Introduction to

LOGIC

Irving M. Copi
Carl Cohen
Victor Rodych

15th edition

ROUTLEDGE

INTRODUCTION TO
LOGIC

For more than six decades, and for thousands of students, *Introduction to Logic* has been the gold standard in introductory logic texts. In this fifteenth edition, Carl Cohen and Victor Rodych update Irving M. Copi's classic text, improving on its many strengths and introducing new and helpful material that will greatly assist both students and instructors.

In particular, Chapters 1, 8, and 9 have been greatly enhanced without disturbing the book's clear and gradual pedagogical approach.

Specifically:

- Chapter 1 now uses a simpler and better definition of "deductive validity," which enhances the rest of the book (especially Chapters 1 and 8–10, and their new components).
- Chapter 8 now has:
  - Simpler definitions of "simple statement" and "compound statement"
  - More and more detailed examples of the Complete Truth-Table Method.
- Chapter 9 now has:
  - A detailed, step-by-step account of the Shorter Truth-Table Method (with detailed step-by-step examples for conclusions of different types)
  - A more complete and detailed account of Indirect Proof
  - A detailed justification for Indirect Proof treating each of the three distinct ways in which an argument can be valid
  - A new section on Conditional Proof, which complements the 19 Rules of Inference and Indirect Proof
  - Explications of proofs of tautologies using both Indirect Proof and Conditional Proof
  - A new section at the end of the chapter explaining the important difference between sound and demonstrative arguments.
- The Appendices now include:
  - A new appendix on making the Shorter Truth-Table Technique (STTT) more efficient by selecting the most efficient sequence of STTT steps
  - A new appendix on Step 1 calculations for multiple-line shorter truth tables
  - A new appendix on unforced truth-value assignments, invalid arguments, and Maxims III–V.

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for Instructors:

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Irving M. Copi was a logician who studied under Bertrand Russell while at the University of Chicago. He held appointments at, among other institutions, Princeton University, the University of Michigan, and the University of Hawaii at Manoa. Among the books he published before his death in 2002 was *The Theory of Logical Types* (Routledge, 1971).

Carl Cohen is the Senior Faculty Member in the Department of Philosophy at the University of Michigan, having taught at this university since 1955. Among his many published books is his account of the battle over affirmative action at the University of Michigan, *A Conflict of Principles* (2014). His most recent book is a concise philosophical rejection of all forms of race preference, *Both Wrong and Bad* (2018).

Victor Rodych is Professor of Philosophy at the University of Lethbridge. He has published extensively on Ludwig Wittgenstein's philosophy of mathematics. Together with Timothy Pope, Rodych is working on *Ludwig Wittgenstein, Writings on Mathematics and Logic*, *1937–1944*, to be published in five volumes by Cambridge University Press.

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FIFTEENTH EDITION

Irving M. Copi
Carl Cohen
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To my parents, Mary and Bernie Rodych, who gave
us so much love, support, encouragement, and
laughter. They taught us how to reason
by reasoning well themselves.

V.R.


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Foreword

In a republican nation, whose citizens are to be led by persuasion and not by force, the art of reasoning becomes of the first importance.

—*Thomas Jefferson*

Logic is an old subject, and since 1879 it has been a great one.

—*Willard V. O. Quine* (*Methods of Logic,* 1950)

Logic has sometimes been defined as the science of the laws of thought. This is inaccurate. Thinking is one of the processes studied by psychologists. If thought refers to any process that occurs in people's minds, not all thought is an object of study for the logician. Thus, one may think of a number between one and ten without doing any reasoning about it. One may also remember, imagine, free-associate, or perform any of a number of mental processes. All reasoning is thinking, but not all thinking is reasoning. The laws that describe the movements of the mind are psychological laws rather than logical principles. To define logic in this way is to include too much.

Logic has also been called the science of reasoning. This is better, but reasoning is a kind of thinking in which inference takes place and conclusions are drawn from premises. This process is extremely complex, characterized by a combination of trial and error, occasionally illuminated by flashes of insight. Logicians are not concerned with the ways in which the mind arrives at its conclusions in the process of reasoning; they are concerned only with the correctness of the completed process: Does the conclusion reached *follow* by necessity from the premises? The study of the methods and principles used to distinguish correct from incorrect reasoning is the central issue with which logic deals.

Reason is the instrument on which one must depend when reliable judgments are needed. Nonrational instruments—feelings, beliefs, habits, hunches, and the like—are commonly employed, but when a great deal depends on the judgments one makes—when one must decide how to act in complicated circumstances, or determine what is true in matters that have a serious impact—reason is our best recourse; nothing can replace it.

There are rational methods, methods well tested and confirmed, for determining what is true. There are well-established, rational techniques, for drawing new inferences from what is already known to be true. Our ignorance is vast, and therefore people often resort to some authority in reaching judgment—but the need for reason cannot be escaped even then, because one must decide which authorities deserve respect. Every serious intellectual pursuit comes ultimately to rely on reasoning, because there is nothing that can successfully replace it.

By nature humans are endowed with powers of reasoning. Logic is the study of the uses of those powers. Intuitively, we may have long acted on sound principles, only partly grasped. With care, these principles can be brought to the surface, formulated precisely, and applied with confidence to problems solvable by reason. Through studying logic, people come first to recognize their own native capacities, then to learn to strengthen

them through practice. The study of logic helps one to reason well by illuminating the principles of *correct* reasoning.

Whatever the sphere in which knowledge is sought—whether in science, politics, or in the conduct of one's private life—logic is used to reach warranted conclusions. In the formal study of logic, with which this book is concerned, the student will learn how to acquire truths and how to evaluate competing claims for truth, to critique arguments, recognize inconsistencies, detect logical fallacies, and construct formal arguments according to demonstrably valid inference patterns. In sum, the study of logic will help the student to reason more carefully and, in general, to think and act more rationally.

Ideally, every college course should contribute to this end, yet many do not. Much that is taught in college classes soon grows out of date. But the skills of accurate thinking never become obsolete, and the development of these skills lies squarely within the province of the study of logic. The study of logic helps us to identify arguments that are good and to understand why they are good. The study of logic helps us to identify arguments that are bad and to understand why they are bad. No study is more useful or more widely relevant to serious concerns than this.

This considered assurance we give to our readers: A command of the fundamental principles of correct reasoning, which the study of this book promotes, will make a deeply satisfying, significant, and permanent contribution to one's intellectual life.

Preface

Through fourteen previous editions, instructors and students have warmly told us how *Introduction to Logic* has made a positive difference in their lives. We are gratified by such kind words, of course, but we are not content. In this, the 15th Edition of *Introduction to Logic*, we have made every effort to address and improve several core topics in our treatment of symbolic logic, without altering the essential structure and substance of the book.

As in all previous editions, Part I presents the basic concepts of logic. We explore the difficulties encountered in everyday uses of language, and the different functions of language. We explain the nature and functions of definitions in ordinary discourse, and then identify and exhibit the many informal fallacies that are commonly encountered. In Part II the methods of deductive reasoning are presented and analyzed. Here we first give an account of syllogistic logic, and then introduce the more powerful notation and techniques of modern symbolic logic. Finally, in Part III, the techniques of inductive logic are presented, beginning with the appraisal of simple analogical arguments and proceeding to an analysis of causal reasoning, and the canons of scientific method. We conclude with an account of alternative theories of probability, and the uses of the theorems in the elementary calculus of probability.

In this edition of *Introduction to Logic*, Chapters 1, 8, and 9 have been greatly enhanced, without disturbing the book's clear and gradual pedagogical approach.

New to This Edition

- Chapter 1 now uses a simpler and better definition of "deductive validity," which enhances the rest of the book (especially Chapters 1 and 8–10, and their new components).
- Chapter 8 now has:
    - Simpler definitions of "simple statement" and "compound statement"
    - More, and more detailed, examples of the Complete Truth-Table Method
    - An updated section on 'The Three "Laws of Thought",' reflecting the centrality of the Principles of Excluded Middle and Non-Contradiction in Classical Symbolic Logic, and indicating some of the extensions and alternatives to Classical Symbolic Logic that have emerged over the last 100 years.
- Chapter 9 now has:
    - A detailed, step-by-step account of the Shorter Truth-Table Method (with detailed step-by-step examples for conclusions of different types)
    - A more complete and detailed account of Indirect Proof
    - A detailed justification for Indirect Proof treating each of the three distinct ways in which an argument can be valid

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Introduction to Logic in all of its editions has been rich with illustrative materials and exercises taken from events and controversies in real life, from history and some classical sources, but mainly from contemporary periodicals and books. We take pride in the fact that, as our reviewers have noted, those studying *Introduction to Logic* are inescapably introduced to a very wide range of intellectual concerns and thus learn much more than logic. Exhibiting arguments and theories (good and bad) by illustrating them with genuine controversies in the world of college students, rather than with illustrations artificially devised for the purpose, has been our continuing concern. Logical theory is most fully grasped when it is vividly applied to contemporary human affairs. In the selection of illustrations and exercises, especially those concerning lively issues in the first years of the twenty-first century, we seek scrupulously to avoid partisanship. On all sides of controversial issues, good arguments, and bad ones, may appear. Support for one view or another in current controversy is not our proper business; the understanding and analysis of arguments is.

In all editions of *Introduction to Logic* we strove to achieve that combination of accuracy, clarity, and penetration that has always been our objective. To this end we have relied on the support and advice of students and instructors who use the book and who are sensitive to its shortcomings. We conclude, therefore, with an earnest invitation to our readers to join us in advancing this never-ending project. Send us corrections as needed, and suggestions of every kind. Your contributions, warmly welcome, may be most conveniently addressed to Carl Cohen at ccohen@umich.edu or Victor Rodych at rodych@uleth.ca. The feedback from students and instructors who rely on *Introduction to Logic* has helped to make it the world's most widely used book in the study of logic. We will receive your responses to it with respect and heartfelt gratitude.

Carl Cohen
The University of Michigan, Ann Arbor
Victor Rodych
University of Lethbridge, Lethbridge

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Mr. Thomas Bird, University of Lethbridge, Lethbridge, Alberta, Canada
Ms. Vanessa Hagedorn, Lethbridge College, Lethbridge, Alberta, Canada
Mr. Joseph McDonald, University of Calgary, Calgary, Alberta, Canada

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Contributors to this edition have been very numerous. College students, as well as instructors, have written to suggest improvements, to point out ambiguities or inaccuracies, to note typographical errors, to suggest useful illustrative materials. All receive our direct response, of course; but we take satisfaction in listing here also the names of some of those to whom we are indebted for contributions large and small to this fifteenth edition of *Introduction to Logic*:

Prof. John M. Abbarno, D'Youville College, Buffalo, New York
Prof. Benjamin Abellera, DCF Foundation, Silver Spring, Maryland
Mr. Russell Alfonso, University of Hawaii, Honolulu, Hawaii
Mr. Wyatt Dean Ammon, Hamline University, St. Paul, Minnesota
Ms. Tamara Andrade, Ann Arbor, Michigan
Emil Badici, University of Florida, Gainesville, Florida
Stephen Barnes, Northwest Vista College, San Antonio, Texas
Mr. Jason Bates, University of Michigan, Ann Arbor, Michigan
Mr. Maximilian Bauer, Ann Arbor, Michigan
Mr. George Beals, Michigan Bible School, Plymouth, Michigan
Drew Berkowitz, Bridgewater State University, Bridgewater, Massachusetts
Ms. Amelia Bischof, Ithaca College, Ithaca, New York
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Mr. Keith Coleman, University of Kansas, Lawrence, Kansas
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Ms. Meredith Crimp, Ann Arbor, Michigan
Mr. Dennis A. De Vera, Dept. of Social Sciences, CAS, CLSU, Philippines
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Prof. Emeritus Albert C. Shaw, Rowan College, Glassboro, New Jersey
Prof. Edward Sherline, University of Wyoming, Laramie, Wyoming
Mr. Amjol Shrestha, Hawaii Pacific University, Honolulu, Hawaii
Ms. Lauren Shubow, University of Michigan, Ann Arbor, Michigan
Mr. Jason A. Sickler, University of North Dakota, Grand Forks, North Dakota
Ms. Stefanie Silverman, University of Michigan, Ann Arbor, Michigan
Prof. Michael Slattery, Villanova University, Villanova, Pennsylvania
Dr. Barbara M. Sloat, University of Michigan, Ann Arbor, Michigan
Mahadevan Srinivasan, University of Tennessee, Knoxville, Tennessee
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Prof. Warren Weinstein, California State University at Long Beach, California
Ms. Jessica Wheeler, Springfield, Missouri
Mr. Michael Wingfield, Lake Dallas, Texas
Mr. Isaiah Wunsch, University of Michigan, Ann Arbor, Michigan
Ms. Cynthia Yuen, Ann Arbor, Michigan
Maria Zaccaria, Georgia Perimeter College, Dunwoody, Georgia

A Very Brief History of Logic

Philosophy begins with wonder. What is the world made of? Where does it come from? Why are we here? The speculations of primitive peoples were often imaginative, but were unfounded, irrational. Philosophy as we think of it today did not arise until the Greek philosophers of the sixth century BCE sought some overriding theories about the world. Is there one stuff of which the world is made? One principle that is fundamental throughout?

We think of Socrates and Plato as the great figures in the birth of Western philosophy, and we study them still today. Their greatness lies in part in their efforts to bring things into intellectual order—to provide, or at least to seek, some coherent system that can explain why things are the way they are. But even before Socrates there had been deep thinkers—Thales, Parmenides, Heraclitus, Democritus, and others who had proposed assorted accounts of the fundamental stuff of the world, or of the fundamental principle by which all is governed.

They were theorizing, not merely guessing—but there was no real science in these early speculations. Dogmatic suppositions, supernatural forces, the gods, ancient myths and legends had always to be called upon. As philosophy gradually matured there grew the drive to *know*, to discover principles that could be relied upon in giving explanations.

Thus logic begins. Judgments are sought that can be tested and confirmed. The *methods* with which we discover and confirm whatever we really know need to be identified and refined. We must *reason* about things, and we hunger to understand the principles of right reasoning.

That first climb from chaotic thought into some well-ordered system of reasoning was an enterprise of extraordinary difficulty. Its first master, Aristotle (see p. 3), having developed a system within which the principles of reasoning could be precisely formulated, was rightly held in awe by rational thinkers from his day to ours. He was the first great logician.

Aristotle approached reasoning as an activity in which we first identify *classes* of things. We then recognize the *relations* among these classes. Then we can manipulate the propositions in which these relations are specified. The fundamental elements of reasoning are, he thought, the groups themselves, the categories into which we can put things. He therefore distinguished types of *categorical* propositions (e.g., "All Xs are Ys"—a universal affirmative proposition; "Some Ys are not Xs"—a particular negative proposition; and so on) and with those understood we can reason immediately to conclusions about the relations among these propositions (e.g., "If some Xs are Ys, then it cannot be true that no Ys are Xs"). More importantly, by combining categorical propositions involving three terms (say, Xs, Ys, and Zs) in various ways, we can reason accurately by constructing *categorical syllogisms* (e.g., "If all Xs are Ys, and some Xs are Zs, it must be

that some Zs are Ys"). Using such techniques, a great system of deductive logic can be built, as will be shown in Chapters 5, 6, and 7 of this book.

A century after Aristotle the work of the Stoic philosopher, Chrysippus (see p. 7), carried logical analysis to a higher level. The fundamental elements of reasoning were taken to be not the Aristotelian categories, but *propositions*, the units with which we can affirm or deny some states of affairs (e.g., "X is in Athens," or "X is in Sparta"). We can then discover the logical relations among propositions: "If X is in Athens then X is not in Sparta." We can then identify elementary arguments that depend upon these various relations: "If X is in Athens then X is not in Sparta. X is in Athens. Therefore X is not in Sparta." The form of this simple argument, called *modus ponens*, is common and useful; many other such elementary forms may be identified and applied in rational discourse, as we will see in later portions of this book.

With these advances it soon becomes clear that the validity of a deductive argument, the solidity with which a conclusion may be inferred if the premises are true, depends upon the *form* of the argument, its shape rather than its content—or as logicians say, its syntactic features rather than its semantic content. *Modus ponens*, and every such argument form, can have an unlimited number of realizations, or instances. The consequences of this formal nature of validity remained to be investigated. With the decline of the Roman Empire, the work of the Greek logicians had been preserved by Muslim scholars, most notably Al-Farabi (c. 872–c. 950), who wrote, in Baghdad, a commentary on the works of Aristotle, and came to be called "the Second Teacher," second only to Aristotle in breadth and depth of learning. He was followed by the great Muslim polymath, Ibn Sina, known by his Latinized name, Avicenna. Their scholarship eventually penetrated and refreshed Western thought. Syntactic forms came again to be of central interest in logic in the twelfth century, in France, with the work of the monk, Peter Abelard (1079–1142).

In England the great logical figure of those early modern years was William of Ockham (1287–1348). He identified some of the theorems more precisely formulated many years later by the mathematical logician, Augustus De Morgan; De Morgan's theorems we will encounter and apply in Part II of this book. Ockham sought to rid metaphysics, in which he was chiefly interested, of useless concepts. He urged that when a term or notion has been shown fruitless it should be simply cut out and discarded. This imperative principle, "Ockham's razor," remains a common guideline: In all rational thinking, entities must not be multiplied beyond necessity.

Deductive logic had largely begun with Aristotle's compiled treatises, *The Organon*. That logic allowed and encouraged the powerful manipulation of what is already known, and that is indeed extremely useful. However, the long-studied analysis of propositions and their relations did not provide the stuff of new knowledge, desperately needed and widely sought in the early modern centuries. What the intellectual world required, many thought, was a *new Organon*. That *Novum Organum* was published by Francis Bacon (1561–1626) in England in 1620. The Baconian method aimed to codify the procedures used by scientists when investigating all natural things. Called "the father of empiricism," Bacon, with other pioneers of the scientific revolution in astronomy and medicine, did not reject the work of classical logicians, but supplemented that work by formulating the methods that make possible the *acquisition* of empirical truths. Facts—what we learn about the world—constitute the premises upon which deductive arguments can be built. These were the first great steps in formulating the principles of *inductive logic*.

It was time to gather the threads of logical analysis, deductive and inductive, into one coherent fabric. The first textbook of logic (*Logic, or the Art of Thinking*), was published anonymously in 1662 by a group known as the Port-Royal logicians. The principal authors, Antoine Arnauld (famous for his published disputes with Descartes) and Pierre Nicole, were joined by Blaise Pascal (1623–1662), a great French mathematician who had invented, while a teenager, a functioning mechanical calculator. Pascal was also one of the originators of the theory of probability—a sphere of logic that we will enter in the final chapter of this book. Other textbooks followed, including *Logick, or the Right Use of Reason* (1725) by Isaac Watts; then *Logic* (1826) by Richard Whately. Then, in 1843, there was published in England one of the greatest of all logic textbooks: *A System of Logic*, by John Stuart Mill (1806–1873). In this work the techniques with which we uncover and confirm causal connections in the real world were for the first time set forth in accurate detail. Mill's methods, his still relevant contributions to the study of inductive logic, we discuss at length in Part III of this book.

In deductive logic much creative work remained to be done. Reasoning was known to be burdened by the ambiguities and imprecision of ordinary language. One of the greatest of early modern thinkers, Gottfried Wilhelm Leibniz (1646–1716), set himself the task of overcoming these deficiencies by developing a mathematically exact symbolic language, one in which concepts might be expressed with unambiguous clarity. Leibniz (also one of the independent inventors of the infinitesimal calculus) had envisioned a sort of logic machine—one with which operations of a logical nature might be performed efficiently and accurately, as can be done in the algebra that he knew well. That great logic machine he never produced, but his dream of it may be seen as the foreshadowing of the modern electronic computer.

A major advance toward Leibniz's goal was made by the English logician George Boole (see p. 189), who devised, in his *Investigation into the Laws of Thought* (1854), a general system for the accurate expression and thus manipulation of propositions. Propositions had played a central role in logic since the time of Aristotle and Chrysippus. But it was only with Boole's deep analysis of propositions—the *Boolean interpretation* discussed in great detail in Chapter 5 of this book—that a fully consistent system of the logic of propositions was at last possible.

Other mathematicians and logicians made significant advances that brought greater precision and efficiency to the realm of deductive logic. One of these was Augustus De Morgan (1806–1871), alluded to above in connection with the work of William of Ockham. The theorems that still carry his name remain to this day critical logical tools in proving the validity of deductive arguments. Another English logician, John Venn (1834–1923), contributed brilliantly to the process of determining deductive validity by designing a system, as beautiful as it is simple, for the iconic exhibition of the relations of the terms in categorical propositions. Venn diagrams, consisting of interlocking circles, are now very widely used. They serve as an easily applied device with which the sense of propositions can be given visual force, and with which the validity or invalidity of categorical syllogisms can be established. We use Venn diagrams extensively in Part II of this book.

One of the greatest American philosophers, Charles Sanders Peirce (1839–1914), best known as the founder of the movement known as *pragmatism*, thought of himself primarily as a logician. Logic was for him a very broad study, involving the methods of all inquiry; formal deductive logic, to which he made some notable contributions, he took to be one of its branches. We think with signs, said Peirce, and logic is the formal

theory of signs. He introduced some new concepts, such as inclusion and logical sum; he devised symbols for the expression of novel logical operations; he explored the logic of relations—and he anticipated work later done in expressing Boolean operations using the features of electrical switching circuits, a key step toward the actual development of the all-conquering logic machine that had been envisioned by Gottfried Leibniz.

A rigorous, formal system of Propositional Logic was produced by the German logician Gottlob Frege (1848–1925). That system, and his invention of the concept of *quantification*, establish him as one of the greatest of modern logicians. With quantification—as we explain in detail in Chapter 10 of this book—it is possible to deal accurately with a huge body of deductive argument that cannot otherwise be readily penetrated by the machinery of modern symbolic logic.

Bertrand Russell (1872–1970) and Alfred North Whitehead (1861–1947) sought to integrate all this modern work on deductive logic in one great and remarkable treatise: *Principia Mathematica*, published in three volumes in 1910, 1912, and 1913. Using (with some adjustments) the notation that had been devised by the Italian logician Giuseppe Peano (1858–1932), as well as the logical system earlier developed by Frege, Russell and Whitehead attempted to show that the whole of mathematics could be derived from a few basic logical axioms. Much of what appears in Chapters 8, 9, and 10 of this book is derived from their work and, more indirectly, the work of Gottlob Frege.

Deductive logic continued to develop. Under the leadership of the great mathematician David Hilbert (1862–1943), the completeness and decidability of axiomatic systems became a matter of great interest in the twentieth century. In his 1929 Ph.D. Dissertation, Kurt Gödel (1906–1978) proved the completeness of First Order Predicate Logic (Chapter 10). A year later, Gödel shocked the worlds of logic and mathematics by demonstrating that for any consistent axiomatic system powerful enough to describe the arithmetic of the natural numbers, there are *undecidable* propositions, such that neither proposition B nor its negation $\sim B$ is derivable in the system. Other aspects of deductive logic have been more recently investigated: the distinction between "fuzzy" and "crisp" logic has been explored; modal logic, in which the concepts of possibility and necessity are manipulated, has been highly developed.

But perhaps nothing that modern logicians have accomplished has had more profound impact than the development—by Alan Turing (1912–1954), John von Neumann (1903–1957), and others—of a rigorous concept of computability and the intellectual architecture of the circuits of digital computers. Not long thereafter, with the actual construction and gradual perfection of the electronic digital computer during the twentieth century, Leibniz's great vision was at last made real.

The account above sketches the history of logic in the West, mainly in Europe and North America. Elsewhere on the planet logic was also studied, of course—but we do not have accessible and accurate records of the discoveries made long ago in China and India. We know that in India much work had been done on the principles of logic. Augustus De Morgan was influenced by that work; the theorems that bear his name, explained in Chapter 9 of this book, were developed independently in India. George Boole was influenced by Indian thinkers as well. The rules of immediate inference, discussed in this book in Chapter 5, appear also to have been articulated in India, but logic there emphasized effective philosophical argumentation, including both deductive and inductive elements, rather than formal systems. In China, at the time of the philosopher Mozi (470–391 BCE), the principles of analogical reasoning, discussed in Chapter 11 of this book, were developed. But of that history we cannot be sure, because in the years 213–206 BCE the Qin

dynasty, to erase all marks of preceding dynasties, burned many books and killed many scholars. Much work done in earlier periods was thus permanently lost.

From the time of Aristotle's *Organon* to the twenty-first century more people have studied logic from one book than from any other; that book, now in your hands, is *Introduction to Logic*, originally conceived and written by one of the most powerful and incisive thinkers of the twentieth century, the late Irving M. Copi (1917–2002).

part I

Logic and Language

> Come now, and let us reason together.
>
> *—Isaiah 1:18*

> All our lives we are giving and accepting reasons. Reasons are the coin we pay for the beliefs we hold.
>
> *—Edith Watson Schipper*

chapter 1

Basic Logical Concepts

1.1 What Logic Is

Logic
The study of the methods and principles used to distinguish correct from incorrect reasoning.

Logic is the study of the methods and principles used to distinguish correct from incorrect reasoning.

When we reason about any matter, we produce arguments to support our conclusions. Our arguments include reasons that we think justify our beliefs. However, not all reasons are good reasons. Therefore we may always ask, when we confront an argument: Does the conclusion reached *follow* from the premises assumed? To answer this question there are objective criteria; in the study of logic we seek to discover and apply those criteria.

Reasoning is not the only way in which people support assertions they make or accept. They may appeal to authority or to emotion, which can be very persuasive, or they may rely, without reflection, simply on habits. However, when someone wants to make judgments that can be completely relied upon, their only solid foundation will be correct reasoning. Using the methods and techniques of logic—the subject matter of this book—one can distinguish reliably between sound and faulty reasoning.

1.2 Propositions and Arguments

We begin by examining more closely the most fundamental concepts in the study of logic, concepts presupposed in the paragraphs just above. In reasoning we construct and evaluate *arguments*; arguments are built with *propositions*. Although these concepts are apparently simple, they require careful analysis.

A. Propositions

Propositions are the building blocks of our reasoning. A **proposition** asserts that something is the case or it asserts that something is not. We may affirm a proposition, or deny it—but every proposition either asserts what really is the case, or it asserts something that is not. Therefore every proposition is either true or false.

Proposition
A statement; what is typically asserted using a declarative sentence, and hence always either true or false—although its truth or falsity may be unknown.

Biography

Aristotle

Of all the great philosophers and logicians, ancient and modern, none is greater than Aristotle (384–322 BCE), whose works and influence largely ruled the world of intellect for two millennia. He was often referred to as "The Philosopher"; his authority (even when he was mistaken!) was rarely questioned.

Born in Macedonia, in the city of Stagira, where his father was physician to the king, he was viewed from birth as a member of the aristocracy, and was a friend of the king's son, Philip. When Philip became king of Macedonia, he summoned Aristotle, who had for many years been studying in Athens at Plato's school, The Academy, to return to Macedonia as tutor to his son Alexander (who later would be known as Alexander the Great). As he advanced on his subsequent conquests in Asia, Alexander remained in contact with his respected teacher, sending back, at Aristotle's request, specimens and artifacts that contributed to the early growth of the sciences.

Aristotle—one of the trio, with Plato and Socrates, who largely founded Western philosophy—had a truly encyclopedic mind. He investigated, contributed to, wrote about, and taught virtually all subjects on which some knowledge had been accumulated at his time: the natural sciences (biology, zoology, embryology, anatomy, astronomy, meteorology, physics, and optics); the arts (poetry, music, theater, and rhetoric); government and politics; psychology and education; economics; ethics; metaphysics—and of course logic, of which he alone was the systematic founder. His treatises on logic, later combined into one great work entitled *The Organon* ("The Instrument"), constitute the earliest formal study of our subject. The penetration and coherence of his logical analyses, and the comprehensiveness and general accuracy of his scientific studies, justify his acknowledged status as one of the finest thinkers ever to have graced our planet.

At the age of 49 Aristotle returned to Athens and established his own highly influential school, the Lyceum, where he taught for twelve years. He died of natural causes in 322 BCE. In his will, he asked to be buried next to his wife, Pythias.

In logic Aristotle grasped the overriding necessity of determining the rules of correct reasoning. He explained validity and characterized the four fundamental types of categorical propositions and their relations. In the *Prior Analytics,* one of the

six books of *The Organon*, he developed a sophisticated theoretical account of categorical syllogisms, an account that long dominated the realm of deductive logic and that remains today an effective tool of sound reasoning.

It is said of Aristotle that he was probably the last person to know everything there was to be known in his own time.

There are many propositions about whose truth we are uncertain. "There is life on some other planet in our galaxy," for example, is a proposition that, so far as we now know, may be true or may be false. Its "truth value" is unknown, but this proposition, like every proposition, must be either true or false.

A question *asserts* nothing, and therefore it is not a proposition. "Do you know how to play chess?" is indeed a sentence, but that sentence makes no claim about the world. Neither is a command a proposition ("Come quickly!"), nor is an exclamation a proposition ("Oh my gosh!"). Questions, commands, and exclamations—unlike propositions—are neither true nor false.

When we assert some proposition, we do so using a sentence in some language. However, the proposition we assert is not identical to that sentence. This is evident because two different sentences, consisting of different words differently arranged, may have the same meaning and may be used to assert the very same proposition. For example, "Leslie won the election" and "The election was won by Leslie" are plainly two different sentences that make the same assertion.

Sentences are always parts of some language, but propositions are not tied to English or to any given language. The four sentences

It is raining.	(English)
Está lloviendo.	(Spanish)
Il pleut.	(French)
Es regnet.	(German)

are in different languages, but they have a single meaning: all four, using different words, may be uttered to assert the very same proposition. *Proposition* is the term we use to refer to what it is that declarative sentences are typically used to assert.

Statement
A proposition; what is typically asserted by a declarative sentence, but not the sentence itself. Every statement must be either true or false, although the truth or falsity of a given statement may be unknown.

The term **statement** is not an exact synonym of *proposition*, but it is often used in logic in much the same sense. Some logicians prefer *statement* to *proposition*, although the latter has been more commonly used in the history of logic. Other logicians eschew both terms as metaphysical, using only the term *sentence*. However, the concept of a proposition is seen by many as making a useful distinction between a sentence and what the sentence asserts. Consequently, in this book we use both terms.

The very same sentence can be used to make very different statements (or to assert very different propositions), depending on the context in which it is expressed. For example, the sentence, "The largest state in the United States was once an independent republic," once expressed a true statement or proposition (about Texas), but if asserted today would express a false statement or proposition (about Alaska). We use the same words, the very same sentence, to assert different propositions at different times.

Propositions may be *simple*, like those used in the preceding illustrations, but they may also be *compound*, containing other propositions within themselves. Consider the following proposition, from a 2007 account of the exploitation of the Amazon Basin in Brazil:

> The Amazon Basin produces roughly 20 percent of the Earth's oxygen, creates much of its own rainfall, and harbors many unknown species.[1]

This sentence simultaneously asserts three propositions, concerning what the Amazon Basin produces and what it creates and what it harbors. The passage thus constitutes a *conjunctive* proposition. Asserting a conjunctive proposition is equivalent to asserting each of its component propositions separately.

Some compound propositions do not assert the truth of their components. In *disjunctive* (or *alternative*) *propositions*, no one of the components is asserted. Abraham Lincoln (in a message to Congress in December 1861) said, "Circuit courts are useful, or they are not useful." This disjunctive proposition is plainly true, but either one of its components might be false.

Other compound propositions that do not assert their components are *hypothetical* (or *conditional*) *propositions*. The eighteenth-century freethinker, Voltaire, said, "If God did not exist, it would be necessary to invent him." Here, again, neither of the two components is asserted. The proposition "God does not exist," is not asserted, nor is the proposition, "it is necessary to invent him." Only the "if–then" proposition is asserted by the hypothetical or conditional statement, and that compound statement might be true even if both of its components were false.

In logic, the internal structure of propositions is important. To evaluate an argument we need a full understanding of the propositions that appear in that argument. Propositions of many different kinds will be analyzed in this book.

B. Arguments

With propositions as building blocks, we construct *arguments*. In any argument we affirm one proposition on the basis of one or more other propositions. In doing this, an **inference** is drawn: one proposition is *inferred from* one or more other propositions. Some inferences (arguments) are *warranted* (or correct); others are not. The logician analyzes the relations between propositions, examining the propositions on which an inference is based and the proposition inferred. Such a cluster of propositions constitutes an *argument*. Arguments are the chief concern of logic.

In everyday discourse, the word "argument" is used in two distinct senses: sometimes we mean dispute, and sometimes we mean inference. The first sense of the word is operative, for example, when we say that Jerome and Megan had an argument about where to go on their vacation. In this case we mean they had a dispute, where a dispute is a disagreement involving multiple people. In logic, however, *argument* is a technical term, designed to make the meaning of "argument" as inference more rigorous. In logic, **argument** refers strictly to any group of propositions of which one is claimed to be supported by the other(s). *An inference*, from one or more propositions to an inferred proposition, is *an argument*.

In writing or in speech, a passage will often contain several related propositions and yet contain no argument. An argument is not merely a collection of propositions; it is a cluster with a structure that captures or exhibits some inference. We describe this structure with the terms *conclusion* and *premise*. The **conclusion** of an argument is the proposition that is affirmed on the basis of the other propositions of the argument. Those other propositions, which are affirmed (or assumed) as providing support for the conclusion, are the **premises** of the argument. The conclusion of an argument is inferred from

Inference
A conclusion and the premises from which it is inferred; an argument. Drawing an inference—inferring a conclusion from premises—is a process by which one proposition is arrived at and affirmed on the basis of some other proposition or propositions.

Argument
Any group of propositions of which one, the conclusion, is claimed to be supported by the others, the premises. The conclusion of an argument is *inferred* from the premises of the argument.

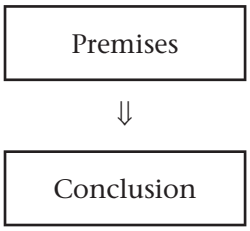
Conclusion
In any argument, the proposition to which the other propositions in the argument are claimed to give support, or for which they are given as reasons. The conclusion is the proposition *inferred* from one or more other propositions (i.e., the premises).

Premises
In an argument, the propositions upon which the inference is based; the propositions that are claimed to provide grounds or reasons for the inferred conclusion.

the premises of the argument. Thus, in the technical sense of logic, an *argument* consists of one or more premises and a conclusion inferred from the premise(s). The structure of an argument is

Premises ⇒ Conclusion

where the arrow indicates that the direction of an inference is *from* premises *to* a conclusion. We will usually write arguments vertically, so we can show an argument and the relation between its premises and its conclusion as follows.



It is customary to use the '∴' symbol to mean 'therefore,' so the structure given by the foregoing diagram will typically be exhibited as:

Premise
Premise
∴ Conclusion

All three of these indicate, as is necessary, which propositions are premises and which proposition is the conclusion.

We will encounter a vast range of arguments in this book—arguments of many different kinds, on many different topics. We will analyze arguments in politics, in ethics, in sports, in religion, in science, in law, and in everyday life. Those who defend these arguments, or who attack them, are usually aiming to establish the truth (or the falsehood) of the conclusions drawn. As logicians, however, our interest is in the arguments as such. As agents or as citizens we may be deeply concerned about the truth or falsity of the conclusions drawn. However, as logicians we put those interests aside, for we are concerned with the *form* of an argument, not with its content. Our task is to determine how well the premises support the conclusion, and, for deductive arguments, whether the conclusion follows necessarily from the premises.

Arguments vary greatly in the degree of their complexity. Some are very simple. Other arguments, as we will see, are quite intricate, sometimes because of the structure or formulation of the propositions they contain, sometimes because of the relations among the premises, and sometimes because of the relations between premises and conclusion.

The simplest kind of argument consists of one premise and a conclusion that is claimed to be supported by it. Each may be stated in a separate sentence, as in the following argument that, until 2016, appeared on or in biology textbooks in the state of Alabama:

> No one was present when life first appeared on earth. Therefore any statement about life's origins should be considered as theory, not fact.

Both premise and conclusion may be stated within the same sentence, as in this argument arising out of recent advances in the science of human genetics:

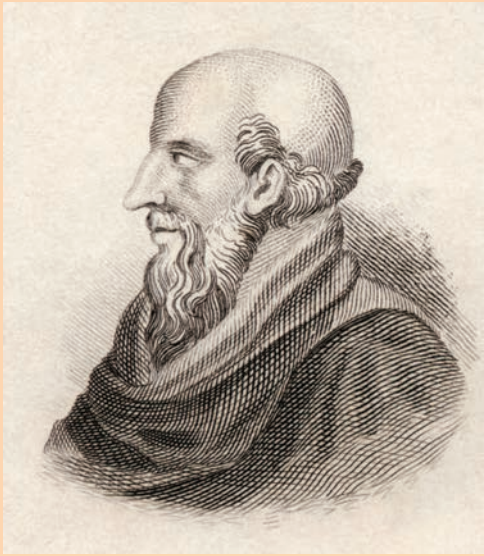
> Since it turns out that all humans are descended from a small number of African ancestors in our recent evolutionary past, believing in profound differences between the races is as ridiculous as believing in a flat earth.[2]

Biography

Chrysippus

Of all the logicians of ancient times, Aristotle and Chrysippus stand out as the two greatest. The enormous influence of Aristotle, who first systematized logic and was its principal authority for two thousand years, has already been recognized. Born a century later, Chrysippus (c. 279–c. 206 BCE) developed a conceptual scheme whose influence has only more recently been appreciated.

The logic of Aristotle was one of classes. In the Aristotelian argument "All men are mortal; Greeks are men; therefore Greeks are mortal," the fundamental elements are the categories, or terms ("men," "mortal things," and "Greeks"). In contrast, the logic of Chrysippus was one built of *propositions* and the connections between them (e.g., "If it is now day, it is now light. It is now day. Therefore it is now light."). This simple argument form (now called *modus ponens*) and many other fundamental argument forms, Chrysippus analyzed and classified. His logical insights were creative and profound.



Born in Asia Minor, in Soli, Chrysippus studied the philosophy of the Stoics—most famous among them Zeno and Cleanthes—and eventually became head of the Stoic school in Athens. In that capacity he taught the need to control one's emotions, which he thought to be disorders or diseases. He urged the patient acceptance of the outcomes of a fate one cannot control, and the recognition that the one God (of which the traditional Greek gods are but aspects) is the universe itself.

But it is as a logician that his influence has been greatest. He grasped the central role of the proposition—"*that which is, in itself, capable of being denied or affirmed.*" From this base he developed the first coherent system of Propositional Logic.

The order in which premises and conclusion appear can also vary, but it is not critical in determining the quality of the argument. It is common for the conclusion of an argument to *precede* the statement of its premise or premises. On the day Babe Ruth hit his 700th home run (13 July 1934), the following argument appeared in *The New York Times*:

> A record that promises to endure for all time was attained on Navin Field today when Babe Ruth smashed his seven-hundredth home run in a lifetime career. It promises to live, first because few players in history have enjoyed the longevity on the diamond of the immortal Bambino, and, second, because only two other players in the history of baseball have hit more than 300 home runs.

This is an example of an argument whose two premises, each numbered, appear after the conclusion is stated. It is also an example of a very plausible argument whose conclusion is false, given that Hank Aaron hit his 700th home run on 21 July 1973, thirty-nine years later.

Even when premise and conclusion are united in one sentence, the conclusion of the argument may come first. The English utilitarian philosopher, Jeremy Bentham, presented this crisp argument in his *Principles of Legislation* (1802):

> Every law is an evil, for every law is an infraction of liberty.

Although this is only one short sentence, it is an argument because it contains two propositions, of which the first (every law is an evil) is the conclusion and the second (every law is an infraction of liberty) is the premise. However, no single proposition can be an argument, because an argument consists of at least one premise and a conclusion.[3] Yet some propositions, because they are compound, do sound like arguments, and care must be taken to distinguish them from the arguments they resemble. Consider the following hypothetical proposition:

> If a state aims to be a society composed of equals, then a state that is based on the middle class is bound to be the best constituted.

Neither the first nor the second component of this proposition is asserted. All that is asserted is that the former implies the latter, and both might well be false. No inference is drawn, no conclusion is claimed to be true. Aristotle, who studied the constitution and quality of actual states in Greece more than two thousand years ago, wrote confidently in *Politics*, Book IV, Chapter 11:

> A state aims at being a society composed of equals, and therefore a state that is based on the middle class is bound to be the best constituted.

In this case we *do* have an argument. This argument of Aristotle is short and simple; most arguments are longer and more complicated. Every argument, however—short or long, simple or complex—consists of a group of propositions of which one is the conclusion and the other(s) are the premises offered to support it.

Although every argument is a structured cluster of propositions, not every structured cluster of propositions is an argument. Consider the following 2006 account of global inequality:

> In the same world in which more than a billion people live at a level of affluence never previously known, roughly a billion other people struggle to survive on the purchasing power equivalent of less than one U.S. dollar per day. Most of the world's poorest people are undernourished—lack access to safe drinking water or even the most basic health services and cannot send their children to school. According to UNICEF, more than 10 million children die every year—about 30,000 per day—from avoidable, poverty-related causes.[4]

This report is deeply troubling—but there is no argument here.

Reasoning is an art, as well as a science. It is something we do, as well as something we understand. Giving reasons for our beliefs comes naturally, but skill in the art of building arguments, and testing them, requires practice. One who has practiced and strengthened these skills is more likely to reason correctly than one who has never thought about the principles involved. Therefore we provide in this book very many opportunities for practice in the analysis of arguments.

EXERCISES

Identify the premises and conclusions in the following passages. Some premises do support the conclusion, others do not. Note that premises may support conclusions directly or indirectly and that even simple passages may contain more than one argument.

Example

1. A well-regulated militia being necessary to the security of a free state, the right of the people to keep and bear arms shall not be infringed.

—*The Constitution of the United States*, Amendment 2

Solution

Premise: A well-regulated militia is necessary for the security of a free state.
Conclusion: The right of the people to keep and bear arms shall not be infringed.

2. What stops many people from photocopying a book and giving it to a pal is not integrity but logistics; it's easier and inexpensive to buy your friend a paperback copy.

—Randy Cohen, *The New York Times Magazine*, 26 March 2000

3. Thomas Aquinas argued that human intelligence is a gift from God and therefore "to apply human intelligence to understand the world is not an affront to God, but is pleasing to him."

—Recounted by Charles Murray in *Human Accomplishment* (New York: HarperCollins, 2003)

4. Sir Edmund Hillary is a hero, not because he was the first to climb Mount Everest, but because he never forgot the Sherpas who helped him achieve this impossible feat. He dedicated his life to helping build schools and hospitals for them.

—Patre S. Rajashekhar, "Mount Everest," *National Geographic*, September 2003

5. Standardized tests have a disparate racial and ethnic impact; white and Asian students score, on average, markedly higher than their black and Hispanic peers. This is true for fourth-grade tests, college entrance exams, and every other assessment on the books. If a racial gap is evidence of discrimination, then all tests discriminate.

—Abigail Thernstrom, "Testing, the Easy Target," *The New York Times*, 15 January 2000

6. Good sense is, of all things in the world, the most equally distributed, for everybody thinks himself so abundantly provided with it that even those most difficult to please in all other matters do not commonly desire more of it than they already possess.

—René Descartes, *A Discourse on Method*, 1637

7. When Noah Webster proposed a *Dictionary of the American Language*, his early 19th-century critics presented the following argument against it: "Because any words

new to the United States are either stupid or foreign, there is no such thing as the American language; there's just bad English."

—Jill Lepore, "Noah's Mark," *The New Yorker*, 6 November 2006

8. The death penalty is too costly. In New York State alone taxpayers spent more than $200 million in our state's failed death penalty experiment, with no one executed.

In addition to being too costly, capital punishment is unfair in its application. The strongest reason remains the epidemic of exonerations of death row inmates upon post-conviction investigation, including ten New York inmates freed in the last 18 months from long sentences being served for murders or rapes they did not commit.

—L. Porter, "Costly, Flawed Justice," *The New York Times*, 26 March 2007

9. Houses are built to live in, not to look on; therefore, let use be preferred before uniformity.

—Francis Bacon, "Of Building," in *Essays*, 1597

10. To boycott a business or a city [as a protest] is not an act of violence, but it can cause economic harm to many people. The greater the economic impact of a boycott, the more impressive the statement it makes. At the same time, the economic consequences are likely to be shared by people who are innocent of any wrongdoing, and who can ill afford the loss of income: hotel workers, cab drivers, restaurateurs, and merchants. The boycott weapon ought to be used sparingly, if for no other reason than the harm it can cause such bystanders.

—Alan Wolfe, "The Risky Power of the Academic Boycott," *Chronicle of Higher Education*, 17 March 2000

11. Ethnic cleansing was viewed not so long ago as a legitimate tool of foreign policy. In the early part of the 20th century forced population shifts were not uncommon; multicultural empires crumbled and nationalism drove the formation of new, ethnically homogenous countries.

—Belinda Cooper, "Trading Places," *The New York Times Book Review*, 17 September 2006

12. If a jury is sufficiently unhappy with the government's case or the government's conduct, it can simply refuse to convict. This possibility puts powerful pressure on the state to behave properly. For this reason a jury is one of the most important protections of a democracy.

—Robert Precht, "Japan, the Jury," *The New York Times*, 1 December 2006

13. Without forests, orangutans cannot survive. They spend more than 95 percent of their time in the trees, which, along with vines and termites, provide more than 99 percent of their food. Their only habitat is formed by the tropical rain forests of Borneo and Sumatra.

—Birute Galdikas, "The Vanishing Man of the Forest," *The New York Times*, 6 January 2007

14. Omniscience and omnipotence are mutually incompatible. If God is omniscient, he must already know how he is going to intervene to change the course of history

using his omnipotence. But that means he can't change his mind about his intervention, which means he is not omnipotent.

—Richard Dawkins, *The God Delusion* (New York: Houghton Mifflin, 2006)

15. Reason is the greatest enemy that faith has; it never comes to the aid of spiritual things, but more frequently than not struggles against the divine Word, treating with contempt all that emanates from God.

—Martin Luther, *Last Sermon in Wittenberg*, 17 January 1546

1.3 Recognizing Arguments

Before we can evaluate an argument, we must *recognize* it. We must be able to distinguish argumentative passages in writing or speech. Doing this assumes, of course, an understanding of the language of the passage. However, even with a thorough comprehension of the language, the identification of an argument can be problematic because of the peculiarities of its formulation. Even when we are confident that an argument is intended in some context, we may be unsure about which propositions are serving as its premises and which as its conclusion. As we have seen, that judgment cannot be made on the basis of the order in which the propositions appear. How then shall we proceed?

A. Conclusion Indicators and Premise Indicators

One useful method depends on the appearance of certain common indicators, certain words or phrases that typically serve to signal the appearance of an argument's conclusion or of its premises. Here is a partial list of **conclusion indicators**:

Conclusion indicator
A word or phrase (such as "therefore" or "thus") appearing in an argument and usually indicating that what follows it is the conclusion of that argument.

therefore	for these reasons
hence	it follows that
so	I conclude that
accordingly	which shows that
in consequence	which means that
consequently	which entails that
proves that	which implies that
as a result	which allows us to infer that
for this reason	which points to the conclusion that
thus	we may infer

Other words or phrases typically serve to mark the premises of an argument and hence are called **premise indicators.** Usually, but not always, what follows any one of these will be the premise of some argument. Here is a partial list of premise indicators:

Premise indicator
In an argument, a word or phrase (like "because" and "since") that normally signals that what follows it are statements serving as premises.

since	as indicated by
because	the reason is that
for	for the reason that
as	may be inferred from

follows from — may be derived from
as shown by — may be deduced from
inasmuch as — in view of the fact that

B. Arguments in Context

The words and phrases we have listed may help to indicate the presence of an argument or identify its premises or conclusion, but such indicators do not necessarily appear. Sometimes it is just the meaning of the passage, or its setting, that indicates the presence of an argument. For example, during the intense controversy over the deployment of additional U.S. troops to Iraq in 2007, one critic of that deployment wrote:

> As we send our young men and women abroad to bring order to Iraq, many of its so-called leaders have abandoned their posts. We have given the Iraqis an opportunity to iron out their differences and they throw it back in our faces. Iraq does not deserve our help.[5]

No premise indicators or conclusion indicators are used here, yet the argument is clear. Indicators are also absent in the following argument in Sam Harris's *Letter to a Christian Nation*, whose premises and conclusions are unmistakable:

> Half the American population believes that the universe is 6,000 years old. They are wrong about this. Declaring them so is not "irreligious intolerance." It is intellectual honesty.[6]

Often, however, the force of an argument can be appreciated only when one understands the *context* in which that argument is presented. For example, the undergraduate admission system of the University of Michigan that gave a fixed number of extra points to all members of certain minority groups was held unconstitutional by the U.S. Supreme Court in *Gratz v. Bollinger* in 2003. Justice Ruth Bader Ginsburg dissented, defending the Michigan system with the following argument:

> Universities will seek to maintain their minority enrollment . . . whether or not they can do so in full candor. . . . [They] may resort to camouflage. If honesty is the best policy, surely Michigan's accurately described, fully disclosed College affirmative action program is preferable to achieving similar numbers through winks, nods, and disguises.[7]

This argument derives its force from the realization that universities had in fact long disguised their preferential admission programs to avoid attacks based on the equal protection clause of the Fourteenth Amendment to the U.S. Constitution. Chief Justice William Rehnquist's response to Justice Ginsburg's argument is also intelligible only in the context of her defense of the preferential admission system. Rehnquist wrote the following:

> These observations are remarkable for two reasons. First, they suggest that universities—to whose academic judgment we are told we should defer—will pursue their affirmative action programs whether or not they violate the United States Constitution. Second, they recommend that these violations should be dealt with, not by requiring the Universities to obey the Constitution, but by changing the Constitution so that it conforms to the conduct of the universities.[8]

Rehnquist's reference to "changing the Constitution" must be understood in light of the fact that the Michigan undergraduate admission system had been held

unconstitutional. His reference to the pursuit of affirmative action programs "whether or not they violate the United States Constitution" can best be understood in light of Ginsburg's earlier reference to the possible use of "winks, nods, and disguises."

The full force of argument and counterargument can be grasped, in most circumstances, only with an understanding of the *context* in which those arguments are presented. In real life, context is critical. For example, if you are told that I am bringing a lobster home for dinner, you will have little doubt that I intend to eat it, not feed it.

C. Premises or Conclusions Not in Declarative Form

It is not uncommon for the premises of an argument to be presented in the form of questions. However, if questions assert nothing, and do not express propositions, how is this possible? On the surface they make no assertions; beneath the surface an interrogative sentence can serve as a premise when its question is **rhetorical**—that is, when it suggests or assumes an answer that is made to serve as the premise of an argument. The sentence may be interrogative even though its meaning is declarative.

Rhetorical question
A sentence or utterance used to make a statement, but which, because it is in interrogative form and is therefore neither true nor false, does not literally assert anything.

This use of questions is sometimes obvious, as in a letter dated 7 January 2007 to *The New York Times*, objecting to a new series of U.S. coins that will honor former presidential wives. Irit R. Rasooly wrote:

> I am irked by the new set of coins being issued. While some first ladies have influenced our country, should we bestow this honor on people who are unelected, whose only credential is having a prominent spouse?

Plainly, the critic means to affirm the proposition that we should not bestow this honor on such people. He continues:

> Wouldn't honoring women who have served as governors, Supreme Court justices or legislators be a more fitting tribute to this nation's women than coins featuring "First Spouses"?

This critic obviously believes that honoring such achievements would be a more fitting tribute, but he again expresses that proposition with a question. His letter also provides an illustration of the need to rely on context to interpret declarative statements that are actually made. The writer's report that he is "irked" by the new set of coins is no doubt true, but this statement is more than a mere description of his state of mind; he means to express the judgment that such a set of coins *ought not* be issued.

Using questions to express a premise is sometimes counterproductive, however, because it may invite answers (by the listener, or silently by the reader) that threaten the conclusion at which the argument aims. For example, the archbishop of the Anglican Church in Nigeria, who is an ardent opponent of homosexuality and views it as deeply sinful, argues thus:

> Why didn't God make a lion to be a man's companion? Why didn't He make a tree to be a man's companion? Or better still, why didn't He make another man to be a man's companion? So even from the creation story you can see that the mind of God, God's intention, is for man and woman to be together.[9]

Conclusions drawn about God's intentions, using as premises questions that invite a myriad of different responses, may be undermined by the answers they elicit.

Questions can serve most effectively as premises when the answers assumed really do seem to be clear and inescapable. In such cases the readers (or hearers) are led to provide

the apparently evident answers for themselves, thus augmenting the persuasiveness of the argument. Here is an example: Some who find euthanasia morally unacceptable reject the defense of that practice as grounded in the right to self-determination possessed by the terminally ill patient. They argue as follows:

> If a right to euthanasia is grounded in self-determination, it cannot reasonably be limited to the terminally ill. If people have a right to die, why must they wait until they are actually dying before they are permitted to exercise that right?[10]

The question is forceful because its answer appears to be undeniable. It seems obvious that there is no good reason why, if people have a right to die grounded in self-determination, they must wait until they are dying to exercise that right. Hence (this critique concludes) the right to euthanasia, if there is one, cannot be limited to the terminally ill. The argument has much merit, but from the perspective of its religious advocates, it may prove to be a two-edged sword.

Arguments that depend on rhetorical questions are always suspect. Because the question is neither true nor false, it may be serving as a device to suggest the truth of some proposition while avoiding responsibility for asserting it. That proposition is likely to be dubious, and it may in fact be false. To illustrate: In 2007 Arab leaders in Jerusalem expressed great anxiety about the safety of the Al-Aqsa mosque when the Israeli government began construction of a ramp leading to the platform (also sacred to the Jews) on which that very holy mosque is situated. In reviewing the situation, David Gelernter, an Israeli partisan asked: "Is it possible that Arab leaders are more interested in attacking Israel than protecting religious and cultural monuments?"[11] Well, yes, that is possible, of course—but it may not be true, and the question framed in this way is plainly intended to cause the reader to believe that Arab leaders were being duplicitous in voicing their concerns. Did the author assert that such duplicity lay behind the Arab objections? No, he didn't say that!

Gossip columnists thrive on suggestive questions. Celebrity tidbits commonly appear in the form, "Does Paris Hilton have any talent as an actress?" Similarly, in discussing social issues, rhetorical questions can be an effective method of covert assertion. When riots in France spread through Islamic neighborhoods, many wondered what motivated those rioters. Journalist Christopher Caldwell wrote:

> Were they admirers of France's majority culture, frustrated at not being able to join it on equal terms? Or did they simply aspire to burn to the ground a society they despised?[12]

Accusers who protect themselves by framing their accusations in interrogative sentences may shield themselves from the indignant complaints of their target. "No," they may insist, "that is not what I said!"

It is wise policy to refrain from arguing with questions.

In some arguments the conclusion appears in the form of an imperative. The reason, or reasons, we ought to perform a given act are set forth as premises, and we are then directed to act in that way. Thus in Proverbs 4:7 we read:

> Wisdom is the principal thing; therefore get wisdom.

Here the second clause is a command, and a command, like a question, is neither true nor false and cannot express a proposition. Therefore, strictly speaking, it cannot be the conclusion of an argument. Nonetheless, it surely is meant to be the conclusion of an

argument in this passage from Proverbs. How can we explain this apparent inconsistency? It is useful in many contexts to regard a command as no different from a proposition in which hearers (or readers) are told that they would be wise to act, or ought to act, in the manner specified in the command. Thus the conclusion of the argument in Proverbs may be rephrased as "Getting wisdom is what you should do." Assertions of this kind may be true or false, as most will agree. What difference there is between a command to do something and a statement that it should be done is an issue that need not be explored here. By ignoring that difference (if there really is one), we are able to deal uniformly with arguments whose conclusions are expressed in this form.

Reformulations of this kind can clarify the roles of an argument's constituent propositions. It is necessary to grasp the *substance* of what is being asserted, to understand which claims are serving to support which inferences, whatever their external forms. Some needed reformulations are merely grammatical. A proposition that functions as a premise may take the form of a phrase rather than a declarative sentence. This is well illustrated in the following argumentative passage, whose conclusion is a very sharp criticism of the United States:

> What is a failed state? It is one that fails to provide security for the population, to guarantee rights at home or abroad, or to maintain functioning democratic institutions. On this definition the United States is the world's biggest failed state.[13]

The second and third premises of this argument are compressed into phrases, but the propositions for which these phrases are shorthand are clear enough, and their critical role in the author's reasoning is evident.

D. Unstated Propositions

Arguments are sometimes obscure because one (or more) of their constituent propositions is not stated but is assumed to be understood. An illustration will be helpful here. The chair of the Department of Sociology at City College, CUNY, presented two strong but controversial arguments, in parallel, regarding the justifiability of the death penalty. The first premise of each argument is the hypothesis that the factual belief (of the proponent, or of the opponent, of the penalty) about what does in fact deter homicide is mistaken. The second premise of each argument, although entirely plausible, is not stated, leaving the reader the task of reconstructing it.

The first argument went like this:

> If the proponent of the death penalty is incorrect in his belief that the [death] penalty deters homicide, then he is responsible for the execution of murderers who should not be executed.[14]

This argument relies on the unstated second premise: "No one should be executed to advance an objective that is not promoted by execution." Hence one who *mistakenly* believes that the objective (deterring murders) is achieved by executing those convicted is responsible for the execution of murderers who should not be executed.

The second argument went like this:

> If the opponent of the death penalty is incorrect in his belief that the death penalty doesn't deter, he is responsible for the murder of innocent individuals who would not have been murdered if the death penalty had been invoked.[15]

This argument relies on the unstated second premise: "Protecting the lives of innocent individuals from murder justifies the execution of murderers if other murderers are then deterred by the fear of execution." Hence one who *mistakenly* believes that the death penalty does not deter murderers is responsible for the lives of innocents who are subsequently murdered.

In each of these arguments the assumed but unstated second premise is plausible. One might find both arguments persuasive—leaving open for empirical investigation the question of whether, in fact, the death penalty does deter murder. However, the force of each of the arguments depends on the truth of the unstated premise on which it relies.

A premise may be left unstated because the arguer supposes that it is unquestioned common knowledge. In the controversy over the cloning of human beings, one angry critic wrote:

> Human cloning—like abortion, contraception, pornography and euthanasia—is intrinsically evil and thus should never be allowed.[16]

This is plainly an argument, but part of it is missing. The argument relies on the very plausible but unstated premise that "what is intrinsically evil should never be allowed." Arguments in everyday discourse very often rely on some proposition that is understood but not stated. Such arguments are called **enthymemes**. We will examine them more closely later in this book.

Enthymeme
An argument that is stated incompletely, the unstated part of it being taken for granted.

The unstated premise on which an enthymeme relies may not be universally accepted; it may be uncertain or controversial. An arguer may deliberately refrain from formulating that critical premise, believing that by allowing it to remain tacit, the premise is shielded from attack. For example, medical research using embryonic stem cells (cells found in the human embryo that can develop into other types of cells and into most types of tissue) is highly controversial. One U.S. senator used the following enthymeme in attacking legislation that would permit government financing of such research:

> This research [involving the use of embryonic stem cells] is illegal, for this reason: The deliberate killing of a human embryo is an essential component of the contemplated research.[17]

The stated premise is true: Research of this kind is not possible without destroying the embryo. However, the conclusion that such research is illegal depends on the unstated premise that the killing of a human embryo is illegal—and *that* claim is very much in dispute.

The effectiveness of an enthymeme may depend on the hearer's knowledge that some proposition is false. To emphasize the falsity of some proposition, a speaker may construct an argument in which the first premise is a hypothetical proposition of which the antecedent (the "if" component), is the proposition whose falsity the speaker wishes to show, and the consequent (the "then" component) is a proposition known by everyone to be false. The unstated falsehood of this second component is the second premise of the enthymematic argument. The unstated falsehood of the first component is the conclusion of the argument. To illustrate: The distinguished political philosopher John Rawls admired Abraham Lincoln as the president who most appreciated the moral equality of human beings. Rawls frequently quoted Lincoln's enthymematic argument, "If slavery is not wrong, nothing is wrong."[18] It is of course wildly false to say that nothing is wrong—from which it follows that it is equally false to say that slavery is not wrong. Similarly, distinguished psychiatrist Bruno Bettelheim, survivor of both Dachau and Buchenwald, wrote: "If all men are good, then there never was an Auschwitz."

1.4 Arguments and Explanations

Passages that appear to be arguments are sometimes not arguments but *explanations*. The appearance of words that are common indicators—such as "because," "for," "since," and "therefore"—cannot settle the matter, because those words are used both in explanations and in arguments (although "since" can sometimes refer to temporal succession). We need to know the intention of the author. Compare the following two passages:

1. Lay up for yourselves treasures in heaven, where neither moth nor rust consumes and where thieves do not break in and steal. For where your treasure is, there will your heart be also.

—Matt. 7:19

2. Therefore is the name of it [the tower] called Babel; because the Lord did there confound the language of all the earth.

—Gen. 11:19

The first passage is clearly an argument. Its conclusion, that one ought to lay up treasures in heaven, is supported by the premise (here marked by the word "for") that one's heart will be where one's treasure is laid up. The second passage, which uses the word "therefore" quite appropriately, is not an argument. It *explains* why the tower (whose construction is recounted in Genesis) is called Babel. The tower was given this name, we are told, because it was the place where humankind, formerly speaking one language, became confounded by many languages—the name is derived from a Hebrew word meaning "to confound." The passage assumes that the reader knows that the tower had that name; the intention is to explain why that name was given to it. The phrase, "Therefore is the name of it called Babel," is not a conclusion but a completion of the explanation of the naming. In addition, the clause, "because the Lord did there confound the language of all the earth," is not a premise; it could not serve as a reason for believing that Babel was the name of the tower, because the fact that that *was* the name is known by those to whom the passage is addressed. In this context, "because" indicates that what follows will *explain* the giving of that name, Babel, to that tower.

These two passages illustrate the fact that superficially similar passages may have very different functions. Whether some passage is an argument or an explanation depends on the *purpose* to be served by it. If our aim is to establish the truth of some proposition, *Q*, and we offer some evidence, *P*, in support of *Q*, we may appropriately say "*Q* because *P*." In this case we are giving an argument *for Q*, and *P* is our premise. Alternatively, suppose that *Q* is known to be true. In that case we don't have to give any reasons to support its truth, but we may wish to give an account of *why* it is true. Here also we may say "*Q* because *P*"—but in this case we are giving not an argument *for Q*, but an explanation *of Q*.

In responding to a query about the apparent color of quasars (celestial objects lying far beyond our galaxy), one scientist wrote:

> The most distant quasars look like intense points of infrared radiation. This is because space is scattered with hydrogen atoms (about two per cubic meter) that absorb blue light, and if you filter the blue from visible white light, red is what's left. On its multibillion-light-year journey to earth quasar light loses so much blue that only infrared remains.[19]

The author is not seeking to convince his reader that quasars have the apparent color they do, but rather giving the causes of this fact; he is explaining, not arguing.

However, it may be difficult at times to determine whether an author intends to be explaining some state of affairs, or to be arguing for some conclusion that is critical in that explanation. Here, for example, is a passage that may be interpreted in either way.

> I would like to highlight another property of water, unique but also vital to making life on Earth possible. As water cools, approaching its freezing point, its density suddenly decreases, reversing the usual "natural convection" patterns in which colder fluids sink. This reversal causes the coldest strata of water to rise to the top of an ocean or lake. These large bodies of water now freeze from the top down. Were it not for this unique property of water, the oceans and lakes would have long and completely frozen over from the bottom up with dire consequences for any life-sustaining liquid water on Earth.[20]

More than one conclusion may be inferred from the same premise, thus presenting two arguments. Similarly, more than one thing may be accounted for by the same fact, thus presenting two explanations. Here is an illustration:

> The *Oxford English Dictionary* is a historical dictionary, providing citations meant to show the evolution of every word, beginning with the earliest known usage. Therefore, a key task, and a popular sport for thousands of volunteer word aficionados, is antedating: finding earlier citations than those already known.[21]

That antedating is a key task for the makers of that dictionary is accounted for by the fact that the *Oxford English Dictionary* is a *historical* dictionary. This fact about the dictionary also explains why, for word aficionados, antedating is a popular sport.

If an author writes "*Q* because *P*," how can we tell whether he intends to explain or to persuade? We can ask: What is the status of *Q* in that context? Is *Q* a proposition whose truth needs to be established or confirmed? In that case, "because *P*" is probably offering a premise in its support; "*Q* because *P*" is in that instance an argument. Or is *Q* a proposition whose truth is known, or at least not in doubt in that context? In that case, "because *P*" is probably offering some account of why *Q* has come to be true; "*Q* because *P*" is in that instance an explanation.

In an explanation, one must distinguish *what* is being explained from what the explanation *is*. In the explanation from Genesis given at the beginning of this section, what is being explained is how the tower of Babel came to have that name; the explanation is that it was there that the Lord did confound the language of all the Earth. In the astronomical example given subsequently, what is being explained is the fact that quasars appear to be red; the explanation is that as light travels from the very distant quasar to Earth all the blue in that light is filtered out.

If we are sensitive to the context, we will usually be able to distinguish an explanation from an argument. However, there will always be some passages whose purpose is uncertain, and such passages may deserve to be given alternative, equally plausible "readings"—viewed as arguments when interpreted in one way and as explanations when interpreted in another.

EXERCISES

Some of the following passages contain explanations, some contain arguments, and some may be interpreted as either an argument or an explanation. What is your judgment about the chief function of each passage? What would have to be the case for the passage in question to be an argument? To be an explanation? Where you find an argument, identify its premises and conclusion. Where you find an explanation, indicate what is being explained and what the explanation is.

Example

1. Humans have varying skin colors as a consequence of the distance our ancestors lived from the Equator. It's all about sun. Skin color is what regulates our body's reaction to the sun and its rays. Dark skin evolved to protect the body from excessive sun rays. Light skin evolved when people migrated away from the Equator and needed to make vitamin D in their skin. To do that they had to lose pigment. Repeatedly over history, many people moved dark to light and light to dark. That shows that color is not a permanent trait.

—Nina Jablonski, "The Story of Skin," *The New York Times*, 9 January 2007

Solution

This is essentially an explanation. *What* is being explained is the fact that humans have varying skin colors. The explanation is that different skin colors evolved as humans came to live at different distances from the Equator and hence needed different degrees of protection from the rays of the sun. One might interpret the passage as an argument whose conclusion is that skin color is not a permanent trait of all humans. Under this interpretation, all the propositions preceding the final sentence of the passage serve as premises.

2. David Bernstein [in *Only One Place of Redress: African Americans, Labor Regulations, and the Courts from Reconstruction to the New Deal*, 2001] places labor laws at the center of the contemporary plight of black Americans. Many of these ostensibly neutral laws (e.g., licensing laws, minimum-wage laws, and collective bargaining laws) were either directly aimed at stymieing black economic and social advancement or, if not so aimed, were quickly turned to that use. A huge swath of the American labor market was handed over to labor unions from which blacks, with few exceptions, were totally excluded. The now longstanding gap between black and white unemployment rates dates precisely from the moment of government intervention on labor's behalf. In short (Bernstein argues) the victories of American labor were the undoing of American blacks.

—Ken I. Kirsch, "Blacks and Labor—the Untold Story," *The Public Interest*, Summer 2002

3. Animals born without traits that led to reproduction died out, whereas the ones that reproduced the most succeeded in conveying their genes to posterity. Crudely speaking, sex feels good because over evolutionary time the animals that liked having sex created more offspring than the animals that didn't.

—R. Thornhill and C. T. Palmer, "Why Men Rape," *The Sciences*, February 2000

4. Changes are real. Now, changes are only possible in time, and therefore time must be something real.

—Immanuel Kant, *Critique of Pure Reason* (1781), "Transcendental Aesthetic," section II

5. The nursing shortage in the United States has turned into a full-blown crisis. Because fewer young people go into nursing, one-third of registered nurses in the United States are now over 50 years of age, and that proportion is expected to rise to 40 percent over the next decade. Nurses currently practicing report high rates of job dissatisfaction, with one in five seriously considering leaving the profession within the next five years. . . . Hospitals routinely cancel or delay surgical cases because of a lack of nursing staff.

—Ronald Dworkin, "Where Have All the Nurses Gone?," *The Public Interest*, Summer 2002

6. To name causes for a state of affairs is not to excuse it. Things are justified or condemned by their consequences, not by their antecedents.

—John Dewey, "The Liberal College and Its Enemies," *The Independent*, 1924

7. One may be subject to laws made by another, but it is impossible to bind oneself in any matter which is the subject of one's own free exercise of will. . . . It follows of necessity that the king cannot be subject to his own laws. For this reason [royal] edicts and ordinances conclude with the formula, "for such is our good pleasure."

—Jean Bodin, *Six Books of the Commonwealth*, 1576

8. I like Wagner's music better than anybody's. It is so loud that one can talk the whole time without people hearing what one says.

—Oscar Wilde, *The Picture of Dorian Gray*, 1891

9. Three aspects of American society in recent decades make cheating more likely.

First, there is the rise of a market-drenched society, where monetary success is lauded above all else. Second, there is the decline of religious, communal, and family bonds and norms that encourage honesty. Finally, there is the absence of shame by those public figures who are caught in dishonest or immoral activities. No wonder so many young people see nothing wrong with cutting corners or worse.

—Howard Gardner, "More Likely to Cheat," *The New York Times*, 9 October 2003

10. Love looks not with the eyes, but with the mind; And therefore is wing'd Cupid painted blind.

—William Shakespeare, *A Midsummer Night's Dream*, act 1, scene 1

11. An article in *The New York Times*, "Why Humans and Their Fur Parted Ways," suggested that the fact that women have less body hair than men is somehow related to greater sexual selection pressure on women. A reader responded with the following letter:

> Here is an elaboration for which I have no evidence but it is consistent with what we think we know: sexual selection has probably strongly influenced numerous traits of both sexes.
>
> Youthful appearance is more important to men when selecting a mate than it is to women. The longer a woman can look young, the longer she will be sexually attractive and the more opportunities she will have to bear offspring with desirable men. Hairlessness advertises youth.
>
> Hence a greater sexual selection pressure on women to lose body hair.

—T. Doyle, "Less Is More," *The New York Times*, 26 August 2003

12. MAD, mutually assured destruction, was effective in deterring nuclear attack right through the cold war. Both sides had nuclear weapons. Neither side used them, because both sides knew the other would retaliate in kind. This will not work with a religious fanatic [like Mahmoud Ahmadinejad, President of the Islamic Republic of Iran]. For him, mutual assured destruction is not a deterrent, it is an inducement. We know already that Iran's leaders do not give a damn about killing their own people in great numbers. We have seen it again and again. In the final scenario, and this applies all the more strongly if they kill large numbers of their own people, they are doing them a favor. They are giving them a quick free pass to heaven and all its delights.

—Bernard Lewis, quoted in *Commentary*, June 2007

13. About a century ago, we discovered that planetary orbits are not stable in four or more dimensions, so if there were more than three space dimensions, planets would not orbit a sun long enough for life to originate. And in one or two space dimensions, neither blood flow nor large numbers of neuron connections can exist. Thus, interesting life can exist only in three dimensions.

—Gordon Kane, "Anthropic Questions," *Phi Kappa Phi Journal*, Fall 2002

14. Translators and interpreters who have helped United States troops and diplomats now want to resettle in the United States. They speak many strategically important languages of their region. The United States does not have an adequate number of interpreters and translators who are proficient in these languages. Therefore, we need them. Q.E.D.

—Oswald Werner, "Welcome the Translators," *The New York Times*, 3 November 2007

15. The Treasury Department's failure to design and issue paper currency that is readily distinguishable to blind and visually impaired individuals violates Section 504 of the Rehabilitation Act, which provides that no disabled person shall be "subjected to discrimination under any program or activity conducted by any Executive agency."

—Judge James Robertson, Federal District Court for the District of Columbia, *American Council of the Blind v. Sec. of the Treasury*, No. 02-0864 (2006)

16. Rightness [that is, acting so as to fulfill one's duty] never guarantees moral goodness. For an act may be the act which the agent thinks to be his duty, and yet be done from an indifferent or bad motive, and therefore be morally indifferent or bad.

—Sir W. David Ross, *Foundations of Ethics* (Oxford: Oxford University Press, 1939)

17. Man did not invent the circle or the square or mathematics or the laws of physics. He discovered them. They are immutable and eternal laws that could only have been created by a supreme mind: God. And since we have the ability to make such discoveries, man's mind must possess an innate particle of the mind of God. To believe in God is not "beyond reason."

—J. Lenzi, "Darwin's God," *The New York Times Magazine*, 18 March 2007

18. Many of the celebratory rituals [of Christmas], as well as the timing of the holiday, have their origins outside of, and may predate, the Christian commemoration of the birth of Jesus. Those traditions, at their best, have much to do with celebrating human relationships and the enjoyment of the goods that this life has to offer. As an atheist I have no hesitation in embracing the holiday and joining with believers and nonbelievers alike to celebrate what we have in common.

—John Teehan, "A Holiday Season for Atheists, Too," *The New York Times*, 24 December 2006

19. All ethnic movements are two-edged swords. Beginning benignly, and sometimes necessary to repair injured collective psyches, they often end in tragedy, especially when they turn political, as illustrated by German history.

—Orlando Patterson, "A Meeting with Gerald Ford," *The New York Times*, 6 January 2007

20. That all who are happy, are equally happy, is not true. A peasant and a philosopher may be equally *satisfied*, but not equally *happy*. Happiness consists in the multiplicity of agreeable consciousness. A peasant has not the capacity for having equal happiness with a philosopher.

—Samuel Johnson, in Boswell's *Life of Johnson*, 1766

1.5 Deductive and Inductive Arguments

Every argument makes the claim that its premises provide grounds for the truth of its conclusion; that claim is the mark of an argument. However, there are two very different ways in which a conclusion may be supported by its premises, and thus there are two great classes of arguments: the *deductive* and the *inductive*. Understanding this distinction is essential in the study of logic.

A *deductive argument* makes the claim that its conclusion is supported by its premises *conclusively*; it claims that *if* its premises are all true, its conclusion *must* be true. An *inductive argument*, in contrast, does not make such a claim. Therefore, if we judge that in some passage a claim for conclusiveness is being made, we treat the argument as deductive;

if we judge that such a claim is not being made, we treat it as inductive. Because every argument either makes this claim of conclusiveness (explicitly or implicitly) or does not make it, every argument is either deductive or inductive.

When the claim is made that the premises of an argument (if true) provide incontrovertible grounds for the truth of its conclusion, that claim will be either correct or not correct. If it is correct, that argument is *valid*. If it is not correct (that is, if the premises when true fail to establish the conclusion irrefutably although claiming to do so), that argument is *invalid*.

For logicians the term *validity* is applicable only to deductive arguments. To say that a deductive argument is valid is to say that it cannot have all true premises and a false conclusion. Thus we define **validity** as follows: A deductive argument is *valid* if and only if it cannot have all true premises and a false conclusion. In everyday speech, of course, the term *valid* is used much more loosely.

Validity
A characteristic of any deductive argument that cannot have all true premises and a false conclusion. Such an argument is said to be *valid*. Validity is a formal characteristic; it applies only to arguments, as distinguished from truth, which applies to propositions.

Although every deductive argument makes the claim that its premises guarantee the truth of its conclusion, not all deductive arguments live up to that claim. Deductive arguments that fail to do so are invalid.

Because every deductive argument either succeeds or does not succeed in achieving its objective, every deductive argument is either valid or invalid. This point is important: If a deductive argument is not valid, it must be invalid; if it is not invalid, it must be valid.

The central task of deductive logic (treated at length in Part II of this book) is to discriminate valid arguments from invalid ones. Over centuries, logicians have devised powerful techniques to do this—but the traditional techniques for determining validity differ from those used by most modern logicians. The former, collectively known as *Aristotelian Syllogistic logic* and rooted in the analytical works of Aristotle, are explained in Chapters 5, 6, and 7 of this book. The techniques of *modern symbolic logic* are presented in detail in Chapters 8, 9, and 10. Logicians of the two schools differ in their methods and in their interpretations of some arguments, but ancients and moderns agree that the fundamental task of deductive logic is to develop the tools that enable us to distinguish arguments that are valid from those that are not.

In contrast, the central task of inductive arguments is to ascertain the facts by which conduct may be guided directly, or on which other arguments may be built. Empirical investigations are undertaken—as in medicine, or social science, or astronomy—leading, when inductive techniques are applied appropriately, to factual conclusions, most often concerning cause-and-effect relationships of some importance.

A great variety of inductive techniques are examined in detail in Part III of this book, but an illustration of the inductive process will be helpful at this point to contrast induction with deduction. Medical investigators, using inductive methods, are eager to learn the causes of disease, or the causes of the transmission of infectious diseases. Sexually transmitted diseases (STDs), such as acquired immune deficiency syndrome (AIDS), are of special concern because of their great seriousness and worldwide spread. Can we learn inductively how to reduce the spread of STDs? Yes, we can.

In 2006 the National Institutes of Health announced that large-scale studies of the spread of STDs in Kenya and Uganda (African countries in which the risk of HIV infection, commonly resulting in AIDS, is very high) showed that the risk of contracting HIV was sharply lower among circumcised men than among those who were not circumcised. Circumcision is not a "magic bullet" for the treatment of disease, of course. However, we did learn, by examining the experience of very many voluntary subjects (3,000 in Uganda, 5,000 in Kenya, divided into circumcised and uncircumcised groups) that

a man's risk of contracting HIV from heterosexual sex is *reduced by half* as a result of circumcision. The risk to women is also reduced by about 30 percent.*

These are discoveries (using the inductive method called *concomitant variation*, which is discussed in detail in Chapter 12) of very great importance. The causal connection between the absence of circumcision and the spread of HIV is not known with certainty, the way the conclusion of a deductive argument is known, but it is now known with a very high degree of probability.

Inductive arguments make weaker claims than those made by deductive arguments. Because their conclusions are never certain, the terms *validity* and *invalidity* do not apply to inductive arguments. We can evaluate inductive arguments, of course; appraising such arguments is a central task of scientists in every sphere. The higher the level of probability conferred on its conclusion by the premises of an inductive argument, the greater is the merit of that argument. We can say that inductive arguments may be "better" or "worse," "weaker" or "stronger," and so on. The argument constituted by the circumcision study is very strong, the probability of its conclusion very high. Even when the premises are all true, however, and provide strong support for the conclusion, that conclusion is not established with certainty. The entire theory of induction, techniques of analogical and causal reasoning, and methods for appraising inductive arguments and for quantifying and calculating probabilities are presented at length in Chapters 11, 12, 13, and 14.

Because an inductive argument can yield no more than some degree of probability for its conclusion, it is always possible that additional information will strengthen or weaken it. Newly discovered facts may cause us to change our estimate of the probabilities, and thus may lead us to judge the argument to be better (or worse) than we had previously thought. In the world of inductive argument—even when the conclusion is judged to be very highly probable—*all* the evidence is never in. New discoveries may eventually disconfirm what was earlier believed, and therefore we never assert that the conclusion of an inductive argument is absolutely certain.

Deductive arguments, on the other hand, either succeed or they do not succeed in having a necessary and conclusive inference relation between premises and conclusion. If a deductive argument succeeds in this way, it is valid, and no additional premises can possibly add to the strength of that argument. For example, if all humans are mortal and Socrates is human, it necessarily is the case that Socrates is mortal—*and that conclusion follows necessarily from those premises no matter what else may be true in the world, and no matter what other information may be discovered or added*. If we come to learn that Socrates is ugly, or that immortality is a burden, or that cows give milk, none of those findings nor any other findings can have any bearing on the validity of the original argument. Thus, the valid argument

> All humans are mortal.
> Socrates is human.
> Therefore, Socrates is mortal

* So great is the advantage of circumcision shown by these studies that they were stopped, on 13 December 2006, by the Data Safety and Monitoring Board of the National Institutes of Health, to be fair to all participants by announcing the probable risks of the two patterns of conduct.

may be modified by adding an additional premise, such as "Socrates is ugly":

All humans are mortal.
Socrates is human.
Socrates is ugly.
Therefore, Socrates is mortal.

The second argument is just as a valid as the first. The conclusion, "Socrates is mortal," follows necessarily from the premises of the first argument, and since those same propositions are premises of the second argument, the conclusion, "Socrates is mortal," (still) follows necessarily from those same two propositions (plus an additional premise). In general, the conclusion that follows with necessity from the premises of a valid deductive argument follows from any enlarged set of premises with the same necessity, regardless of the nature of the premises added.[22] If an argument is valid, nothing in the world can make it more (or less) valid; if a conclusion is validly inferred from some set of premises, nothing can be added to that set to make that conclusion follow more validly (or less validly).

This is not true of inductive arguments, however, for which the relationship claimed between premises and conclusion is much less strict and very different in kind. Consider the following inductive argument:

Most corporation lawyers are conservatives.
Miriam Graf is a corporation lawyer.
Therefore, Miriam Graf is probably a conservative.

This is a fairly good inductive argument; its first premise is true, and if its second premise also is true, its conclusion is more likely to be true than false. But in this case (in contrast to the argument about Socrates' mortality), new premises added to the original pair might weaken or (depending on the content of those new premises) strengthen the original argument. Suppose we also learn that

Miriam Graf is an officer of the American Civil Liberties Union (ACLU).

and suppose we add the (true) premise that

Most officers of the ACLU are not conservatives.

Now the conclusion (that Miriam Graf is a conservative) no longer seems very probable; the original inductive argument has been greatly weakened by the presence of this additional information about Miriam Graf. Indeed, if the final premise were to be transformed into the universal proposition

No officers of the ACLU are conservatives.

the opposite of the original conclusion would then follow deductively—and validly—from the full set of premises affirmed.

On the other hand, suppose we enlarge the original set of premises by adding the following additional premise:

> Miriam Graf has long been an officer of the National Rifle Association (NRA).

The original conclusion (that she is a conservative) would be supported by this enlarged set of premises with even greater likelihood than it was by the original set.

Inductive arguments do not always acknowledge explicitly that their conclusions are supported only with some degree of probability. On the other hand, the mere presence of the word "probability" in an argument gives no assurance that the argument is inductive. There are some strictly deductive arguments *about* probabilities themselves, in which the probability of a certain combination of events is deduced from the probabilities of other events. For example, if the probability of three successive heads in three tosses of a coin is $\frac{1}{8}$, one may infer deductively that the probability of getting at least one tail in three tosses of a coin is $\frac{7}{8}$. Other illustrations of such arguments are given in Chapter 14.

In sum, the distinction between induction and deduction rests on the nature of the claims made by the two types of arguments about the *relations* between their premises and their conclusions. Thus we characterize the two types of arguments as follows: A **deductive argument** is one whose conclusion is claimed to follow from its premises with absolute necessity. In sharp contrast, an **inductive argument** is one whose conclusion is claimed to follow from its premises only with probability, this probability being a matter of degree and dependent on what else may be the case. Unlike an inductive argument, the conclusion of a *valid* deductive argument *follows necessarily* from its premises, and this necessity is not a matter of degree and does not depend in any way on whatever else may be the case.

Deductive argument
One of the two major types of argument traditionally distinguished, the other being the inductive argument. A deductive argument claims that its conclusion follows from its premises with absolute necessity. If its conclusion does follow necessarily from its premises, it is valid; if not, it is invalid.

Inductive argument
One of the two major types of argument traditionally distinguished, the other being the deductive argument. An inductive argument claims that its premises give only some degree of probability, but not certainty, to its conclusion.

1.6 Validity and Truth

A deductive argument is valid when it succeeds in linking, with logical necessity, its conclusion to its premises. Its validity resides in the *inference relation* between its propositions—between the set of propositions that serve as the premises and the one proposition that serves as the conclusion of that argument. *A deductive argument is* ***valid*** *if and only if it cannot have all true premises and a false conclusion*—if and only if its conclusion follows with logical necessity from its premises. Therefore *validity can never apply to any single proposition by itself*, because the needed relation cannot possibly be found within any one proposition.

Truth and falsehood, on the other hand, are attributes of individual propositions. A single statement that serves as a premise in an argument may be true; the statement that serves as the argument's conclusion may be false. This conclusion might have been validly inferred, but to say that any conclusion (or any single premise) is itself valid or invalid makes no sense.

Truth is the attribute of those propositions that assert what really is the case. When I assert that Lake Superior is the largest of the five Great Lakes, I assert what really is the case, what is true. If I had claimed that Lake Michigan is the largest of the Great Lakes my assertion would not be in accord with the real world; therefore it would be false. This contrast between validity and truth is important: *Truth and falsity are attributes of individual propositions or statements; validity and invalidity are attributes of deductive arguments*.

Just as the concept of validity cannot apply to single propositions, the concept of truth cannot apply to arguments. Of the several propositions in an argument, some (or all) may be true and some (or all) may be false. However, the argument as a whole is neither true nor false. Propositions, which are statements about the world, may be true or false; deductive arguments, which consist of an inference from one set of propositions to another proposition, may be valid or invalid.

The relations *between* true (or false) propositions and valid (or invalid) arguments are critical and complicated. Those relations lie at the heart of deductive logic. Part II of this book is devoted largely to the examination of those complex relations, but a preliminary discussion of the relation between validity and truth is in order here.

We begin by emphasizing that an argument may be valid even if one or more of its premises is not true. Every argument makes a claim about the relation between its premises and the conclusion drawn from them; that relation may hold even if the premises turn out to be false or the truth of the premises is in dispute. This point was made dramatically by Abraham Lincoln in 1858 in one of his debates with Stephen Douglas. Lincoln was attacking the *Dred Scott* decision of the Supreme Court, which had held that slaves who had escaped into Northern states must be returned to their owners in the South. Lincoln said:

> I think it follows [from the *Dred Scott* decision], and I submit to the consideration of men capable of arguing, whether as I state it, in syllogistic form, the argument has any fault in it:
>
> > Nothing in the Constitution or laws of any State can destroy a right distinctly and expressly affirmed in the Constitution of the United States.
> >
> > The right of property in a slave is distinctly and expressly affirmed in the Constitution of the United States.
> >
> > Therefore, nothing in the Constitution or laws of any State can destroy the right of property in a slave.
>
> I believe that no fault can be pointed out in that argument; assuming the truth of the premises, the conclusion, so far as I have capacity at all to understand it, follows inevitably. There is a fault in it as I think, but the fault is not in the reasoning; the falsehood in fact is a fault of the premises. I believe that the right of property in a slave is not distinctly and expressly affirmed in the Constitution, and Judge Douglas thinks it is. I believe that the Supreme Court and the advocates of that decision [the *Dred Scott* decision] may search in vain for the place in the Constitution where the right of property in a slave is distinctly and expressly affirmed. I say, therefore, that I think one of the premises is not true in fact.[23]

The reasoning in the argument that Lincoln recapitulates and attacks is not faulty—but its second premise (that "the right of property in a slave is . . . affirmed in the Constitution") is plainly false. The conclusion has therefore not been established. Lincoln's logical point is correct and important: *An argument may be valid even when its conclusion and one or more of its premises are false*. The validity of an argument, we emphasize once again, depends only on the *relation* of the premises to the conclusion: a valid argument cannot have all true premises and a false conclusion because of its inference relation, but it *can* have a false conclusion (as in the argument just above), and it can have one or more false premises (as above).

There are many possible combinations of true and false premises and conclusions in both valid and invalid arguments. In fact—and this is crucially important for an understanding of logic—*all but one combination of truth values is possible*. The one exception is that ***a valid deductive argument cannot have all true premises and a false conclusion***. An invalid argument can have every combination of truth values for its

premises and conclusion; a valid argument can have every combination *except one*! This one exception is what makes a valid argument valid: A valid argument *cannot have* all true premises and a false conclusion because its premises are connected to its conclusion with logical necessity. An invalid argument can have all true premises and a false conclusion because its conclusion *does not follow with necessity* from its premises.

This crucial difference between valid and invalid arguments is illustrated by the following seven illustrative arguments. These arguments—four of them invalid, three of them valid—show that valid and invalid arguments can have various combinations of all true or all false premises and a true conclusion. What distinguishes an invalid argument from a valid argument is that an invalid argument can have all true premises and a false conclusion, but a valid argument cannot.

I. Some *valid* arguments contain *only true propositions*—true premises and a true conclusion:

All mammals have lungs.
All whales are mammals.
Therefore all whales have lungs.

II. Some *valid* arguments contain *only false propositions*—false premises and a false conclusion:

All four-legged creatures have wings.
All spiders have exactly four legs.
Therefore all spiders have wings.

This argument is valid because it cannot have all true premises and a false conclusion. If the argument's premises were true, its conclusion would have to be true also—even though we know that in fact both the premises *and* the conclusion of this argument are false.

III. Some *invalid* arguments contain *only true propositions*—all their premises are true, and their conclusions are true as well:

If I owned all the gold in Fort Knox, then I would be wealthy.
I do not own all the gold in Fort Knox.
Therefore I am not wealthy.

The true conclusion of this argument does not follow from its true premises, because its premises could all be true and its conclusion false (as they are for any person who is wealthy and does not own all the gold in Fort Knox). This will be seen more clearly when the immediately following illustration is considered.

IV. Some *invalid* arguments have *all true premises* and a *false conclusion*. This is illustrated by an argument exactly like the previous one (III) in form, changed only enough to make the conclusion false.

If Bill Gates owned all the gold in Fort Knox, then Bill Gates would be wealthy.
Bill Gates does not own all the gold in Fort Knox.
Therefore Bill Gates is not wealthy.

The premises of this argument are true, but its conclusion is false. Such an argument is *invalid* because it *can* have all true premises and a false conclusion, as it *does in fact have* here. It is impossible for *all* the premises of a *valid* argument to be true and its conclusion to be false.

V. Some *valid* arguments have all *false premises* and a *true conclusion:*

All fishes are mammals.
All whales are fishes.
Therefore all whales are mammals.

The conclusion of this argument is true, as we know; moreover, it may be validly inferred from these two premises, both of which are wildly false. This argument is valid because the conclusion follows necessarily from the premises; if all of the premises were true, the conclusion would necessarily be true.

VI. Some *invalid* arguments also have all *false premises* and a *true conclusion*:

All mammals have wings.
All whales have wings.
Therefore all whales are mammals.

From Examples V and VI taken together, it is clear that we cannot tell from the fact that an argument has all false premises and a true conclusion whether it is valid or invalid.

VII. Some *invalid* arguments contain *all false propositions*—all false premises and a false conclusion:

All mammals have wings.
All whales have wings.
Therefore all mammals are whales.

These seven examples make it clear that there are valid arguments (Example II) and invalid arguments (Examples IV and VII) with false conclusions, as well as valid arguments (Examples I and V) and invalid arguments (Examples III and VI) with true conclusions. Hence it is clear that *the truth or falsity of an argument's conclusion does not by itself determine the validity or invalidity of that argument*. Moreover, *the fact that an argument is valid does not guarantee the truth of its conclusion* (Example II).

Two tables (referring to the seven preceding examples) will make very clear the variety of possible combinations of truth and falsity for the premises and conclusion of invalid arguments, and for valid arguments. The first table shows that *invalid* arguments can have every possible combination of true (or false) premises and true (or false) conclusion:

Invalid Arguments		
	True Conclusion	**False Conclusion**
True Premises	Example III	Example IV
False Premises	Example VI	Example VII

The second table shows that *valid* arguments can have *only three* of those combinations of true (or false) premises and true (or false) conclusion:

Valid Arguments		
	True Conclusion	**False Conclusion**
True Premises	Example I	—
False Premises	Example V	Example II

The one blank position in the second table exhibits *the* fundamental point in deductive logic: *A valid argument* ***cannot have all true premises and a false conclusion.*** There are two vitally important logical consequences of this. *First, if an argument is valid and its premises are all true, its conclusion must also be true*. Second, *if an argument is valid and its conclusion is false, not all of its premises can be true*. Some perfectly valid arguments do have false conclusions, but any such argument must have at least one false premise.

Sound argument
An argument is sound if and only if (a) it is valid, and (b) it has all true premises. Given (a) and (b), a sound argument must have a true conclusion.

When an argument is valid *and* all of its premises are true, we call it ***sound***. The conclusion of a sound argument obviously must be true—and *only a sound argument can establish the truth of its conclusion*.[24] If a deductive argument is not sound—that is, if the argument is not valid or if not all of its premises are true—it fails to *establish* the truth of its conclusion even if in fact its conclusion is true.

To test the truth or falsehood of premises is the task of science in general, because premises may deal with any subject matter at all. The logician is not (professionally) interested in the truth or falsehood of propositions so much as in the logical relations between them. By *logical relations between propositions* we mean those relations that determine the correctness or incorrectness of the arguments in which they occur. The task of determining the correctness or incorrectness, the validity or invalidity, of arguments is the central task of logic. The logician is interested in the correctness even of arguments whose premises may be false.

Given, however, that only a sound argument can establish the truth of its conclusion, why do we not confine ourselves to arguments with true premises, ignoring all others? Because the correctness of arguments whose premises are not known to be true may be of great importance. Since validity resides in the relation between premises and conclusion, we *can* determine validity and invalidity without knowing, *or having to know*, anything about the actual truth or falsity of the statements constituting an argument.

This fact—the fact that we can determine the validity and invalidity of deductive arguments, and the strength of inductive arguments, without knowing whether the premises are true—is a very important fact, for it enables us to systematically learn about reality using the scientific method, and also to optimize our decision making.

To learn about reality, and especially about causal regularities, scientists *deductively* infer the logical and empirical consequences of a scientific theory or hypothesis *without knowing* whether that theory or hypothesis is true. In this manner, they compare the deduced consequences of a theory or hypothesis with observations and, where possible, the observational results of experiments. If the deduced predictions agree with observations, the theory or hypothesis is confirmed (corroborated), and if the deduced predictions disagree with observations, the theory or hypothesis is disconfirmed or refuted (falsified).

Similarly, in everyday life, we must often choose between alternative courses of action. To avoid deceiving ourselves, we must reason correctly about the consequences of the alternatives. Taking each alternative action as a premise, we infer the consequences of each action (premise), seeking to determine the course of action with the most desirable consequences. We strive to *decide* on the best course of action by means of such reasoning, and then to act accordingly. If we were interested only in arguments with true premises, we would not know which set of consequences to trace out until we knew which of the alternative premises was true. But if we knew which of the alternative premises was true, we would not need to reason about it at all, because our purpose was to help us decide which alternative premise to *make* true—which course of action to take! To confine our attention to arguments with premises known to be true would therefore

be self-defeating. Prudent conduct is based on prudent decision making, which is based on good reasoning.

Effective methods for establishing the validity or invalidity of deductive arguments are presented and explained at length in Part II of this book.

EXERCISES

For each of the argument descriptions provided below, construct a deductive argument (on any subject of your choosing) having only two premises.

1. A valid argument with one true premise, one false premise, and a false conclusion.
2. A valid argument with one true premise, one false premise, and a true conclusion.
3. An invalid argument with two true premises and a false conclusion.
4. An invalid argument with two true premises and a true conclusion.
5. A valid argument with two false premises and a true conclusion.
6. An invalid argument with two false premises and a true conclusion.
7. An invalid argument with one true premise, one false premise, and a true conclusion.
8. A valid argument with two true premises and a true conclusion.

chapter 1 Summary

The most fundamental concepts of logic are introduced in this chapter.

In Section 1.1 we explained what logic is and why it is necessary, and we defined it as the study of the methods and principles used to distinguish correct from incorrect reasoning.

In Section 1.2 we gave an account of propositions, which may be asserted or denied, and which are either true or false, and of arguments, which are clusters of propositions of which one is the conclusion and the others are the premises offered in its support. Arguments are the central concern of logicians.

In Section 1.3 we discussed difficulties in the recognition of arguments, arising from the variety of ways in which the propositions they contain may be expressed, and sometimes even from the absence of their express statement in arguments called enthymemes.

In Section 1.4 we discussed the differences between arguments and explanations, showing why this distinction often depends on the context and on the intent of the passage in that context.

In Section 1.5 we explained the fundamental difference between deductive arguments, whose conclusions may be certain (if the premises are true and the reasoning valid), and inductive arguments, aiming to establish matters of fact, whose conclusions may be very probable but are never certain.

In Section 1.6 we discussed validity and invalidity (which apply to deductive arguments) as contrasted with truth and falsity (which apply to propositions). We explored some of the key relations between validity and invalidity, on the one hand, and truth and falsity, on the other. We emphasized that, whereas an invalid argument can have any combination of truth and falsity for its premises and conclusion, a valid deductive argument *cannot have* all true premises and a false conclusion.

End Notes

1 Scott Wallace, "Last of the Amazon," *National Geographic*, January 2007.
2 David Hayden, "Thy Neighbor, Thy Self," *The New York Times*, 9 May 2000.
3 As we will see in Section 4.5 and more precisely in Section 8.9 (B), even in a case of *petitio principii* (i.e., the fallacy of *begging the question*), where one proposition is inferred from itself, there are two occurrences of the same proposition, one as premise, and one as conclusion.
4 Peter Singer, "What Should a Billionaire Give—and What Should You?" *The New York Times Magazine*, 17 December 2006.
5 Roger Woody, "Why Iraq's a Mess," *The New York Times*, 26 January 2007.
6 Sam Harris, *Letter to a Christian Nation* (New York: Alfred A. Knopf, 2006).
7 *Gratz v. Bollinger*, 539 U.S. 244 (2003).
8 Ibid.
9 Archbishop Peter Akinola, quoted in *The New York Times*, 25 December 2006.
10 Ramsey Colloquium of the Institute on Religion and Public Life, "Always to Care, Never to Kill," *The Wall Street Journal*, 17 November 1991.
11 David Gelernter, "Ramping Up the Violence," *The Weekly Standard*, 26 February 2007.
12 Christopher Caldwell, Reflections on the *Revolution in Europe: Immigration, Islam, and the West* (Doubleday, 2009).
13 Noam Chomsky, *Failed States* (New York: Henry Holt, 2006).
14 Steven Goldberg, "The Death Penalty," *The New York Times*, 20 December 2004.
15 Ibid.
16 "The Vote to Ban Human Cloning," *The New York Times*, 2 August 2001.
17 Senator Sam Brownback, of Kansas, at a Senate hearing in April 2000.
18 Samuel Freeman, "John Rawls, Friend and Teacher," *Chronicle of Higher Education*, 13 December 2002.
19 Jeff Greenwald, "Brightness Visible," *The New York Times Magazine*, 14 May 2000.
20 Joseph Bamberger, "Water's Inimitable Qualities," *The New York Times*, 17 July 2007.
21 James Gleick, "Cyber-Neologisms," *The New York Times Magazine*, 5 November 2006.
22 In Section 9.10, we shall see that if we add "Socrates is not human" to the original or augmented premises, the resultant argument is (still) valid.
23 From *The Collected Works of Abraham Lincoln*, vol. 3, Roy P. Basler, editor (New Brunswick, NJ: Rutgers University Press, 1953).
24 More precisely, only a sound argument with a contingent conclusion can *establish* the truth of its conclusion (i.e., on the *basis* of its premises and the valid logical relation between its premises and its conclusion). See Section 9.13, "Sound Arguments and Demonstrative Arguments Distinguished."

Analyzing Arguments

chapter 2

2.1 Paraphrasing Arguments

Arguments in everyday life are often more complex—more tangled and less precise—than those given as illustrations in Chapter 1. Premises may be numerous and in topsy-turvy order; they may be formulated awkwardly, and they may be repeated using different words; even the meaning of premises may be unclear. To sort out the connections of premises and conclusions so as to evaluate an argument fairly, we need some analytical techniques.

The most common, and perhaps the most useful, technique for analysis is *paraphrase*. We paraphrase an argument by setting forth its propositions in clear language and in logical order. This may require the reformulation of sentences, and therefore great care must be taken to ensure that the paraphrase put forward captures correctly and completely the argument that was to be analyzed.

The following passage, whose premises are confusingly intertwined, was part of the majority decision of the U.S. Supreme Court when, in 2003, it struck down as unconstitutional a Texas statute that had made it a crime for persons of the same sex to engage in certain forms of intimate sexual conduct. Justice Anthony Kennedy, writing for the majority, said this:

> The [present] case does involve two adults who, with full and mutual consent from each other, engaged in sexual practices common to a homosexual life style. The petitioners are entitled to respect for their private lives. The state cannot demean their existence or control their destiny by making their private sexual conduct a crime. Their right to liberty under the Due Process Clause [of the Fourteenth Amendment to the U.S. Constitution] gives them the full right to engage in their conduct without intervention of the government. It is a premise of the Constitution that there is a realm of personal liberty which the government may not enter. The Texas statute furthers no legitimate state interest which can justify its intrusion into the personal and private life of the individual.[1]

Although the general thrust of this decision is clear, the structure of the argument, which is really a complex of distinct arguments, is not. We can clarify the whole by paraphrasing the decision of the Court as follows:

1. The Constitution of the United States guarantees a realm of personal liberty that includes the private, consensual sexual activity of adults.
2. The conduct of these petitioners was within that realm of liberty and they therefore had a full right, under the Constitution, to engage in the sexual conduct in question without government intervention.
3. The Texas statute intrudes, without justification, into the private lives of these petitioners, and demeans them, by making their protected, private sexual conduct a crime.
4. The Texas statute that criminalizes such conduct therefore wrongly denies the rights of these petitioners and must be struck down as unconstitutional.

In this case the paraphrase does no more than set forth clearly what the premises indubitably assert. Sometimes, however, paraphrasing can bring to the surface what was assumed in an argument but was not fully or clearly stated. For example, the great English mathematician, G. H. Hardy, in *A Mathematician's Apology* (Cambridge University Press, 1940), argued thus: "Archimedes will be remembered when Aeschylus is forgotten, because languages die and mathematical ideas do not." We may paraphrase this argument by spelling out its claims:

1. Languages die.
2. The plays of Aeschylus are written in a language.
3. So the work of Aeschylus will eventually die.
4. Mathematical ideas never die.
5. The work of Archimedes was with mathematical ideas.
6. So the work of Archimedes will never die.
7. Therefore Archimedes will be remembered when Aeschylus is forgotten.

This paraphrase enables us to distinguish and examine the premises and inferences compressed into Hardy's single sentence.

Biography

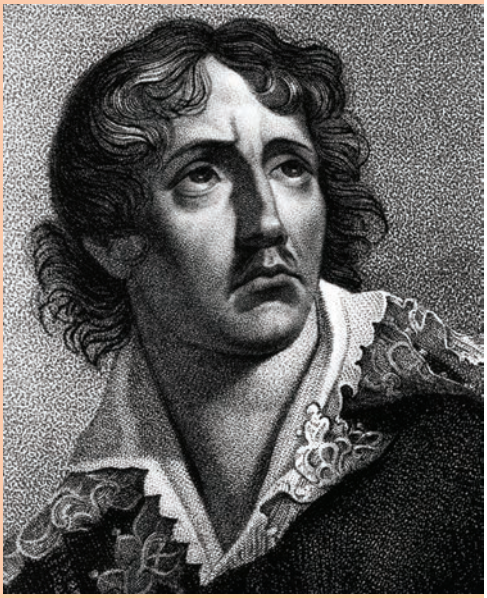
Peter Abelard

Peter Abelard was born near Nantes, in Brittany, in 1079 CE, to a noble family. He could have become a wealthy knight, but rejected such a life, instead choosing an academic career. He left home for Paris, and studied with William of Champeaux, with whom he quarreled acrimoniously, resulting in his opening a school of his own. Eventually he was elected to the faculty of the school of Notre Dame, where he was extremely popular, attracting students from all over Europe. He was primarily interested in logic, which was then called dialectic, and in metaphysics. He confronted the deep metaphysical problem of universals, or abstract objects. General terms (e.g., *justice, yellow, smooth*) plainly do exist, but are there abstract *objects* that actually exist, beneath or behind those terms, in some nonphysical world? Abelard held that there are no such entities, but that we are sometimes misled by

the words we use for the common properties of things. His position came to be known as *nominalism*.

While working as a tutor to Heloise, the 17-year-old niece of a Parisian named Fulbert, a relationship developed that resulted in her becoming pregnant. The couple ran away to his home in Brittany, where she gave birth to a child. Abelard eventually married Heloise, later sending her to become a nun. Her uncle, outraged by the scandal, hired thugs to assault Abelard and castrate him. Abelard then became a monk and lecturer, unpopular among colleagues because of his intellectual arrogance. He was obliged to move from abbey to abbey, became embroiled in theological controversies, and died in Paris in 1142.

In logic, Abelard explored the relations of premises and conclusions in deductive arguments. He was one of the first to emphasize the *syntactic* nature of validity. An argument is valid, he pointed out, not because of the semantic content of its propositions, but because of the *formal relations* among those propositions.



EXERCISES

Paraphrase each of the following passages, which may contain more than one argument.

1. The [Detroit] Pistons did not lose because of the lack of ability. They are an all-around better team. They lost because of the law of averages. They will beat the [San Antonio] Spurs every two times out of three. When you examine the NBA finals [of 2005], that is exactly how they lost the seventh (last game) because that would have been three out of three. The Spurs will beat the Pistons one out of three. It just so happens that, that one time was the final game, because the Pistons had already won two in a row.

—Maurice Williams, "Law of Averages Worked Against Detroit Pistons," *The Ann Arbor* (MI) News, 8 July 2005

2. Hundreds of thousands of recent college graduates today cannot express themselves with the written word. Why? Because universities have shortchanged them, offering strange literary theories, Marxism, feminism, deconstruction, and other oddities in the guise of writing courses.

—Stanley Ridgeley, "College Students Can't Write?" *National Review Online*, 19 February 2003

3. Racially diverse nations tend to have lower levels of social support than homogenous ones. People don't feel as bound together when they are divided on ethnic lines and are less likely to embrace mutual support programs. You can have diversity or a big welfare state. It's hard to have both.

—David Brooks (presenting the views of Seymour Lipset), "The American Way of Equality," *The New York Times*, 14 January 2007

4. Orlando Patterson claims that "freedom is a natural part of the human condition." Nothing could be further from the truth. If it were true, we could expect to find free societies spread throughout human history. We do not. Instead what we find are every sort of tyrannical government from time immemorial.

—John Taylor, "Can Freedom Be Exported?"
The New York Times, 22 December 2006

5. *The New York Times* reported, on 30 May 2000, that some scientists were seeking a way to signal back in time. A critical reader responded thus:

It seems obvious to me that scientists in the future will never find a way to signal back in time. If they were to do so, wouldn't we have heard from them by now?

—Ken Grunstra, "Reaching Back in Time,"
The New York Times, 6 June 2000

6. Nicholas Kristof equates the hunting of whales by Eskimos with the whaling habits of Japanese, Norwegians, and Icelanders. The harsh environment of the Inupiat [Eskimos] dictates their diet, so not even the most rabid antiwhaling activist can deny their inalienable right to survive. The Japanese and the European whale-hunting countries can choose the food they consume; they have no need to eat whales. It is not hypocritical to give a pass to the relatively primitive society of the Inupiat to hunt a strictly controlled number of whales for survival while chastising the modern societies that continue to hunt these magnificent mammals for no good reason.

—Joseph Turner, "Their Whale Meat, and Our Piety,"
The New York Times, 18 September 2003

7. Space contains such a huge supply of atoms that all eternity would not be enough time to count them and count the forces which drive the atoms into various places just as they have been driven together in this world. So we must realize that there are other worlds in other parts of the universe with races of different men and different animals.

—Lucretius, *De Rerum Natura*, first century BCE

8. If you marry without love, it does not mean you will not later come to love the person you marry. And if you marry the person you love, it does not mean that you will always love that person or have a successful marriage. The divorce rate is very low in many countries that have prearranged marriage. The divorce rate is very high in countries where people base their marriage decisions on love.

—Alex Hammoud, "I Take This Man, for Richer Only,"
The New York Times, 18 February 2000

9. Our entire tax system depends upon the vast majority of taxpayers who attempt to pay the taxes they owe having confidence that they're being treated fairly and that their competitors and neighbors are also paying what is due. If the public concludes that the IRS cannot meet these basic expectations, the risk to the tax system will become very high, and the effects very difficult to reverse.

—David Cay Johnston, "Adding Auditors to Help IRS Catch Tax Cheaters," *The New York Times*, 13 February 2000

10. People and governments want to talk, talk, talk about racism and other forms of intolerance; we are obsessed with racial and ethnic issues. But we come to these issues wearing earplugs and blinders, and in a state of denial that absolves us of complicity in any of these hateful matters. Thus, the other guy is always wrong.

—Bob Herbert, "Doomed to Irrelevance,"
The New York Times, 6 November 2001

2.2 Diagramming Arguments

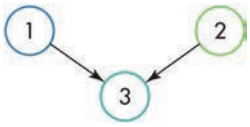
A second technique for the analysis of arguments is *diagramming*. With a diagram we can represent the structure of an argument graphically; the flow of premises and conclusions is displayed in a two-dimensional chart, or picture, on the page. A diagram is not needed for a simple argument, even though drawing one can enhance our understanding. When an argument is complex, with many premises entwined in various ways, a diagram can be exceedingly helpful.

To construct the diagram of an argument we must first number all the propositions it contains, in the order in which they appear, circling each number. Using arrows between the circled numbers, we can then construct a diagram that shows the relations of premises and conclusions without having to restate them. To convey the process of inference on the two-dimensional page, we adopt this convention: A conclusion always appears in the space *below* the premises that give it support; coordinate premises are put on the same horizontal level. In this way, an argument whose wording may be confusing can be set forth vividly in iconic form. The structure of the argument is displayed visually.[2]

Here follows a straightforward argument that may be readily diagrammed:

① There is no consensus among biologists that a fertilized cell is alive in a sense that an unfertilized egg or unused sperm is not. ② Nor is there a consensus about whether a group of cells without even a rudimentary nervous system is in any sense human. ③ Hence there are no compelling experimental data to decide the nebulous issue of when "human" life begins.[3]

The circled numbers serve to represent the propositions, so we can diagram the argument as follows:

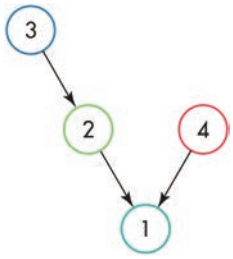


When the several premises of an argument are not all coordinate—that is, when some premises give direct support not to the conclusion but to other premises that support the conclusion—the diagram can show this quite clearly. Here is an argument illustrating this feature of diagramming:

① Football analysis is trickier than the baseball kind because ② Football really is a team sport. ③ Unlike in baseball, all eleven guys on the field are involved in every play. ④ Who deserves the credit or blame is harder to know than it looks.[4]

The diagram looks like this:

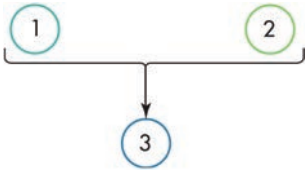
An alternative plausible interpretation of this argument can be represented by a different diagram:



Another strength of diagrams is their ability to exhibit relations between the premises—relations that may be critical to the argument. Each premise of an argument may support its conclusion separately, as in the arguments above. In some arguments, however, the premises support the conclusion only when they are considered *jointly*—and this is a feature of the reasoning that a diagram is well suited to display, by providing a visual representation of that connection. The following argument illustrates this:

> ① General Motors makes money (when it does) on new cars and on the financing of loans. ② Car dealers, by contrast, make most of their money on servicing old cars and selling used ones. ③ So car dealers can thrive even when the automaker languishes.[5]

By bracketing the premises in the diagram of this argument, we show that its premises give support only because they are joined, thus:

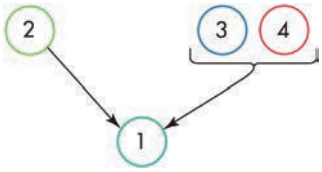


In this argument, neither premise supports the conclusion independently. It is the combination of the facts that General Motors makes most of its money in one way, while car dealers make most of their money in another way, that supports the conclusion that the latter may thrive while the former languishes.

Often we can *show* what we cannot as conveniently say. Diagrams are particularly useful when an argument's structure is complicated. Consider the following argument:

> ① Desert mountaintops make good sites for astronomy. ② Being high, they sit above a portion of the atmosphere, enabling a star's light to reach a telescope without having to swim through the entire depths of the atmosphere. ③ Being dry, the desert is also relatively cloud-free. ④ The merest veil of haze or cloud can render a sky useless for many astronomical measures.[6]

Proposition ① is plainly the conclusion of this argument, and the other three provide support for it—but they function differently in giving that support. Statement ② supports, by itself, the claim that mountaintops are good sites for telescopes. But statements ③ and ④ must work together to support the claim that desert mountaintops are good sites for telescopes. A diagram shows this neatly:



Some complications may be revealed more clearly using paraphrase. When an argument has a premise that is not stated explicitly, a paraphrase allows us to formulate the tacit premise and then add it to the list explicitly. A diagram requires the representation of the tacit premise in some way that indicates visually that it has been added (a broken circle around a number is commonly used), but even then the added premise remains to be precisely formulated. Thus the argument

> Since there are no certainties in the realm of politics, politics must be the arena for negotiation between different perspectives, with cautious moderation likely to be the best policy.[7]

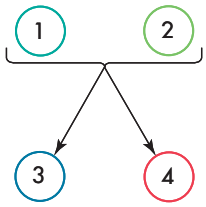
is best clarified by a paraphrase in which its tacit premise and internal complexity is made explicit, thus:

1. There are no certainties in the realm of politics.
2. Where there are no certainties, those with different perspectives must negotiate their differences.
3. The best policy likely to emerge from such negotiation is one of cautious moderation.
4. Therefore politics is the realm for negotiation between different perspectives, with cautious moderation likely to be the best policy.

The number of arguments in a passage is determined, most logicians agree, by the number of conclusions it contains. If a passage contains two or more arguments, and a number of propositions whose relations are not obvious, a diagram may prove particularly useful in sorting things out. A passage in a letter from Karl Marx to Friedrich Engels illustrates this nicely:

> ① To hasten the social revolution in England is the most important object of the International Workingman's Association. ② The sole means of hastening it is to make Ireland independent. Hence ③ the task of the "International" is everywhere to put the conflict between England and Ireland in the foreground, and ④ everywhere to side openly with Ireland.[8]

There are two conclusions in this passage and hence two arguments. But both conclusions are inferred from the same two premises. A diagram exhibits this structure:



Two conclusions (and hence two arguments) may have a single stated premise. For example,

> Older women have less freedom to fight sexual harassment at their jobs or to leave a battering husband, because age discrimination means they won't easily find other ways of supporting themselves.[9]

The single premise here is that older women cannot easily find alternative ways to support themselves. The two conclusions supported by that premise are (a) that older women have less freedom to fight sexual harassment at their jobs, and (b) that older married women have less freedom to leave a battering husband. A *single argument* ordinarily means an argument with a single conclusion, regardless of how many premises are adduced in its support.

When there are two or more premises in an argument, or two or more arguments in a passage, the order of appearance of premises and conclusions may need to be clarified. The conclusion may be stated last, or first; it may sometimes be sandwiched between the premises offered in its support, as in the following passage:

> The real and original source of inspiration for the Muslim thinkers was the Quran and the sayings of the Holy Prophet. It is therefore clear that the Muslim philosophy was not a carbon copy of Greek thought, as it concerned itself primarily and specifically with those problems which originated from and had relevance to Muslims.[10]

Here the conclusion, that "Muslim philosophy was not a carbon copy of Greek thought," appears after the first premise of the argument and before the second.

The same proposition that serves as a conclusion in one argument may serve as premise in a different argument, just as the same person may be a commander in one context and a subordinate in another. This is well illustrated by a passage from the work of Thomas Aquinas. He argues:

> Human law is framed for the multitude of human beings.
> The majority of human beings are not perfect in virtue.
> Therefore human laws do not forbid all vices.[11]

The conclusion of this argument is used immediately thereafter as a premise in another, quite different argument:

> Vicious acts are contrary to acts of virtue.
> But human law does not prohibit all vices. . . .
> Therefore neither does it prescribe all acts of virtue.[12]

No special techniques are needed to grasp these arguments of St. Thomas. However, when the cascade of arguments is compressed, a paraphrase is helpful in showing the flow of reasoning. Consider the following passage:

> Because ① the greatest mitochondrial variations occurred in African people, scientists concluded that ② they had the longest evolutionary history, indicating ③ a probable African origin for modern humans.[13]

We might diagram the passage thus:

A paraphrase of this passage, although perhaps more clumsy, exhibits more fully the cascade of the two arguments that are compressed in it:

1. The more mitochondrial variation in a people, the longer its evolutionary history.
2. The greatest mitochondrial variations occur in African people.

Therefore African people have had the longest evolutionary history.

1. African people have had the longest evolutionary history.
2. Modern humans probably originated where people have had the longest evolutionary history.

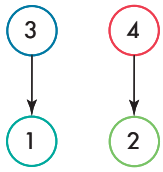
Therefore modern humans probably originated in Africa.

These examples make it evident that the same proposition can serve as a premise where it occurs as an assumption in an argument; or as a conclusion where it is claimed to follow from other propositions assumed in an argument. "Premise" and "conclusion" are always *relative* terms.

Multiple arguments may be interwoven in patterns more complicated than cascades, and these will require careful analysis. The diagramming technique then becomes particularly useful. In John Locke's *Second Treatise of Government*, for example, two arguments are combined in the following passage:

> It is not necessary—no, nor so much as convenient—that the legislative should be always in being; but absolutely necessary that the executive power should, because there is not always need of new laws to be made, but always need of execution of the laws that are made.

The component propositions here may be numbered thus: ① It is not necessary or convenient that the legislative [branch of government] should be always in being; ② it is absolutely necessary that the executive power should be always in being; ③ there is not always need of new laws to be made; ④ there is always need of execution of the laws that are made. The diagram for this passage is



which shows that the conclusion of the second argument is stated between the conclusion and the premise of the first argument, and that the premise of the first argument is stated between the conclusion and the premise of the second argument. The diagram also shows that both conclusions are stated before their premises.

That very same diagram shows the logical structure of two related arguments of the Roman philosopher Seneca, in support of the deterrence theory of punishment. He wrote:

> ① No one punishes because a sin has been committed, ② but in order that a sin will not be committed. [For] ③ what has passed cannot be recalled, but ④ what lies in the future may be prevented.

That "no one punishes because a sin has been committed" is the conclusion of one argument; its premise is that "what has passed cannot be recalled." That "[we do punish] in order that a sin will not be committed" is the conclusion of a second argument, whose premise is that "what lies in the future may be prevented."

Diagramming and paraphrasing are both very useful tools with which we can analyze arguments so as to understand more fully the relations of premises to conclusions.

EXERCISES

A. Diagram each of the following passages, which may contain more than one argument.

Example

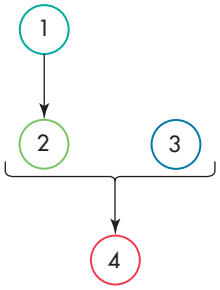
1. In a recent attack upon the evils of suburban sprawl, the authors argue as follows:

> The dominant characteristic of sprawl is that each component of a community—housing, shopping centers, office parks, and civic institutions—is segregated, physically separated from the others, causing the residents of suburbia to spend an inordinate amount of time and money moving from one place to the next. And since nearly everyone drives alone, even a sparsely populated area can generate the traffic of a much larger traditional town.[14]

Solution

① The dominant characteristic of sprawl is that each component of a community—housing, shopping centers, office parks, and civic institutions—is segregated, physically

separated from the others, causing ② the residents of suburbia to spend an inordinate amount of time and money moving from one place to the next. And since ③ nearly everyone drives alone, ④ even a sparsely populated area can generate the traffic of a much larger traditional town.



2. At any cost we must have filters on our Ypsilanti Township library computers. Pornography is a scourge on society at every level. Our public library must not be used to channel this filth to the people of the area.

—Rob. J. and Joan D. Pelkey, *The Ann Arbor* (MI) *News*, 3 February 2004

3. At his best, Lyndon Johnson was one of the greatest of all American presidents. He did more for racial justice than any president since Abraham Lincoln. He built more social protections than anyone since Franklin Roosevelt. He was probably the greatest legislative politician in American history. He was also one of the most ambitious idealists. Johnson sought power to use it to accomplish great things.

—Alan Brinkley, "The Making of a War President," *The New York Times Book Review*, 20 August 2006

4. Married people are healthier and more economically stable than single people, and children of married people do better on a variety of indicators. Marriage is thus a socially responsible act. There ought to be some way of spreading the principle of support for marriage throughout the tax code.

—Anya Bernstein, "Marriage, Fairness and Taxes," *The New York Times*, 15 February 2000

5. The distinguished economist J. K. Galbraith long fought to expose and improve a society exhibiting "private opulence and public squalor." In his classic work, *The Affluent Society* (Boston: Houghton Mifflin, 1960), he argued as follows:

> Vacuum cleaners to insure clean houses are praiseworthy and essential in our standard of living. Street cleaners to insure clean streets are an unfortunate expense. Partly as a result, our houses are generally clean and our streets generally filthy.

6. Defending the adoption of the euro in place of the pound as the monetary unit of the United Kingdom, Prime Minister Tony Blair said this: "The argument is simple. We are part of Europe. It affects us directly and deeply. Therefore we should exercise leadership in order to change Europe in the direction we want."

—Reported by Alan Cowell in the *The New York Times*, 9 December 2001

7. California's "three strikes and you're out" law was enacted 10 years ago this month (March, 2004). Between 1994 and 2002, California's prison population grew by 34,724, while that of New York, a state without a "three strikes" law, grew by 315. Yet during that time period New York's violent crime rate dropped 20 percent more than California's. No better example exists of how the drop in crime cannot be attributed to draconian laws with catchy names.

—Vincent Schiraldi, "Punitive Crime Laws,"
The New York Times, 19 March 2004

8. No one means all he says, and yet very few say all they mean, for words are slippery and thought is viscous.

—Henry Adams, *The Education of Henry Adams* (1907)

9. The first impression becomes a self-fulfilling prophesy: we hear what we expect to hear. The interview is hopelessly biased in favor of the nice.

—Malcom Gladwell, "The New-Boy Network,"
The New Yorker, 29 May 2000

10. No government can ever guarantee that the small investor has an equal chance of winning. It is beyond dishonest to pretend that rules can be written to prevent future financial scandals. No set of regulations can insure fairness and transparency in the [securities] markets.

—Lester Thurow, "Government Can't Make the Market Fair,"
The New York Times, 23 July 2002

B. There may be one argument or more than one argument in each of the following passages. Paraphrase the premises and conclusions (or use diagrams if that is helpful) to analyze the arguments found in each passage.

Example

1. An outstanding advantage of nuclear over fossil fuel energy is how easy it is to deal with the waste it produces. Burning fossil fuels produces 27,000 million tons of carbon dioxide yearly, enough to make, if solidified, a mountain nearly one mile high with a base twelve miles in circumference. The same quantity of energy produced from nuclear fission reactions would generate two million times less waste, and it would occupy a sixteen-meter cube. All of the high-level waste produced in a year from a nuclear power station would occupy a space about a cubic meter in size and would fit safely in a concrete pit.

—James Lovelock, *The Revenge of Gaia: Earth's Climate Crisis and the Fate of Humanity* (New York: Basic Books, 2006)

Solution

① An outstanding advantage of nuclear over fossil fuel energy is how easy it is to deal with the waste it produces. ② Burning fossil fuels produces 27,000 million tons of carbon dioxide yearly, enough to make, if solidified, a mountain nearly one mile high with a base twelve miles in circumference. ③ The same quantity of energy produced

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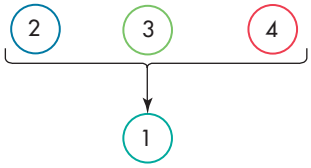

2. Why decry the wealth gap? First, inequality is correlated with political instability. Second, inequality is correlated with violent crime. Third, economic inequality is correlated with reduced life expectancy. A fourth reason? Simple justice. There is no moral justification for chief executives being paid hundreds of times more than ordinary employees.

—Richard Hutchinsons, "When the Rich Get Even Richer,"
The New York Times, 26 January 2000

3. Genes and proteins are discovered, not invented. Inventions are patentable, discoveries are not. Thus, protein patents are intrinsically flawed.

—Daniel Alroy, "Invention vs. Discovery,"
The New York Times, 29 March 2000

4. Ultimately, whaling's demise in Japan may have little to do with how majestic, smart, or endangered the mammals are, but a good deal to do with simple economics. A Japanese newspaper conducted a survey in Japan regarding the consumption of whale meat, and reported that of all the thousands of respondents, only 4 percent said that they actually ate whale meat at least sometimes. The newspaper then wrote this: "A growing number of Japanese don't want to eat whale meat. And if they won't eat it, they won't buy it. And if they won't buy it, say goodbye to Japanese whaling."

—Reported in *Asahi Shimbun*, April 2002

5. On the 18th of July, 2002, the *Consejo Juvenil Sionista Argentino* (Young Zionists of Argentina) held a mass demonstration to promote widespread remembrance of the horror of the bombing of the Jewish Community Center in Buenos Aires, exactly eight years earlier. At this demonstration the Young Zionists carried a huge banner, which read: "*Sin memoria, no hay justicia. Sin justicia, no hay futuro.*" ("Without remembrance, there is no justice. Without justice, there is no future.")

6. Back in 1884, Democratic nominee Grover Cleveland was confronted by the charge that he had fathered an out-of-wedlock child. While Republicans chanted, "Ma, Ma, where's my Pa," Cleveland conceded that he had been supporting the child. No excuses, no evasions. One of his supporters—one of the first spin doctors—gave this advice to voters:

> Since Grover Cleveland has a terrific public record, but a blemished private life, and since his opponent, James G. Blaine, has a storybook private life but a checkered public record, why not put both where they perform best—return Blaine to private life, keep Cleveland in public life.

7. "Wars don't solve problems; they create them," said an October 8 letter about Iraq.

World War II solved problems called Nazi Germany and militaristic Japan, and created alliances with the nations we crushed. The Revolutionary War solved the

problem of taxation without representation, and created the United States of America. The Persian Gulf War solved the problem of the Iraqi invasion of Kuwait. The Civil War solved the problem of slavery.

These wars created a better world. War is the only way to defeat evil enemies with whom there is no reasoning. It's either us or them. What creates true peace is victory.

—Keith Kraska, "Necessary Wars,"
The New York Times, 15 October 2002

8. In the Crito, Plato presents the position of the Athenian community, personified as "the Laws," speaking to Socrates or to any citizen of the community who may contemplate deliberate disobedience to the state:

> He who disobeys us is, as we maintain, thrice wrong; first, because in disobeying us he is disobeying his parents; secondly, because we are the authors of his education; thirdly, because he has made an agreement with us that he will duly obey our commands.

9. The reality is that money talks. Court officers, judges and juries treat private lawyers and their clients differently from those who cannot pay for representation. Just as better-dressed diners get prime tables at a restaurant, human nature dictates better results for those who appear to have money.

—Desiree Buenzle, "Free Counsel and Fairness,"
The New York Times, 15 January 2007

10. The town of Kennesaw, GA passed a *mandatory gun ownership* law, in 1982, in response to a *handgun ban* passed in Morton Grove, IL. Kennesaw's crime rate dropped sharply, while Morton Grove's did not. Criminals, unsurprisingly, would rather break into a house where they aren't at risk of being shot. . . . Criminals are likely to suspect that towns with laws like these on the books will be unsympathetic to malefactors in general, and to conclude that they will do better elsewhere. To the extent that's true, we're likely to see other communities adopting similar laws so that criminals won't see them as attractive alternatives.

—Glenn Reynolds, "A Rifle in Every Pot,"
The New York Times, 16 January 2007

Biography

William of Ockham

William of Ockham, sometimes spelled Occam, (c. 1288–c. 1348) was an influential Franciscan friar, born in the village in Surrey, England, after which he was named. Sent while young to a monastery, he went on to study theology and philosophy at Oxford, and then at the University of Paris, where he eventually taught.

The great intellectual theme of William's life was *simplification*. This was manifested most famously in what came to be known as "Ockham's Razor" —the drive for parsimony in the construction of theories. If any phenomenon can be explained without the assumption of this or that hypothetical entity, we ought not assume that entity; one should not multiply entities beyond necessity. In metaphysics this drive for simplification led him to the position known as *nominalism*: what exists in the universe are only individuals. The