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What is Logic?

_____ **Introduction.** The best way to answer the question “What is logic?” is with a definition. But that is easier said than done. Throughout history, many people have thought and written about the subject of logic and many people have offered definitions. Some of them are useful and some are not.

Josiah Royce, an American philosopher, defined logic as “the science of order,” but this definition is so general that it really could include things outside of logic, and so it really doesn’t tell us much.

Other definitions are a little too simple. The writer Oliver Wendell Holmes said, “Logic is logic. That’s all I say.” That obviously won’t help us.

The writers of a book on fallacies (we’ll explain what those are later) defined logic as “the defense against trickery.” That’s one thing logic is, but certainly not all.

Much better is the definition given by Raymond McCall: “Logic in general is the science of right thinking.” Jacques Maritain, a very famous philosopher, had a similar definition. “Logic,” he said, “is the art which enables us to proceed with order, ease, and correctness in the act of reason itself.”

Irving Copi, who wrote a book on logic still used in many colleges, gets even a little more specific. “The distinction between correct and incorrect reasoning is the central problem with which logic deals.” As you proceed in this book, you will see that this is so.

_____ **The History of Logic.** The eighteenth-century German philosopher Immanuel Kant called Aristotle, the ancient Greek philosopher, the “father of logic.” If we are thinking only of traditional, or *formal*, logic (which is the only kind of logic we study in this book), this is true. In fact, formal logic has changed hardly at all since the time of Aristotle, who lived from 384-322 B.C.

Shortly after the time of Aristotle, another Greek philosopher laid the groundwork for modern symbolic logic—his name was Chrysippus (279-206 B.C.). During the Middle Ages, the kind of logic developed by Chrysippus

Logic is the science of right thinking.

Aristotle is considered the father of logic.



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The two main branches of logic are formal logic and material logic.

did not receive much attention. But in the 17th and early 18th centuries, philosophers began to take another look at the logical system of Chrysippus. One of the first and most famous of these is Gottfried Wilhelm Leibniz (1781-1848). Since then, many advances have been made in symbolic logic.

In addition, another form of logical thought, called *induction*, has become a part of the subject that we know as logic. John Stuart Mill (1806-1873), who lived in the 19th century, pioneered the theories about induction that we study today.

At the end of the 19th century and into our own, other logical methods have been developed, many of which have as much, if not more, to do with mathematics than with philosophy. Gottlob Frege (1848-1925), Alfred North Whitehead (1861-1947), and Bertrand Russell (1872-1970) are names associated with the more modern kinds of mathematical logic.

For our purposes, we will stick to the formal logic of Aristotle, which is just as useful today as it was when it was set forth over 2,300 years ago.

————— **The Two Main Branches of Logic.** There are two main branches of logic. One is called *formal*, or “minor,” logic, the other *material*, or “major,” logic. The two branches are quite distinct and deal with different problems.

Material logic is concerned with the *content* of argumentation. It deals with the *truth* of the terms and the propositions in an argument.

Formal logic is interested in the *form* or structure of reasoning. The truth of an argument is of only secondary consideration in this branch of logic. Formal logic is concerned with the method of deriving one truth from another.

The distinction between these two branches of logic was nicely described by G. K. Chesterton:

Logic and truth ... have very little to do with each other. Logic is concerned merely with the fidelity and accuracy with which a certain process is performed, a process which can be performed with any materials, with any assumption. You can be as logical about griffins and basilisks as about sheep and pigs.... Logic, then, is not necessarily an instrument for finding out truth; on the contrary, truth is a necessary instrument for using logic—for using it, that is, for the discovery of further truth.... Briefly, you can only find truth with logic if you have already found truth without it.

This last remark of Chesterton’s is important. It is not the purpose of formal logic to discover truth. That is the business of everyday observation and, in certain more formal circumstances, empirical science. Logic serves only to lead us from one truth to another.

That is why, for example, you should not call a statement of fact *logical* or *illogical* (although this is commonly done in everyday argument). You should instead call it *true* or *false*. Likewise, you should not call an argument (which contains several statements of fact) true or false. You should only call it *valid* or *invalid*. Validity is the term we use when we mean to say that an argument is logical. The term *soundness*, however, can be applied to an argument to say something about both its truth and its validity.

Three important terms in logic are truth, validity, and soundness.



_____ **Truth, Validity, and Soundness.** *Truth* means the correspondence of a statement to reality. An argument is valid when its conclusion follows logically from its premises. The term ‘soundness’ is used to indicate that all the premises in an argument are true *and* that the argument is valid.

An argument can contain true premises and still be invalid. Likewise, it can be perfectly valid (or logical, if you prefer) and contain false premises. But if an argument is sound, its premises must be true and it must be valid.

If this sounds confusing, don’t worry: these concepts will become clearer as we progress through the material in this book.

_____ **The Components of an Argument.** An argument contains several components. In order to illustrate what these components are and how they work in the reasoning process, let us begin with a simple argument:

All men are mortal
Socrates is a man
Therefore, Socrates is mortal

The first two statements are premises and the last is the conclusion. All arguments must have at least two premises and one conclusion.

On the face of it, this argument contains a number of words making up three statements which fit together into what looks and sounds like an argument. But there is more here than meets the eye.

In formal logic, we recognize three kinds of logical processes. We recognize that each of these originates in a *mental act*, but that each also manifests itself as (and is known to us in the form of) a *verbal expression*.

_____ **Term.** The mental act involved in the first of these three logical processes is called *simple apprehension*. We call the verbal expression of simple apprehension the *term*. A simple apprehension occurs when we first form in our mind a concept of something. When we put this concept into words, we have put this simple apprehension in the form of a term.

At the point of simple apprehension, we do not affirm or deny anything about it. We just possess or grasp it.

If in your mind, for example, you think of this book (the one you’re reading right now), you are performing this first logical process. You are having a simple apprehension. And if you speak or write anything about it, you will have to use a term, the term ‘book.’

In the argument above (the one about Socrates), there are three terms representing three simple apprehensions. The first is ‘men’; the second is ‘Socrates’; and the third is ‘mortal.’ Each one of these represents in our mind a concept that we have transformed into a word. The concept we call the *simple apprehension* and the word we call the *term*.

Mental Act

Verbal Expression

Simple Apprehension

Term

The verbal expression of a simple apprehension is called the term.



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The verbal expression of a judgment is called a proposition.

_____ **Proposition.** The mental act involved in the second of these three logical processes is called *judgment*. The verbal expression of a judgment is called a *proposition*. We perform a judgment any time we think in our mind that something *is* something else (which we call affirmation), and also when we think that something *is not* something else (which we call denial). To judge is to affirm or deny.

If you think that this book is boring, then you are performing a judgment. If you verbally express this judgment, you will have to do it in the form of a proposition, the proposition “This book is boring.” The judgment is the mental act you have when you think that this book is boring, and the proposition is the statement you make to express that thought.

In the argument above, there are three propositions expressed. The first is “All men are mortal”; the second is “Socrates is a man”; and the third is “Socrates is mortal.” Each one of these represents in our mind a thought that something is something else: that all ‘men’ are ‘mortal’; that ‘Socrates’ is a ‘man’; and that ‘Socrates’ is ‘mortal.’

We should point out that some people use the word ‘statement’ instead of ‘proposition.’ They mean the same thing, but to be consistent, we will use the word ‘proposition.’

Mental Act

Verbal Expression

Judgment

Proposition

The verbal expression of a deductive inference is called a syllogism.

_____ **Syllogism.** The mental act involved in the third of these three logical processes is called *deductive inference*. We call the verbal expression of deductive inference the *sylogism*. A deductive inference occurs when we make the logical connections in our mind between the terms in the argument in a way that shows us that the conclusion either follows or does not follow from the premises. When we verbally express this in an argument, we have put this deductive inference in the form of a syllogism.

It is at this point that we are said to make progress in knowledge. It is through the process of deductive inference, as expressed in a syllogism, that we can say, as we explained above, that we have gone from one truth or set of truths to another truth.

Let’s say the reason you think this book is boring is because you think all books are boring. If this were true, you would be performing a deductive inference. You would be thinking to yourself, all books are boring, and this is a book. Therefore, this book is boring. And if you verbally expressed this deductive inference, you would do it in the form of a syllogism. The judgment expressed by “All books are boring” and “This is a book” are different than the judgment “This book is boring.” Through deductive inference, however, you can go from these first two to the last one. In this way, you have gone from one set of truths to another truth (if indeed they are true, which hopefully they are not).



We would say that the argument above (the one about Socrates), in its entirety, is a syllogism. It expresses a deductive inference that logically connects certain simple apprehensions that are parts of three judgments. And this process has been expressed in the form of a syllogism.

<u>Mental Act</u>	<u>Verbal Expression</u>
Deductive Inference	Syllogism

If we now put this all together, keeping our distinction between mental acts and verbal expressions, it would look like this:

<u>Mental Act</u>	<u>Verbal Expression</u>
Simple Apprehension	Term
Judgment	Proposition
Deductive Inference	Syllogism

In order to give ourselves a mental picture of these three logical processes, let us think of a man walking. In order to get from, say, one room to another, he has to pick up his foot and take several steps in order to get to the room that is his destination. The initial act—picking up his foot—is like the initial logical act of simple apprehension. Taking a full step is like making a judgment. And stringing all the steps together into one movement is like deductive inference—we move from one place to another.

_____ **Summary.** We started out by defining logic as “the science of right thinking.” We said there are two main branches of logic. One is called *formal*, or *minor*, logic, the other *material*, or *major*, logic. Material logic is concerned with the *content* of argumentation. Formal logic is interested in the *form* or structure of reasoning. We defined *truth* as correspondence with reality. We said an argument is *valid* when its conclusion follows logically from its premises. And we said that *soundness* indicates that all the premises in an argument are true *and* that the argument is valid.

We said also that all arguments must contain two premises and a conclusion. And we said, finally, that there are three mental acts that make up the logical process: *simple apprehension*, *judgment*, and *deductive inference*. These three mental acts correspond to three verbal expressions: *term*, *proposition*, and *syllogism*.

The initial act—picking up his foot—is like the initial logical act of simple apprehension. Taking a full step is like making a judgment. And stringing all the steps together into one movement is like deductive inference.



Exercises for Day 1. Read the entire chapter. You may read it fairly quickly on this first reading. Don't expect to understand everything you read. Try only to get a general idea of what the chapter is about. Next, read the beginning sections of the introduction: "The History of Logic" and "The Two Main Branches of Logic." Read these sections carefully and try to fully understand them.

1. Based on what you have read in this chapter, what is the definition of logic?
2. Who was called the "father of logic"?
3. Who laid the groundwork for modern symbolic logic?
4. Give the name of one philosopher who made advances in symbolic logic.
5. Who pioneered the theories about induction that we study today?
6. Give the names of three people whose names are associated with modern kinds of mathematical logic.
7. Give the names of the two main branches of logic.
8. Explain the first of the main branches of logic (in Question 7) and describe it in your own words.
9. Explain the second of the main branches of logic (in Question 7) and describe it in your own words.
10. Indicate whether the following statements are true or false:

T	F	The purpose of formal logic is to discover truth.
T	F	It is necessary to have logic in order to discover truth.
T	F	Logic leads us from one truth to another.
T	F	A statement can be true or false.
T	F	A statement can be valid or invalid.
T	F	An argument can be true or false.
T	F	An argument can be valid or invalid.
T	F	Truth is only of secondary consideration in formal logic.

Exercises for Day 2. Read "Truth, Validity, and Soundness" and "The Components of an Argument." Read them carefully.

11. On the basis of today's reading, define 'truth.'
12. On the basis of today's reading, explain what it means to say an argument is valid.
13. On the basis of today's reading, define 'soundness.'
14. Indicate whether the following statements are true or false:

T	F	An argument can contain true premises and be invalid.
T	F	An argument can be sound and contain false premises.
T	F	A sound argument must be valid.
T	F	A valid argument must be sound.
T	F	An argument with true premises can be unsound.
T	F	An argument can contain only one premise.



15. In the following argument, identify the premises and the conclusion by writing the words ‘premise’ or ‘conclusion’ in the space next to the statement.

All men are mortal
Socrates is a man
Therefore, Socrates is mortal

16. Name the three types of logical processes (or acts of the mind) involved in logic.

Exercises for Day 3. Read “Term” and “Proposition.”

17. Each of these logical processes or mental acts (in Question 16 above) originates in a _____ and manifests itself in the form of a _____.

18. What is the mental act involved in the first of the three kinds of logical processes?

19. What is the verbal expression connected to this mental act (in Question 18)?

20. What occurs in our minds when we have a simple apprehension?

21. If you think of this book and have the concept in your mind, you are having a simple apprehension. What is the term you use to verbally express this particular simple apprehension?

22. Name the terms included in the argument in Question 15 above.

23. What does each one of these terms (in Question 22) represent?

24. What is the mental act involved in the second of the three kinds of logical processes?

25. What is the verbal expression connected to this mental act (in Question 24)?

26. What occurs in our minds when we perform a judgment?

27. If you think that this book is boring by affirming in your mind that this is so, your mind is performing a judgment. What is the term you use to verbally express this judgment?

28. Indicate the propositions included in the argument in Question 15 above.

29. What does each one of these propositions (in Question 28) represent?

Exercises for Day 4. Read “Syllogism” and “Summary.” Read them carefully.

30. What is the mental act involved in the third of the three kinds of logical processes?

31. What is the verbal expression connected to this mental act (in Question 30)?

32. Describe in no less than one and no more than three sentences what occurs in our minds when we engage in deductive inference.



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33. If you think that because all books are boring and that this is a book, and that therefore this book is boring, your mind engaged in deductive inference. What is the term you use to verbally express this deductive inference?
34. Fill out the chart below, listing the mental acts and their corresponding verbal expressions in the order in which we have covered them:

<u>Mental Act</u>	<u>Verbal Expression</u>
■ _____	■ _____
■ _____	■ _____
■ _____	■ _____

35. Draw a line to indicate which action best describes what each mental act is like:

Taking a step	Simple Apprehension
Picking up your foot	Deductive Inference
Walking from one place to another	Judgment