence (premise). In other words, the **conclusion** is the claim that an argument is trying to establish.

All film stars are celebrities. (PREMISES 1)

Halle Berry is a film star. (PREMISES 2)

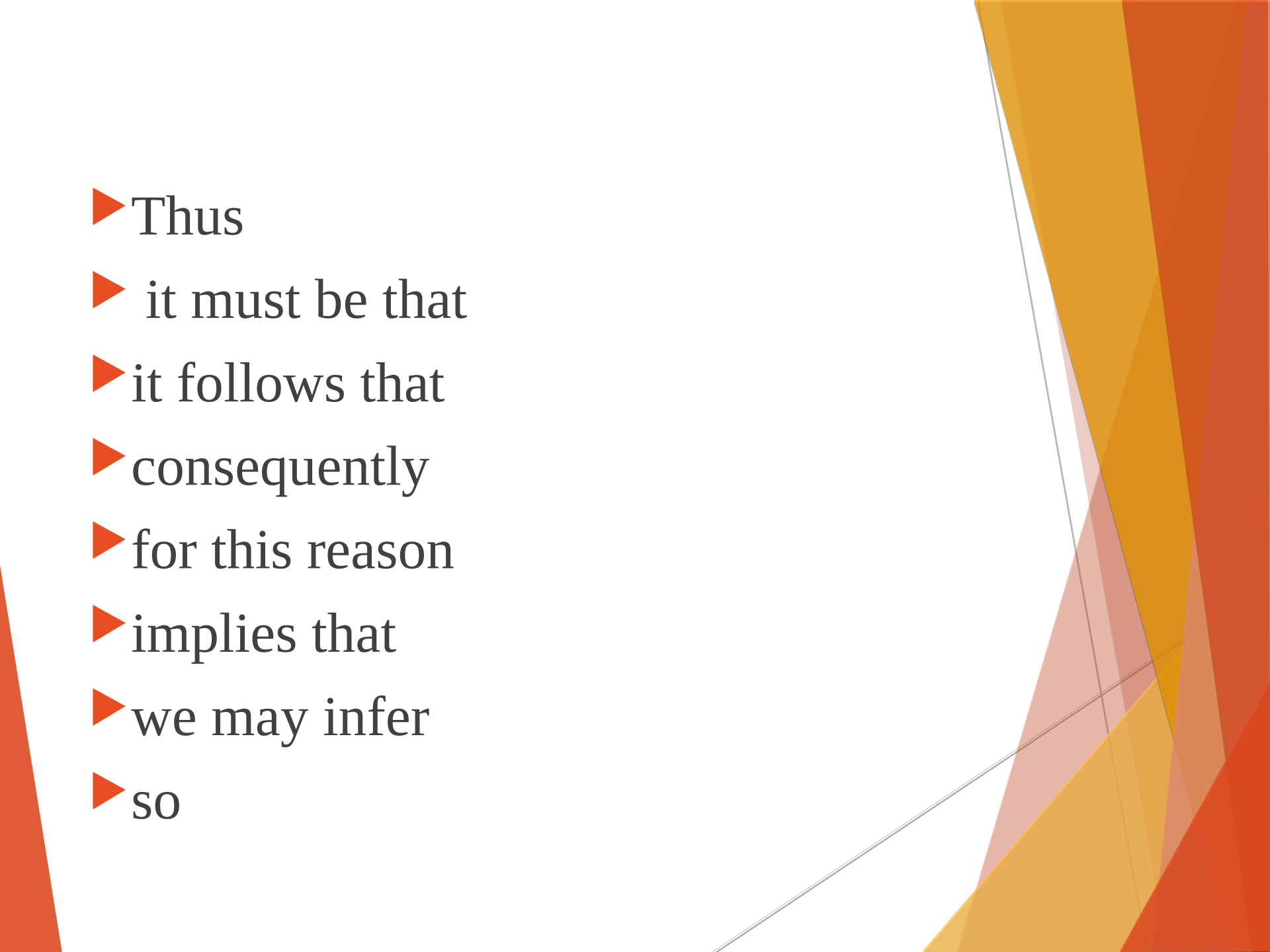
Therefore, Halle Berry is a celebrity.

- ▶ The first two statements are the premises; the third is the conclusion.

- ▶ The first technique that can be used to identify premises from a conclusion and vice versa is *looking at an indicator word*.

Here below are some Conclusion Indicators:

- ▶ Therefore
- ▶ accordingly

- 
- ▶ Thus
 - ▶ it must be that
 - ▶ it follows that
 - ▶ consequently
 - ▶ for this reason
 - ▶ implies that
 - ▶ we may infer
 - ▶ so

- ▶ Tortured prisoners will say anything just to relieve the pain. Consequently, torture is not a reliable method of interrogation.
- ▶ The conclusion of this argument is “Torture is not a reliable method of interrogation,”
- ▶ and the premise is “Tortured prisoners will say anything just to relieve the pain.”

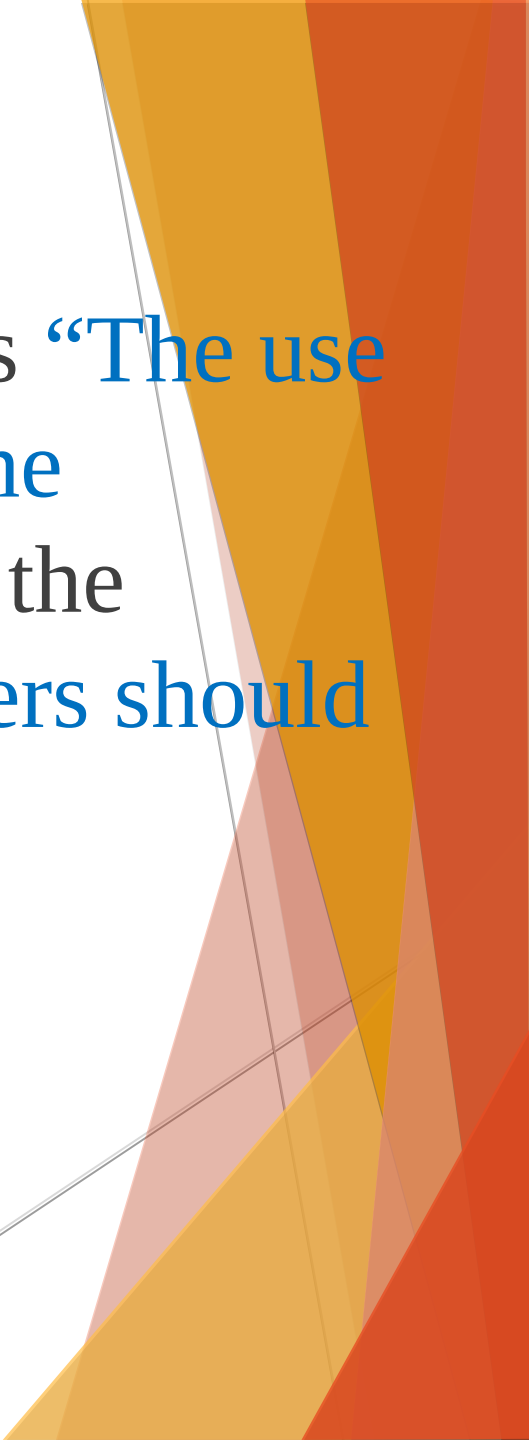
- ▶ If an argument does not contain a conclusion indicator, it may contain a premise indicator.
- ▶ *Here below are some typical Premise Indicators:*
- ▶ Since;

- ▶ in that;
- ▶ seeing that
- ▶ Because;
- ▶ As;
- ▶ inasmuch as
- ▶ For;
- ▶ given that;
- ▶ owing to

Any statement following one of these indicators can usually be identified as a **premise**.

► Example:

“Expectant mothers should never use recreational drugs, since the use of these drugs can jeopardize the development of the fetus”.

- 
- ▶ The **premise** of this argument is “The use of these drugs can jeopardize the development of the fetus,” and the **conclusion** is “Expectant mothers should never use recreational drugs.”

- ▶ NOTE: In reviewing the list of indicators, note that “for this reason” is a conclusion indicator,
- ▶ whereas “for the reason that” is a premise indicator. **“For this reason”** (except when followed by a colon) means for the reason (premise) that was just given, so what follows

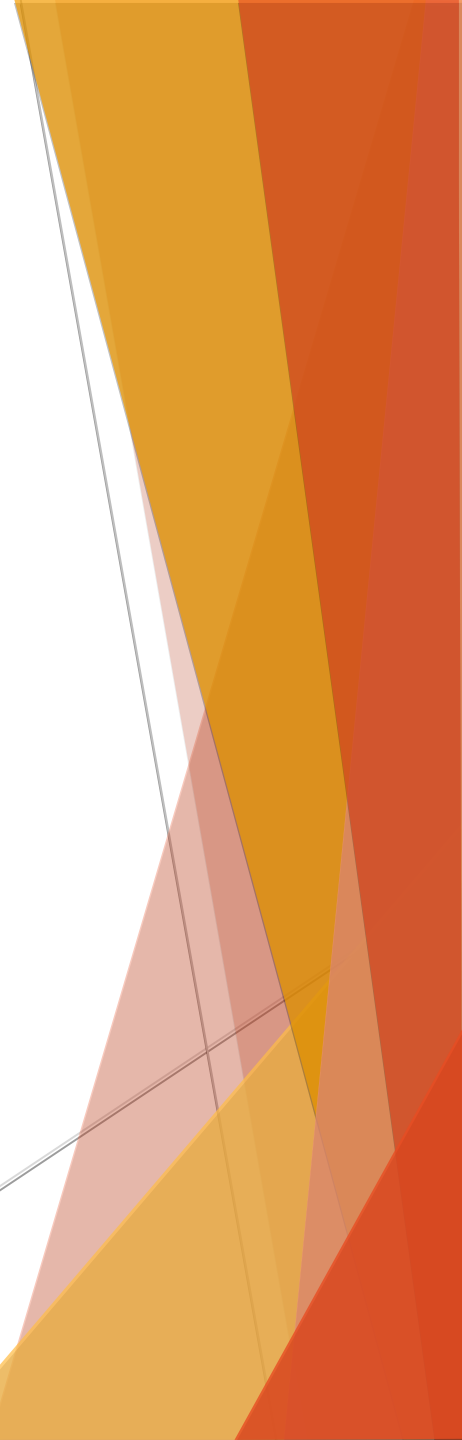
- ▶ is the conclusion. On the other hand, “for the reason that” announces that a premise is about to be stated.

Sometimes a single indicator can be used to identify more than one premise.

Consider the following argument:

- ▶ *It is vitally important that wilderness areas be preserved, for wilderness provides essential habitat for wildlife, including endangered species, and it is a natural retreat from the stress of daily life.*

- ▶ The premise indicator “for” goes with both “Wilderness provides essential habitat for wildlife, including endangered species,” and “It is a natural retreat from the stress of daily life.”

- 
- ▶ These are the **premises**.
 - ▶ By method of elimination,

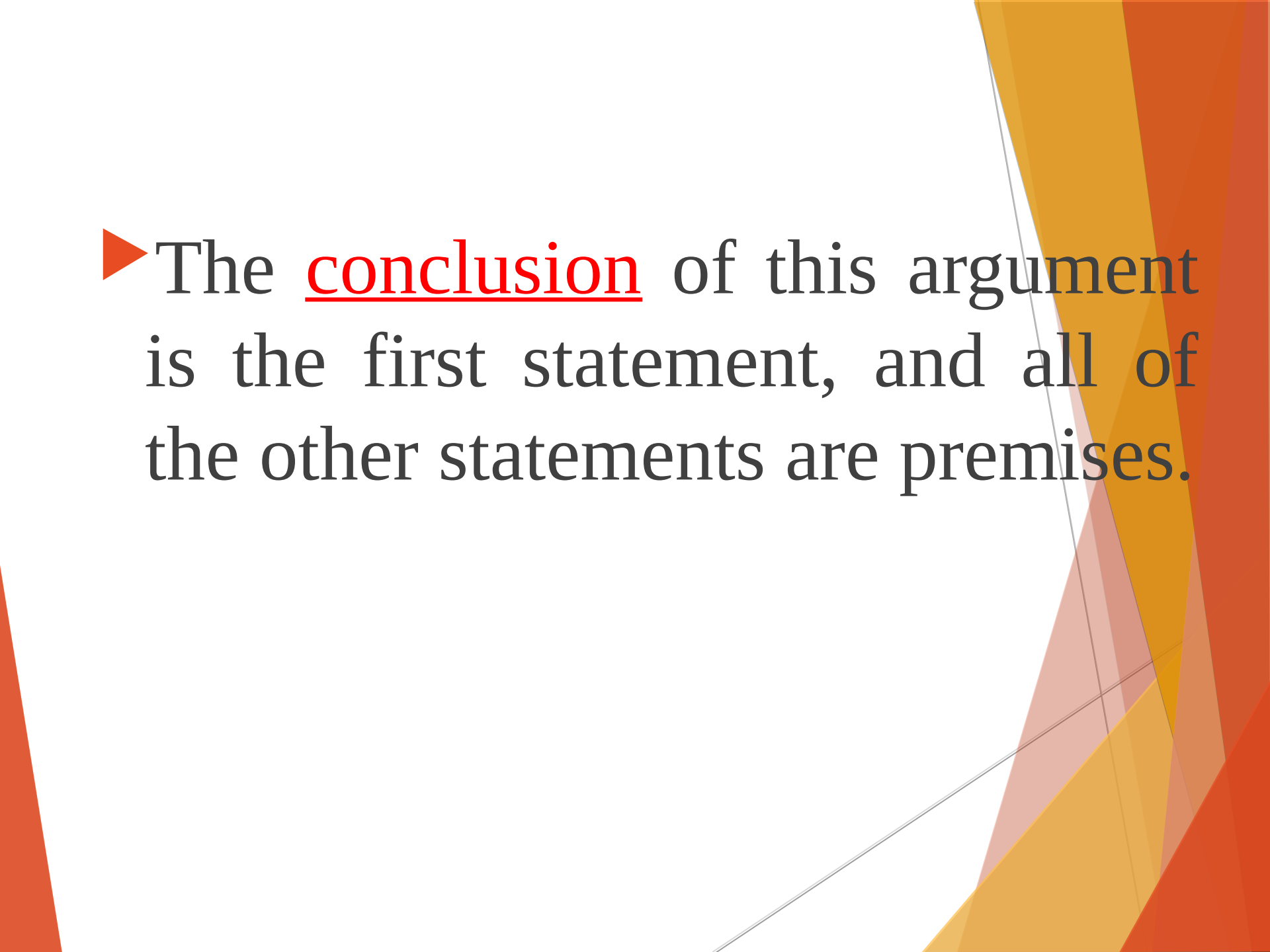
- ▶ “It is vitally important that wilderness areas be preserved” is the conclusion.
- ▶ Sometimes you may find an argument that contains no indicator all: neither a conclusion indicator word nor a premise indicator word. When this occurs, the reader/ listener must ask himself or herself such questions as:

- ▶ What single statement is claimed (implicitly) to follow from the others?
- ▶ What is the arguer trying to prove?
- ▶ What is the main point in the passage?

The answers to these questions should point to the conclusion.

► *Example:*

We must get serious about modernizing our nation's crumbling (disintegration) infrastructure. Many of our bridges are practically falling down, and our transit system is in dire (awful) need of repair. Furthermore, making these improvements would create jobs for millions of workers.

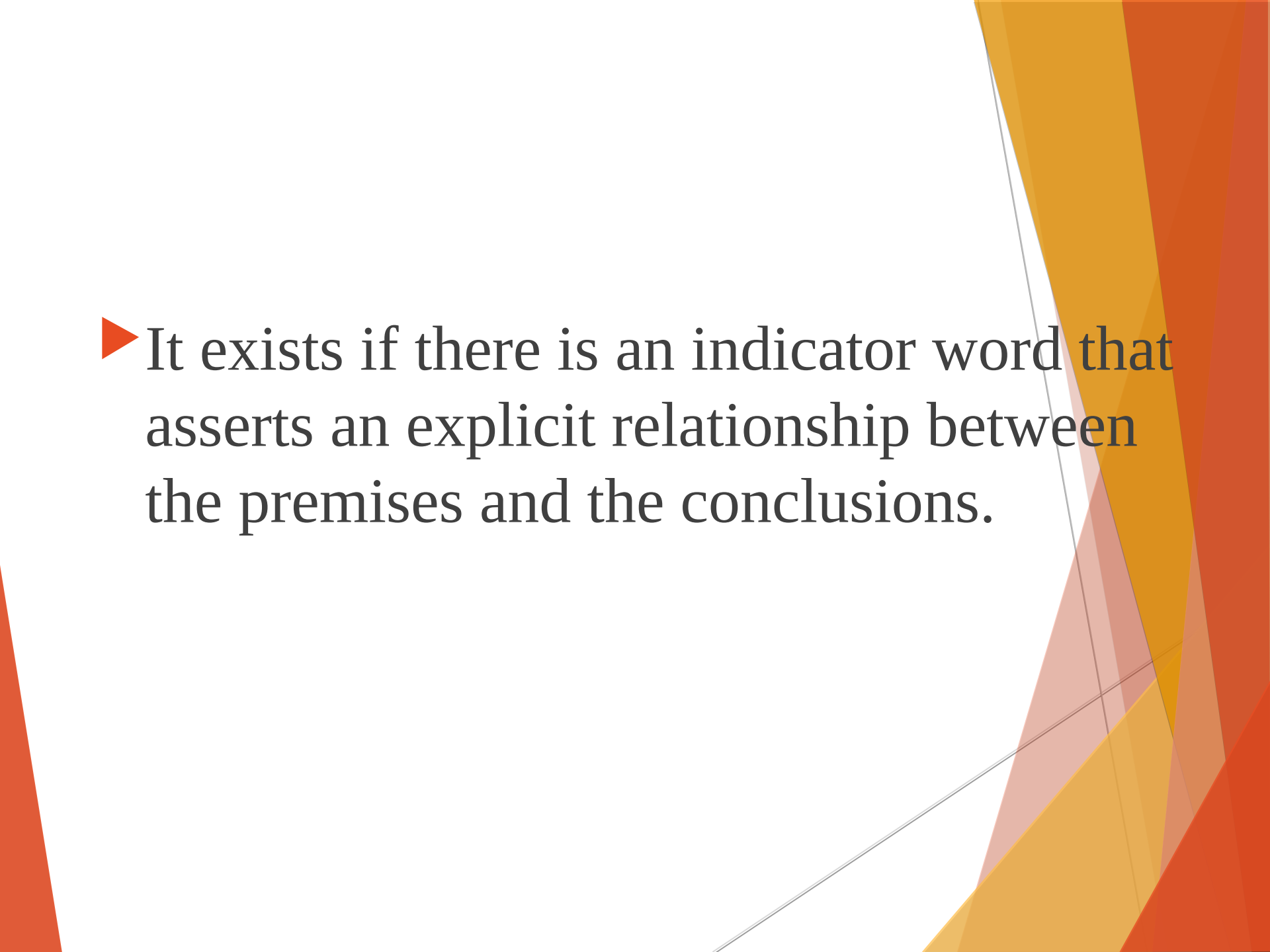
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- ▶ The conclusion of this argument is the first statement, and all of the other statements are premises.

Lesson 2: Techniques of Recognizing Arguments

- ▶ **2.1 Recognizing Argumentative Passages**
- ▶ In deciding whether there is a claim that evidence supports or implies something, keep an eye out for :
- ▶ 1) premise and conclusion indicator words and.

(2) the presence of an inferential relationship between the statements

An inferential claim can be either *explicit* or *implicit*. An *explicit inferential claim* is usually asserted by premise or conclusion indicator words (==thus,“ ==since,“ ==because,“ ==hence,“ ==therefore,“ and so on).

- 
- ▶ It exists if there is an indicator word that asserts an explicit relationship between the premises and the conclusions.

- ▶ An *implicit inferential claim* exists if there is an inferential relationship between the statements in a passage, but the passage contains no indicator words.

2.2 Recognizing Non-argumentative Passages

► Non-argumentative passages are passages, which lack an inferential claim. These include:

1. simple non-inferential passages,
2. expository passages,

- 
- 3. illustrations,
 - 4. explanations, and
 - 5. conditional statements.

1. simple non-inferential passages

- ▶ Simple non-inferential passages are unproblematic passages that lack a claim that anything is being proved. Such passages contain statements that could be premises or conclusions (or both), but what is missing is a claim that any potential premise supports a conclusion or that any potential conclusion is supported by premises

Passages of this sort include:

- A) warnings,
- B) pieces of advice,
- C) statements of belief or opinion,
- D) loosely associated statements, and
- E) reports.

A) warnings,

- ▶ A ***warning*** is a form of expression that is intended to put someone on guard against a dangerous or detrimental situation.
- ▶ **Example:**
- ▶ *Whatever you promise to tell, never confide political secrets to your wife.*
- ▶ In this passage, no evidence is given to prove that the statement is true; and if

Cont...

- ▶ no evidence is given to prove that the statement is true, then there is no argument.
- ▶ B) *A piece of advice*
- ▶ It is a form of expression that makes a recommendation about some future decision or course of conduct.

▶ **Example:**

- ▶ *After class hours, I would suggest that you give careful consideration to the subject matter you have discussed.*

c) A statement of belief or opinion

is an expression about what someone happens to believe or think about something.

Example:

- ▶ *We believe that our university must develop and produce outstanding students who will perform with great skill and fulfill the demands of our nation.*

D) Loosely associated statements

- ▶ may be about the same general subject, but they lack a claim that one of them is proved by the others.

Example:

- ▶ *Not to honor men of worth will keep the people from contention; not to*

Cont...

- ▶ *value goods that are hard to come by will keep them from theft; not to display what is desirable will keep them from being unsettled of mind.*

E) *A report*

- ▶ consists of a group of statements that convey information about some topic or event.

Example:

- ▶ *The great renaissance dam of Ethiopia has opened an employment opportunity for thousands of Ethiopians. In its completion, thirteen thousand Ethiopians are expected to be hired.*

2. *Expository Passages*

- ▶ It is a kind of discourse that begins with a topic sentence followed by one or more sentences that develop the topic sentence. If the objective is not to prove the topic sentence but only to expand it or elaborate it, then there is no argument.

Example

- ▶ There are three familiar states of matter: solid, liquid, and gas. Solid.....A liquid occupies..... A gas maintains.....
- ▶ In each passage the topic sentence is stated first, and the remaining sentences merely develop and flesh out this topic sentence.

- ▶ These passages are not arguments, because they lack an inferential claim

3. *Illustrations*

- ▶ is an expression involving one or more examples that is intended to show what something means or how it is done

4. *Explanations*

- ▶ is an expression that importance to shed light on some event or phenomenon, which is usually accepted as a matter of fact. It attempts to clarify, or describe such alike why something is happen that way or why something is what it is

Example:

- ▶ The sky appears blue from the earth's surface because light rays from the sun are scattered by particles in the atmosphere.
- ▶ Every explanation is composed of two distinct components: the explanandum and explanans.

I) *Explanandum*

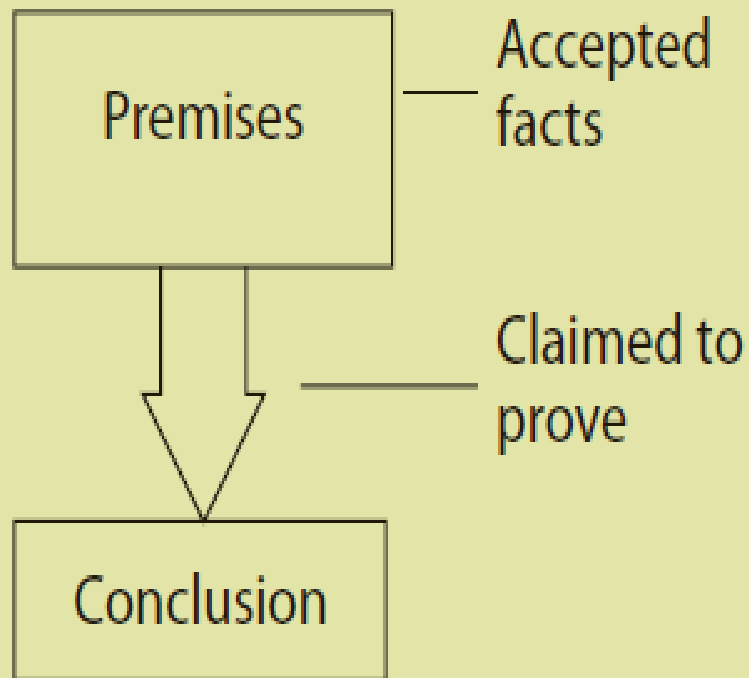
- ▶ is the statement that describes the event or phenomenon to be explained,

▶ II) Explanans

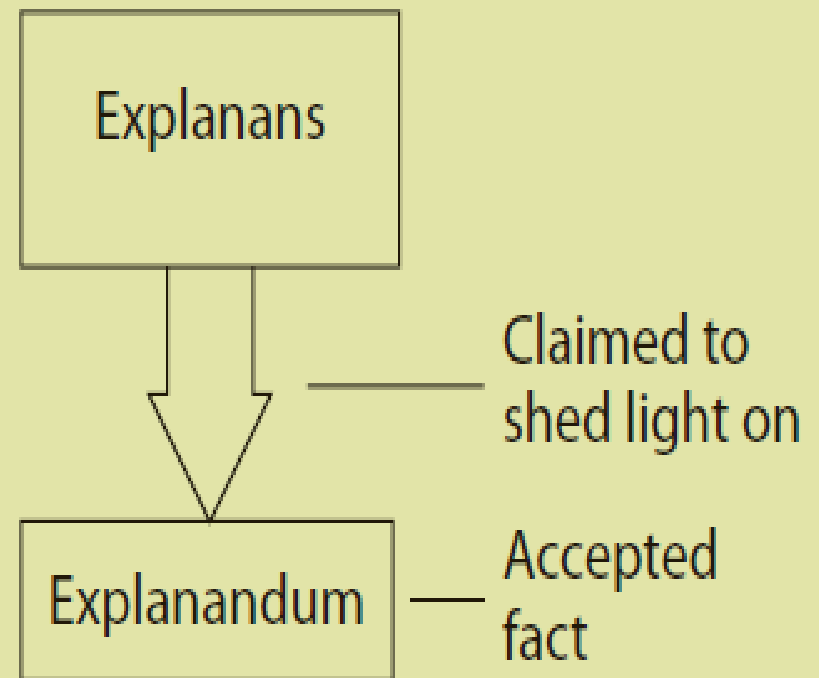
- ▶ the statement or group of statements that purports to do the explaining.

- ▶ In the first example, the **explanandum** is the statement “The sky appears blue from the earth’s surface” and the **explanans** is “Light rays from the sun are scattered by particles in the atmosphere.”

Argument



Explanation



- ▶ Explanations are sometimes mistaken for arguments because they often contain the indicator word “because.”
- ▶ in an explanation the purpose of the explanans is to shed light on, or to make sense of, the explanandum event—not to prove that it occurred.

- ▶ the purpose of the explanans is to show *why* something is the case, whereas in an argument, the purpose of the premises is to prove *that* something is the case.

5. Conditional Statements

A *conditional statement* is an —if . . . then . . .|| statement.

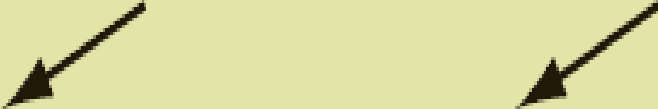
Example: *If you study hard, then you will score „A“ grade.*

- ▶ Every conditional statement is made up of two component statements. The component statement immediately following the “if ” is called the **antecedent**, and the one following the “then” is called the **consequent**.

Conditional statements

Antecedent Consequent

If _____ then _____ .



Consequent Antecedent

_____ if _____ .



Lesson 3: Types of Arguments: Deduction and Induction

A) Deductive Arguments

- ▶ is an argument incorporating the claim that it is impossible for the conclusion to be false given that the premises are true.
- ▶ it is impossible for the premises to be true and the conclusion false.
- ▶ Thus, deductive arguments are those that involve necessary reasoning.

B) Inductive Arguments

- ▶ is an argument incorporating the claim that it is improbable for the conclusion to be false given that the premises are true
- ▶ . It is an argument in which the premises are claimed to support the conclusion in such a way that it is improbable for the premises to be true

- ▶ and the conclusion false.
- ▶ , the conclusion is claimed to follow only probably from the premises.
- ▶ The premises may provide some considerable evidence for the conclusion but they do not imply (necessarily support) the conclusion.

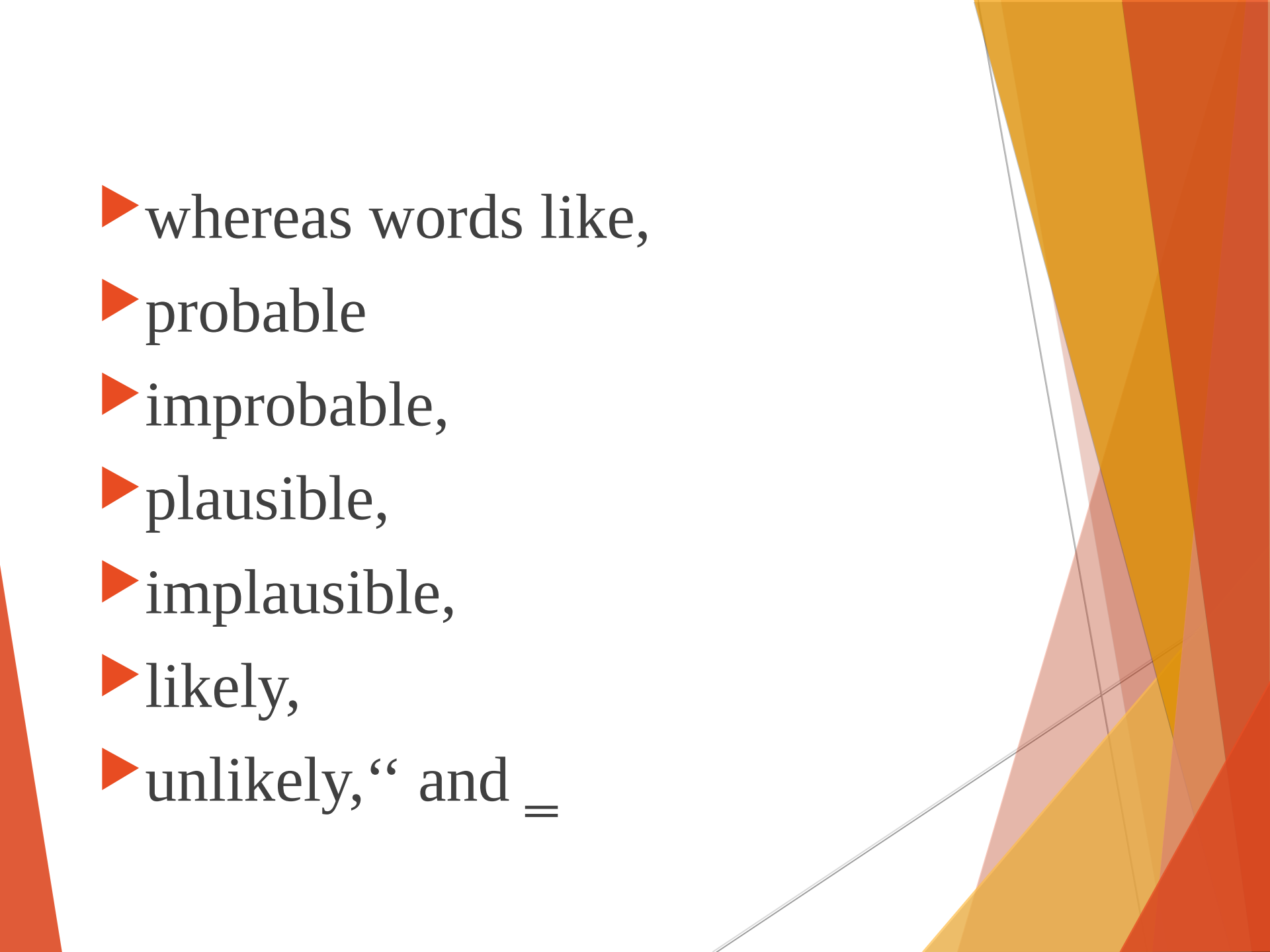
C) Differentiating Deductive and Inductive Arguments

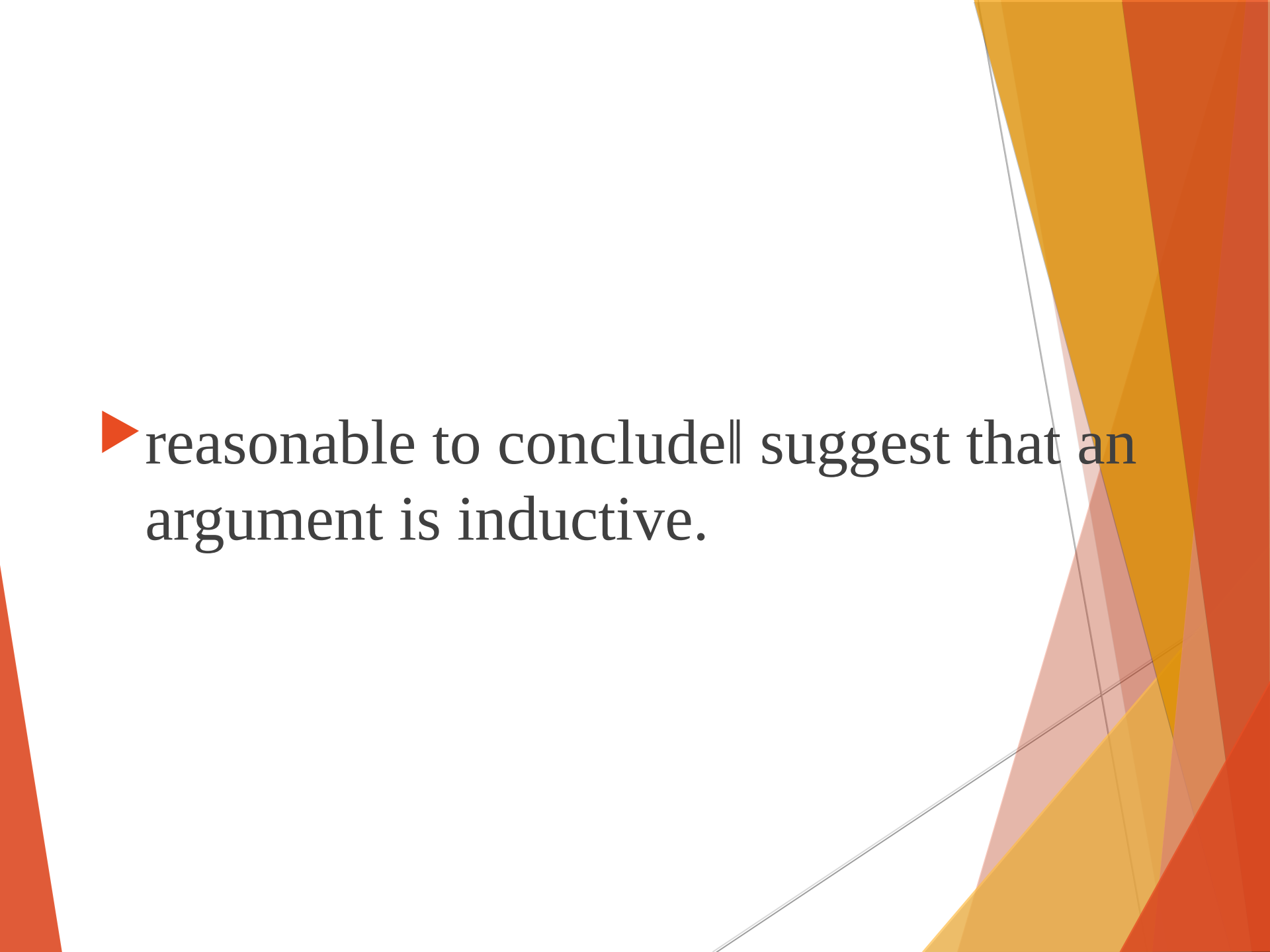
- ▶ There are three factors that influence the decision about the deductiveness or inductiveness of an argument's inferential claim. These are:

1) The occurrence of special indicator words,

Words like:

- ▶ certainly,
- ▶ necessarily,
- ▶ absolutely,
- ▶ definitely“ indicate that the argument should be taken as deductive,

- 
- ▶ whereas words like,
 - ▶ probable
 - ▶ improbable,
 - ▶ plausible,
 - ▶ implausible,
 - ▶ likely,
 - ▶ unlikely, “ and =

- 
- ▶ reasonable to conclude|| suggest that an argument is inductive.

2) *The actual strength of the inferential link between premises and conclusion,*

If the conclusion actually does follow with strict necessity from the premises, the argument is clearly deductive. In such an argument, it is impossible for the premises **to be true** and the **conclusion false**

- ▶ If, on the other hand, the conclusion of an argument does not follow with strict necessity but does follow probably, it is usually best to interpret it as inductive argument. Consider the following examples.

Example-1:

All Ethiopian people love their country.

Debebe is an Ethiopian.

Therefore, Debebe loves his country.

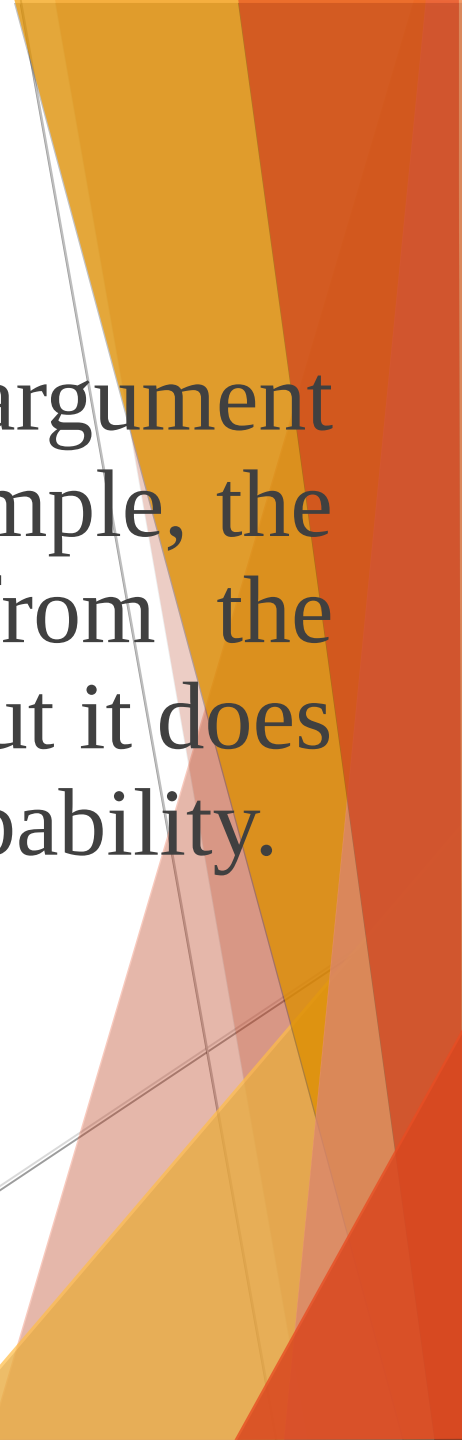
Example-2:

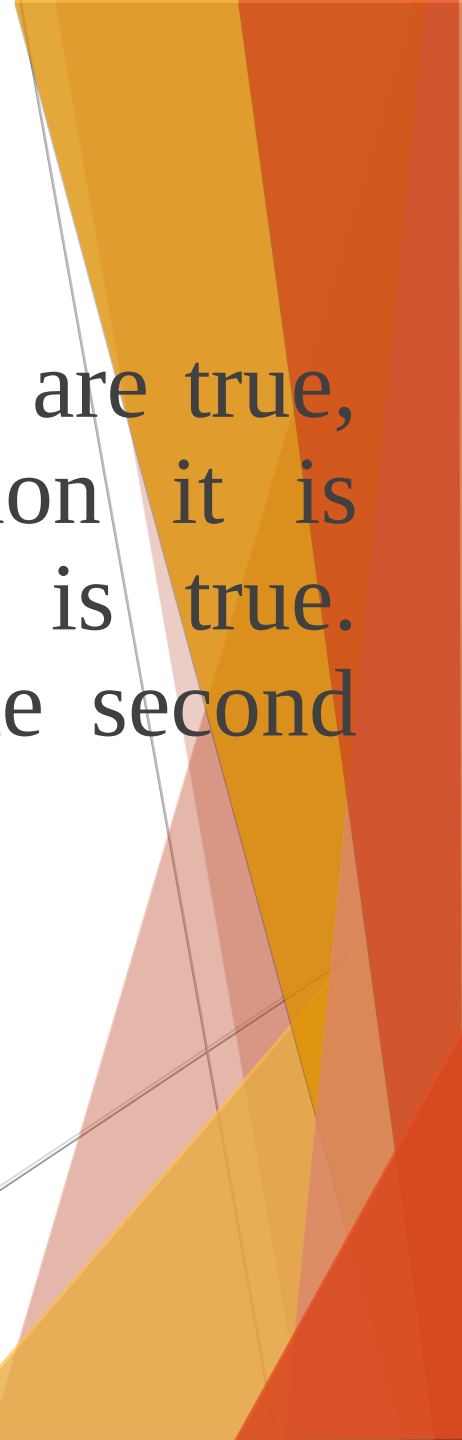
The majority of Ethiopian people are poor.

Alamudin is an Ethiopian.

Therefore, Alamudin is poor.

- ▶ In the first example, the conclusion follows with **strict necessity** from the premises. If we assume that all Ethiopian people love their country and that Debebe is an Ethiopian, then it is impossible that Debebe not love his country.

- 
- ▶ Thus, we should interpret this argument as deductive. In the second example, the conclusion does not follow from the premises with strict necessity, but it does follow with some degree of probability.

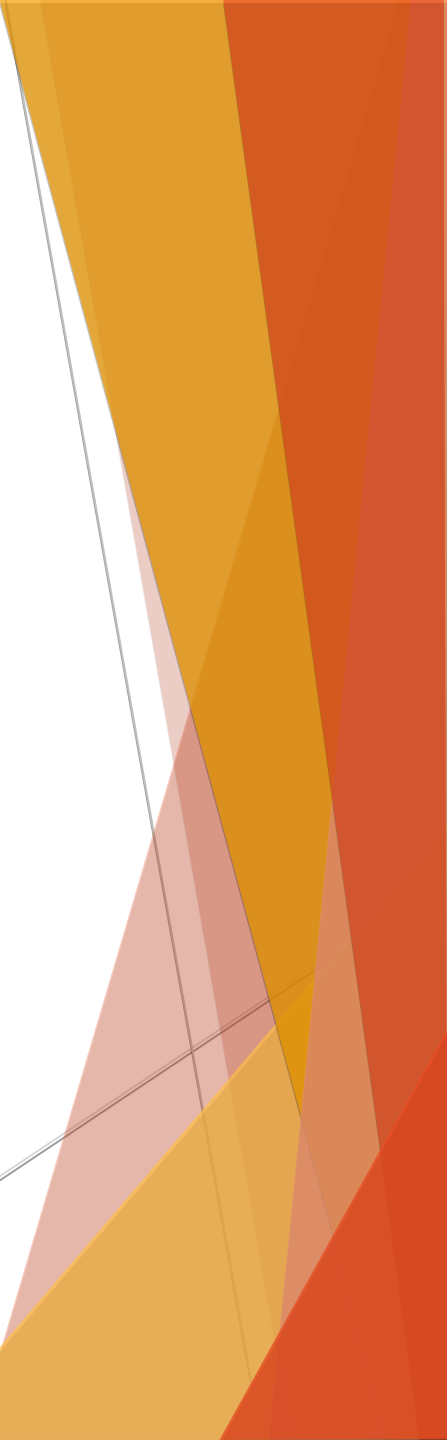
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- ▶ If we assume that the premises are true, then based on that assumption it is probable that the conclusion is true. Thus, it is best to interpret the second argument as inductive.

3) *The character or form of argumentation the arguers use.*

A) Instances of Deductive Argumentative Forms

► Five examples of such forms or kinds of argumentation are arguments based on:

- 1) mathematics,
- 2) definition,



► syllogisms:

3) categorical,

4) hypothetical, and

5) disjunctive syllogisms.

1) Based on Mathematics:

- ▶ It is deductive argument
- ▶ the conclusions depend on some purely arithmetic or geometric computation or measurement.
- ▶ For example, a shopper might place two apples and three oranges into a paper bag and then conclude that the bag contains five pieces of fruit.

- ▶ Or a surveyor might measure a square piece of land and, after determining that it is 100 feet on each side, conclude that it contains 10,000 square feet.

2) *Arguments based on definition:*

it is an argument in which the conclusion is claimed to depend merely up on the definition of some words or phrase used

- ▶ in the premise or conclusion. For example, one may argue that Angel is honest; it follows that Angel tells the truth. Or again, Kebede is a physician; therefore, he is a doctor.

Syllogisms

- ▶ are arguments consisting of exactly two premises and one conclusion.

3) Categorical syllogism:

- ▶ each statement begins with one of the words:
 - “all,”
 - “no,” or
 - “some.”

Examples

- ▶ **All** ancient forests ...
- ▶ **Some** ancient
- ▶ Therefore, **some**

4) Hypothetical syllogism:

having a conditional statement (“if . . . then”) for one or both of its premises.

▶ **Example:**

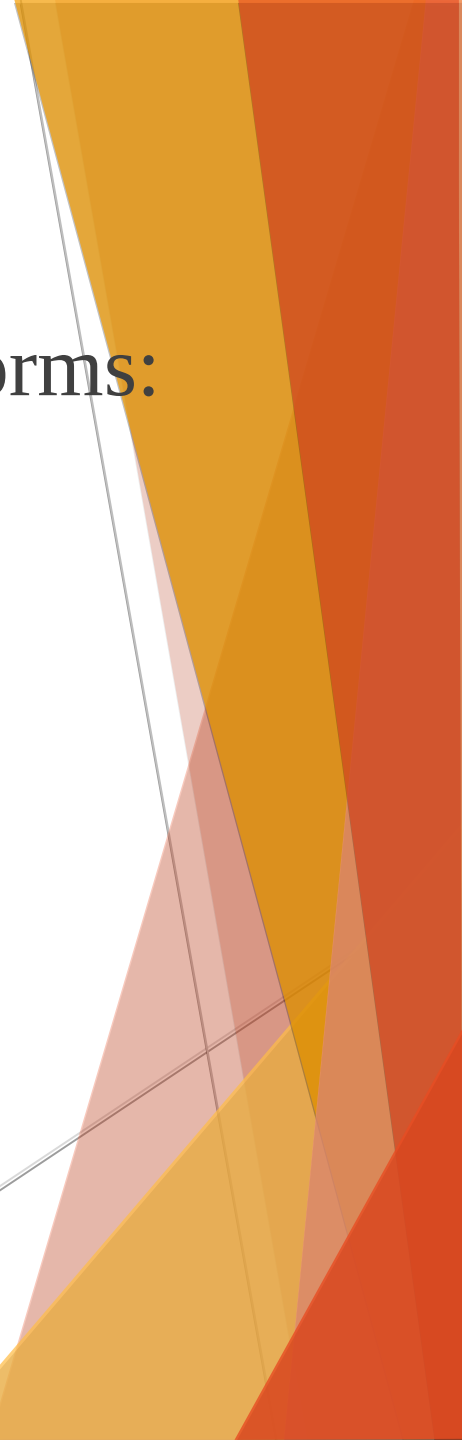
- ▶ *If you study hard, then you will graduate with Distinction.*
- ▶ *If you graduate with Distinction, then you will get a rewarding job.*
- ▶ *Therefore, if you study hard, then you will get a rewarding job.*

5) *Disjunctive syllogism:*

- ▶ having a disjunctive statement. (either ... or statement.)
- ▶ **Example:**
- ▶ *Rewina is either Ethiopian or Eritrean.*
- ▶ *Rewina is not Eritrean.*
- ▶ *Therefore, Rewina is Ethiopian.*

B) Inductive Argument Forms

- ▶ In general, inductive arguments are such that the content of the conclusion is in some way intended to “go beyond” the content of the premises. The premises of such an argument typically deal with some subject that is relatively familiar, and the conclusion then moves beyond this to a subject that is less familiar or that little is known about.



▶ argument may take any of several forms:

- 1) predictions about the future,
- 2) Arguments from analogy,
- 3) inductive generalizations,
- 4) arguments from authority,
- 5) arguments based on signs, and
- 6) causal inferences

1) Predictions About the Future,

- ▶ in a prediction the premises deals with some known event in the present or the past and the conclusions moves beyond this event to some event to relative future. For example, one may argue that because certain clouds develop in the center of the highland, a rain will fall within twenty-four hours.

2) Arguments From Analogy,

- ▶ that depends on the existence of an analogy or similarity between two things or state of affairs.
- ▶ For instance, one may conclude, after observing the similarity of some features of Computer A and car B: that both are manufactured in 2012;

- ▶ that both are easy to access; that Computer A is fast in processing; it follows that Computer B is also fast in processing.

3) Inductive Generalizations,

proceeds from the knowledge of a selected sample to some claim about the whole group. Because the members of the sample have a certain characteristic, it is argued that all the members of the group have that same characteristic.

4) An argument from authority:

concludes something is true because a presumed expert or witness has said that it is.

5) Arguments based on sign:

- ▶ that proceeds from the knowledge of a sign to a claim about the thing or situation that the sign symbolizes. The word “sign,” as it is used here, means any kind of message (usually visual) produced by an intelligent being.

For instance, one may infer that after observing ‘No Parking’ sign posted on the side of a road, the area is not allowed for parking.

6) A causal inference

- ▶ proceeds from knowledge of a cause to a claim about an effect, or, conversely, from knowledge of an effect to a claim about a cause.

Lesson 4: Evaluating Arguments

4.1 Evaluating Deductive Arguments: Validity, Truth, and Soundness

Deduction and Validity

- ▶ An argument is deductively valid if and only if the truth of its premises is sufficient for the truth of its conclusion.
- ▶ An argument is deductively valid if and only if it is impossible for its premises to all be true while its conclusion is simultaneously false.
- ▶ if the premises are assumed true, it is impossible for the conclusion to be false

- ▶ . the conclusion follows with strict necessity from the premises

Example-1: *All men are mammals.*

All bulls are men.

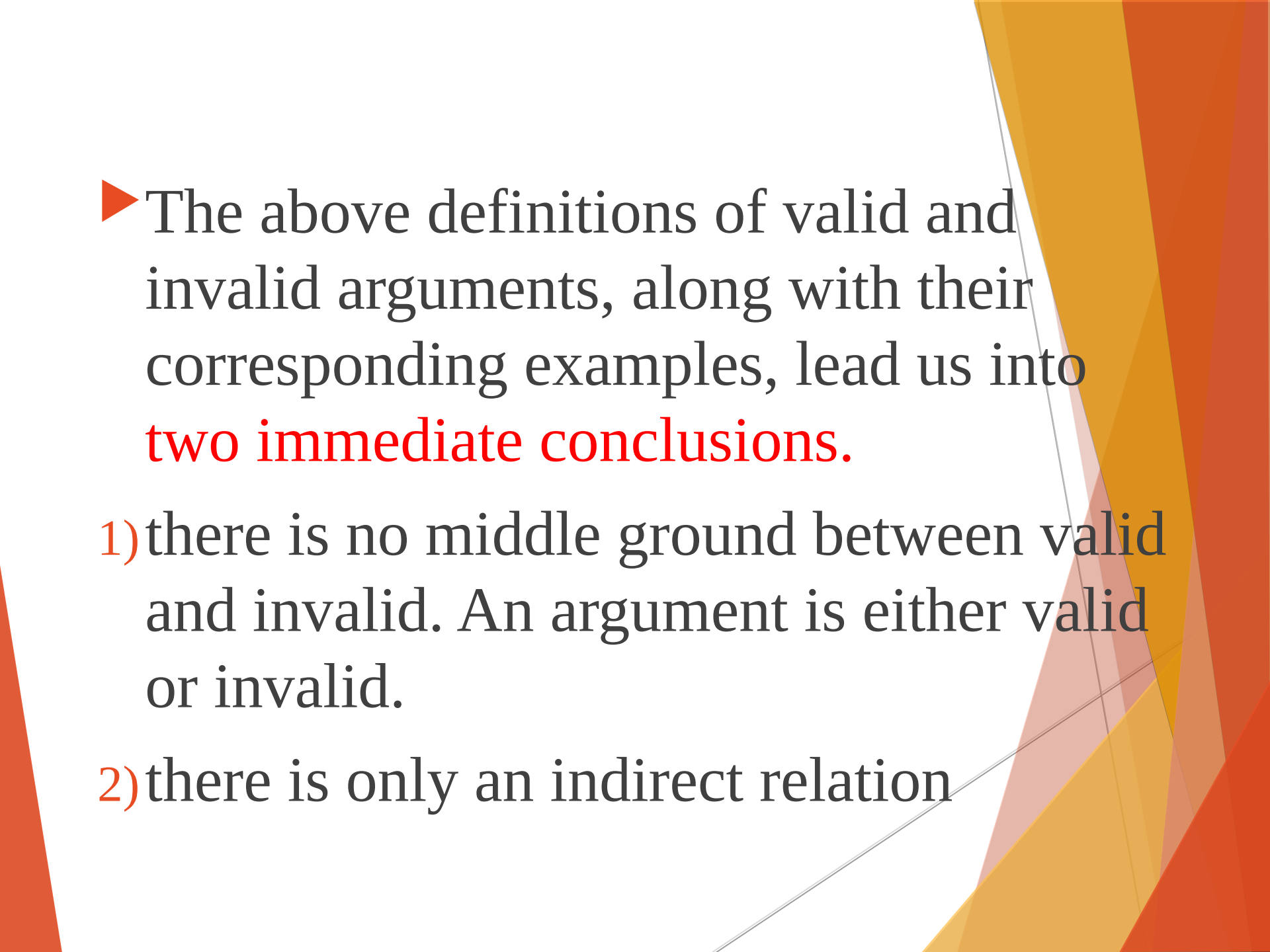
Therefore, all bulls are mammals.

Invalid Deductive Argument

- ▶ the conclusion does not follow with strict necessity from the premises,
- ▶ if the premises are assumed true, it is possible for the conclusion to be false.

Example-2:

- ▶ *All philosophers are rational.*
- ▶ *Socrates was rational.*
- ▶ *Therefore, Socrates was a philosopher*



► The above definitions of valid and invalid arguments, along with their corresponding examples, lead us into **two immediate conclusions.**

- 1) there is no middle ground between valid and invalid. An argument is either valid or invalid.
- 2) there is only an indirect relation

between validity and truth.

For an argument to be valid it is not necessary that either the premises or the conclusions be true, but merely that if the premises assumed true, it is impossible for the conclusion be false

► There are ***four possibilities*** with respect to the truth or falsity of the premises and conclusion of a given argument:

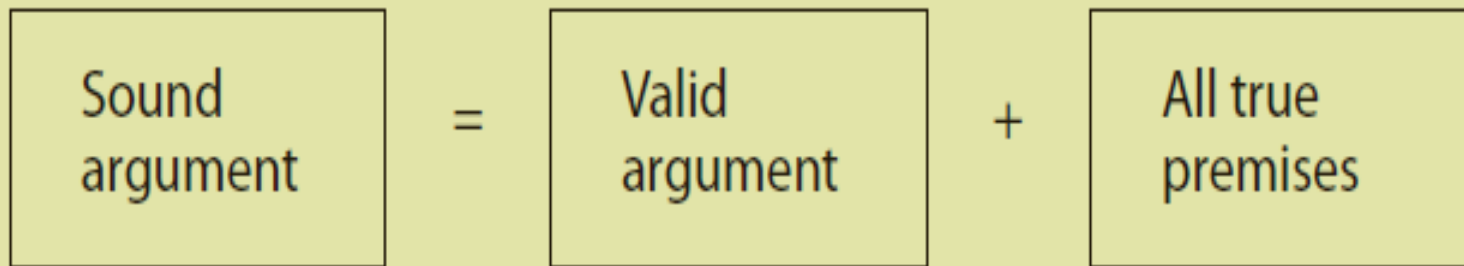
- 1) *True premises and True conclusion,*
- 2) *True premises and False conclusion,*
- 3) *False premises and True conclusion, and*
- 4) *False premises and False conclusion.*

- Note that all of the above possibilities, except the second case (true premises and false conclusion), allow for both valid and invalid arguments.

Premises	Conclusion	Validity
True	True	Valid/invalid
True	False	Invalid
False	True	Valid/invalid
False	False	Valid/invalid

Deduction and Soundness

- ▶ is a deductive argument that is *valid* and has *all true premises*.
- ▶ is what is meant by a good, or successful, deductive argument in the fullest sense of the term.



Unsound Argument

- is a deductive argument that is invalid, has one or more false premises, or both.

TABLE 1.1 Deductive Arguments

	Valid	Invalid
True premises	All flowers are plants. All daisies are flowers.	All flowers are plants. All daisies are plants.
True conclusion	Therefore, all daisies are plants. [sound]	Therefore, all daisies are flowers. [unsound]
True premises	None exist	All roses are flowers. All daisies are flowers.
False conclusion		Therefore, all daisies are roses. [unsound]
False premises	All flowers are dogs. All poodles are flowers.	All dogs are flowers. All poodles are flowers.
True conclusion	Therefore, all poodles are dogs. [unsound]	Therefore, all poodles are dogs. [unsound]
False premises	All flowers are dogs. All tigers are flowers.	All roses are cats. All daisies are cats.
False conclusion	Therefore, all tigers are dogs. [unsound]	Therefore, all daisies are roses. [unsound]

4.2 Evaluating Inductive Arguments: Strength, Truth, and Cogency

I) Induction and Strength

A) strong inductive argument

is an inductive argument in which it is improbable that the conclusion be false given that the premises are true.

B) weak inductive argument

- ▶ the conclusion does in fact follow probably from the premises.
- ▶ The procedure for testing the strength of inductive arguments runs parallel to the procedure for deduction.

II) Strength and Truth Value

the strength or weakness of an inductive argument results not from the actual truth or falsity of the premises and conclusion, but from the probabilistic support the premises give to the conclusion.

Premises	Conclusion	Strength
True	True	Strong/Weak
True	False	Weak
False	True	Strong/Weak
False	False	Strong/Weak

III) Induction and Cogency

A) cogent argument

- ▶ is an inductive argument that is *strong* and has *all true premises*

Cogent Argument = A strong argument + All true premises

B) uncogent argument

is an inductive argument that is weak,
has one or more false premises

- ▶ is the inductive analogue of a sound deductive argument and is what is meant by a good, or successful, inductive argument without qualification.

TABLE 1.2 Inductive Arguments

	Strong	Weak
True premise Probably true conclusion	Every previous U.S. president was older than 40. Therefore, probably the next U.S. president will be older than 40. [cogent]	A few U.S. presidents were lawyers. Therefore, probably the next U.S. president will be older than 40. [uncogent]
True premise Probably false conclusion	None exist	A few U.S. presidents were unmarried. Therefore, probably the next U.S. president will be unmarried. [uncogent]
False premise Probably true conclusion	Every previous U.S. president was a TV debater. Therefore, probably the next U.S. president will be a TV debater. [uncogent]	A few U.S. presidents were dentists. Therefore, probably the next U.S. president will be a TV debater. [uncogent]
False premise Probably false conclusion	Every previous U.S. president died in office. Therefore, probably the next U.S. president will die in office. [uncogent]	A few U.S. presidents were dentists. Therefore, probably the next U.S. president will be a dentist. [uncogent]