# Logic: The Study of Arguments

Today, you’ll learn to:

1. Define key terms, including **logic, argument, premise, conclusion,** and **statement.**
2. Identify sentences that are/are not **statements** and produce examples of each sort of sentence.
3. Locate the **premises** and **conclusion** of simple arguments using **indicator words.**
4. Put arguments into **standard form**.

## What is Logic?

In order to get started, we’ll need to begin with a few definitions:

* **Logic** is the study of arguments, or forms of reasoning. Logicians try to determine what separates good forms of reasoning from bad forms. Studying logic is, in essence, the study of how to think rationally (i.e., of how to be a **critical thinker**).
* An **argument** is a group of statements, one or more of which (the **premises**) are claimed to provide reasons to believe another (the **conclusion**). Not every collection of statements is an argument, obviously. For example, you are not making an argument when you say “I disagree with X” or “I believe Y.” Making an argument requires that you provide *reasons* (even if these reasons ultimately turn out to be unconvincing)*.*
  + Not all arguments are between two people! You are engaging in “argumentation” whenever you weigh the reasons for or against believing in a certain conclusion.
* A **statement** (or **proposition**)is any sentence that is true or false, even if we don’t know which. Both the premises and the conclusion of any argument must be statements. Not every sentence is a statement, however, as we will see next.

## Why Am I Studying Logic?

While most people have heard the words “argument” and “logical” at various points in their life, it isn’t always immediately obvious to everyone why they’d want to take a course on this, or what it would mean to be “successful” in this sort course. After all, many of us don’t think of ourselves as “big arguers,” and perhaps we’re even a bit proud of the way we can use our “intuition” or “emotions” as opposed to “cold, hard logic.” To a large extent, this seems to be based on a misunderstanding of what logic is actually all about. So, while arguments between two competing people (or political parties) make up *some* of the arguments that studying logic will help you understand, it can ALSO help you understand the (much more numerous) arguments you have with yourself on a day-to-day basis. After, you are making an argument (in the logical sense) whenever you try to determine what to believe (or what to do) based on your available evidence. For most of us, this is something that happens every hour of every day. Getting even a *little* bit better at doing this can pay big dividends.

This is a survey course in logic, which means we will be covering many *different* forms of logic, which have been used for many *different* sorts of purposes. With this in mind, here are some of the main areas of logic that we’ll touch on over the course of the semester:

1. One main area of logic is called **informal logic.** This involves studying the structure of arguments expressed in “ordinary” language. These arguments might concern politics, sports, business, health, finance, etc. We’ll be especially interested in learning to recognize *when* arguments are being made, *how* to go about clarifying the structure of these arguments, and what (two) *types* of inferential claims people can make when they argue (and why knowing this makes a BIG difference in how we evaluate their arguments). Once we’ve done this, we can start talking about common **fallacies,** which are common ways of arguing/reasoning *badly.* The main goal of learning these fallacies is to (a) avoid being taken in by the bad arguments of others and (b) more importantly, learning to recognize when WE are engaging in this sort of reasoning (and hopefully, start to avoid it).
2. Another type of logic is **formal (deductive) logic.** This is the sort of logic that makes up most upper-level mathematics/computer science/philosophy classes in logic. This sort of logic was (and is) central to designing and understanding things like computer programming languages (and spreadsheets, databases, etc.), mathematical “proofs,” and puzzles and paradoxes of various sorts. Even for people who are confident they’ll never have to work with any of these things, though, formal deductive logic can help provide a model for what it means to reason *systematically,* since it requires that we say *exactly* what we mean, that we proceed in a methodical, step-by-step manner to prove that our conclusion follows from our premises, to ensure that there is absolutely no possibility for error. We’ll be looking at two different versions of formal logic: **categorical logic** (like it says, it looks at how to make arguments about categories) and **propositional/predicate logic** (here, we’ll be looking to understand the logical structure of sentences, and how we can use this to assess arguments).
3. A final type of logic is **inductive logic.** Where deductive logic tries to establish conclusions with 100% certainty, inductive logic deals with arguments where we are simply aiming to establish which conclusions are PROBABLY true. This includes many of the most important topics about which reason about: making predictions, deciding which people/sources to trust, causes and effects, scientific reasoning, statistical reasoning, moral and legal reasoning, etc. More generally, any time we try to draw conclusions about the future based on the sorts of experiences we’ve had in the past, we are reasoning inductively. For this reason, it’s important that we do it as well as we can!

In any case, don’t worry too much if you don’t understand all of these ideas/concepts right now—I promise you we’ll come back and study them in much more detail! And now, on to our study of informal logic…

## Statements and nonStatements

Statements are sentences that are true or false, *even if we don’t know which*. Some examples of statements include:

* God exists.
* Julie believes in God.
* If Julie believes in God, then her disagreeable boyfriend Jones does not.
* Julie ought to break up with Jones because he is such a jerk.
* I don’t like Julie.
* Mahatma Gandhi was a famous general in the American Civil War.

Sentences that cannot be true or false are not statements. Some examples of nonstatements include:

* Hallelujah! (Exclamation)
* Jones, stop being so disagreeable. (Command)
* Do you know anything about the American Civil War? (Question)
* George and Lenny (Not a sentence)

## How Arguments Work and Why they Matter

The following diagram illustrates the basic structure shared by *all* arguments (this is a famous argument called the **ontological argument**—see if you can figure out what it is wrong with it…):

**So why do arguments matter?** Every time we engage in *reasoning* from what we know to some new conclusion, we are engaged in argumentation (although maybe just with ourselves). Nearly all of us want to be *good* reasoners. For example:

* You are trying to decide whether to buy a new phone. Your premises concern things like the price of the new phone, the amount of money you have, the status of your old phone, etc. The conclusion is of the form “I should (not) buy the phone.”
* You are on a jury for a murder trial. Your premises concern the testimony of witnesses and experiments plus forensic and circumstantial evidence. Your conclusion is of the form “I should (not) vote to convict.”
* An evangelist tries to convert you to a new religion. Your premises concern the various things he tells you. Your conclusion is of the form “I should (not) convert to this religion.”

## Conclusions and Premises

**How to find the conclusion.** When you are trying to determine whether a group of statements constitutes an argument, you should first attempt to locate the conclusion. Every argument has one, though it may be **implicit** (i.e., not stated directly). *If a group of statements does not contain a conclusion, it is not an argument.* No single statement, however controversial, counts as an argument all by itself.

**Conclusion indicators** are words or phrases that sometimes (though not always) signal a conclusion. Some examples of conclusion indicators include:

* therefore C
* consequently C
* hence C
* thus C
* so C
* implies that C
* we can infer that C
* for this reason C
* we can conclude that C.

If there are no conclusion indicators, the conclusion is often the first statement (i.e., the topic sentence or thesis sentence).

**How to find the premises.** After you have found the conclusion, locate the premises. Every argument has to have at least one premise; many arguments will have multiple premises. Some premises may be implicit. Again, *if there are no premises, there is no argument.* A person cannot make an argument simply by asserting the truth of a given statement (no matter how loudly it is repeated!)—he or she must also provide *reasons* for thinking that this statement is true.

**Premise indicators** include words and phrases that sometimes (but not always) signal a premise. Some examples include

* since P
* because P
* for P
* inasmuch that P
* given that P
* it follows from P
* seeing that P.

Remember that (1) conditional (if-then) statements are not arguments and (2) that *if* is not a premise indicator. Conditional statements can be premises or conclusions to arguments, however.

## How (and Why) to Put an Argument in Standard Form

In order to make the structure of an argument clear, it often helps to put it into **standard form,** where the premises and conclusion can be clearly distinguished. To do this, follow these steps:

1. Identify the conclusion and write it down on its own line, leaving room to write the premises above it.
2. Write down the premises ABOVE the conclusion in whatever order is most natural. Include any **implicit content** (content that the arguer hasn’t stated explicitly, but which is nevertheless part of the argument).
3. The conclusion should be clearly marked as the conclusion, for example, by including the word “Therefore,” before it, and/or by including a line between the premises and conclusion.
4. Express each premise or conclusion as a simple, declarative sentence.
   1. It is often helpful to break complex sentences into multiple simple statements. You might need to replaced pronouns (like “it” or “he” or “they”) with regular nouns, in order to make everything perfectly clear.
5. Include all and only that content relevant to the argument. Indicator words should generally NOT be included, nor should rhetorical devices (e.g., “Everyone knows that X” becomes “X”).

Sample Argument: “**Since** it is January in Minnesota, and **because** most Minnesotans like warm weather, **I can conclude that** most Minnesotans would probably enjoy taking a trip to Costa Rica.”

1. It is January in Minnesota
2. Most Minnesotans like warm weather.
3. (Implicit): It is cold in Minnesota in January, while it is warm in Costa Rica.
4. Therefore, Most Minnesotans would enjoy a trip to Costa Rica.

**The Principles of Charity.** Putting an argument in standard form often requires that you reword the premises and/or conclusion. When doing so, however, be sure to follow the **principle of charity**, which requires that you try and make the argument as convincing as possible. Charity requires that:

* If the premises or conclusion are ambiguous or unclear, you should generally interpret them in whatever way they are most likely to be true.
* If the structure of the argument is unclear, you should always aim to interpret the argument as being either deductively valid or inductively strong. (We’ll learn more about these ideas later, but the basic idea is that we should aim to interpret the argument in such a way that, if the premises really were true, the conclusion would be true as well.).
* A good rule of thumb: When putting any argument in standard form (*especially* one whose conclusion you disagree with), you should aim to express it in such a way that the person who originally made it would say something like “Yes, that’s exactly what I think! I couldn’t have put it better myself.”
* Why do all this? First, doing this makes it much more likely you’ll *learn* something about the other person’s argument (“Oh, that’s why they think the thing they do.”). Second, if and when you end up disagreeing with the argument, this makes it much more likely the other person will listen to you (since they’ll know that you’ve made a genuine effort to understand their perspective).

## Solved Problems

### Sample Problem 1: Identifying Statements

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| **Sentence** | **Is it a statement? (Or, “Does it express a proposition?”)** |
| Emma is 19 years old. | Yes. Simple declarative sentences are statements. This is a claim about the world that might be true (she really is 19) or it might be false (she’s really 29). Either way, though, it’s a statement. |
| When will Emma turn 20? | No. Questions are not statements, since they can’t be true or false. |
| Emma, stop being so rude. | No. Commands (like questions) are not statements, since they cannot be true or false. |
| If you read a book by Jane Austen, you should read *Emma.* | Yes. If-then statements (**conditional statements**) are still statements. |
| I don’t like old novels. | Yes. This sometimes confuses people, but claims about how you feel, or what you think/believe/like are statements. They can be true (you are telling the truth) or false (you are lying). |
| Emma went to London last week, and is planning and going again next week; however, if she go, then she won’t go to any parties this time. | Yes. This (complex) sentence is a statement. It also contains a number of subparts that are also statements. In general, if both A and B are statements, then so are sentences like “A and B”, “A or B”, “A but B”, and so on. |
| Emma is kind of a gossip. | Yes, this is a statement. It might just be your “opinion” (and you might be wrong about it), but this doesn’t change the fact it is a claim about the way the world is. |
| Emma! | No. |
| Emma believes that she will someday marry Knightley. | Yes. Claims about what people “believe” or “think” are still statements. After all, you might wrong about them. |
| Jane Austen was secretly a robot. | Yes. Even clearly false statements are statements. |

### Sample Problem: arguments in standard form.

In real life arguments, putting arguments in standard form often requires that we rephrase/clarify things, add in **implicit premises** or **conclusion,** and reorder things so they make sense. In many cases, this is actually one of the more difficult parts of being a “good logician,” but it’s also crucially important. After all, if you don’t know precisely *why* someone believes the conclusion that they do, it’s very difficult to figure out whether you should agree with them or not!

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| **Original** | **Standard Form** |
| All Smurfs are blue. Smurfette is a Smurf. So, Smurfette is blue. | P1: All Smurfs are blue.  P2: Smurfette is a Smurf.  C: Smurfette is blue. |
| If squirrels are mammals, they take care of their young. After all, if squirrels are mammals, they give live birth. And if they give live birth, they must take care of their young. | P1: If squirrels are mammals, they give live birth.  P2: If squirrels give live birth, they must take care of their young.  C: If squirrels are mammals, they take care of their young. |
| I agree with Candidate A’s position on both abortion and education, while I disagree with candidate B’s positions on these things. **Hence,** I should probably vote for Candidate A. | P1: I agree with Candidate A…  P2: I disagree with Candidate B…  P3 [Implicit]: I should vote for the candidate who agrees with me on issues I find important.  C: I should vote for Candidate A. |
| Democracy cannot succeed unless those who express their choice are prepared to choose wisely. The real safeguard of democracy**, therefore,** is education. (FDR) | P1: Democracy cannot succeed unless voters can make wise choices.  P2 [Implicit]: In order to make wise choices, voters need education.  C: Education is necessary for democracy to succeed. |
| Each victim of suicide gives his act a personal stamp which expresses his temperament, the special conditions in which he is involved, and which, **consequently,** cannot be explained by the social and general causes of the phenomenon. (Emile Durkheim) | P1: Each victim of suicide did so for reasons depending on both their temperament (or personality) and the special conditions in which they were involved.  P2 [Implicit]: General, sociological accounts of the causes of suicide happens can’t take account of these individual differences.  C: General, sociological accounts of suicide can’t explain why particular individuals killed themselves. |

## Review Questions

1. Without looking at the notes, write down your definitions of **logic** and **argument.** Now, check to see how close your definitions are.
2. Give TWO examples of sentences that are statements, and TWO examples of sentences that are not statements.
3. Mark conclusion and premise indicators and then put these arguments in standard form.
   1. Our problems are man-made; therefore they may be solved by man. (JFK)
   2. It is strange that men should fear death seeing that death, a necessary end, will come when it comes. (William Shakespeare)
   3. It is an acknowledged fact that we find vast amounts of truly horrendous evil in the world. Moreover, one must grant that, if there were a God, we should not find vast amounts of horrendous evil in the world. From this, we can conclude that there is no God. (Peter van Inwagen)
   4. The happiness of your life depends upon the quality of your thoughts: therefore, guard accordingly, and take care that you entertain no notions unsuitable to virtue and reasonable nature. (Marcus Aurileus)
   5. If someone avoids and is afraid of everything, standing firm against nothing, he becomes cowardly; if he is afraid of nothing at all and goes to face everything, he becomes rash. Similarly, if he gratifies himself with every pleasure and abstains from none, he becomes intemperate [has no self-control]; if he avoids all pleasure, he becomes a sort of insensible person [without emotion; completely callous] . Temperance and bravery, then, are ruined by excess and deficiency, but preserved by the mean. (Aristotle)