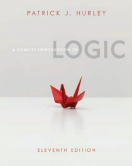


Sequenced. Precise.  

Elegant. Clear.



Hurley’s *A Concise Introduction to Logic*, 11th Edition

How to Make an Origami Crane 

Make your own origami crane using these instructions and the perforated



sheet of paper included in your book.

About the Cover

The iconic red crane on the

1. Start with a square piece of paper, colored side up. Fold in half and open. Then fold in half the other way.

2. Turn the paper over to the white side.

Fold the paper in half, crease well and open, and then fold again in the other direction.

3. Using the creases you have made, bring the top 3 corners of the model down to the bottom corner. Flatten model.

cover of this new edition of Hurley’s, *A Concise Introduction to Logic* symbolizes the qualities that make it the most successful logic text on the market. We have chosen origami to symbolize this text’s careful sequencing, precision, elegance, and clarity. Couple an icon steeped in tradition with a clean, modern design, and you will quickly get a sense of the qualities

4. Fold top triangular flaps into the

center and unfold.

5. Fold top of model downwards, crease well and unfold.

6. Open the uppermost flap of the model, bringing it upwards and pressing the sides of the model inwards at the same time. Flatten down, creasing well.

that make this new edition of Hurley the best yet. Along with instructions, each new text includes a sheet of red paper so that you can bring the cover to life. This exercise serves as a metaphor for the process of learning logic. It is

7. Turn model over and repeat Steps 4-6 on the other side.

8. Fold top flaps into the center.

9. Repeat on other side.

10. Fold both ‘legs’ of model up, crease very well, then

unfold.

11. Inside Reverse Fold the “legs”

along the creases you just made.

challenging, requires practice, but can be fun. Ideas for other ways to create your own origami can be found at www.origami-resource-center.com.

12. Inside Reverse Fold one side to make a head, then fold down the wings.

Finished Crane.

Source: www.origami-fun.com

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A CONCISE INTRODUCTION TO

Logic

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A CONCISE INTRODUCTION TO

Logic

ELEVENTH EDITION

PATRICK J. HURLEY

University of San Diego

Australia • Brazil • Japan • Korea • Mexico • Singapore • Spain • United Kingdom • United States

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To: All of the instructors, past and present,

who have taught logic from this book.

It is wrong always, everywhere, and for anyone,

to believe anything upon insuffi cient evidence.

–W. K. Cliff ord

Nothing can be more important than the art of

formal reasoning according to true logic.

–Gottfried Wilhelm Leibniz

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Preface

The most immediate benefit derived from the study of logic is the skill needed to construct sound arguments of one’s own and to evaluate the arguments of others. In accomplishing this goal, logic instills a sensitivity for the formal component in lan guage, a thorough command of which is indispensable to clear, eff ective, and mean ingful communication. On a broader scale, by focusing attention on the requirement for reasons or evidence to support our views, logic provides a fundamental defense against the prejudiced and uncivilized attitudes that threaten the foundations of our democratic society. Finally, through its attention to inconsistency as a fatal fl aw in any theory or point of view, logic proves a useful device in disclosing ill-conceived policies in the political sphere and, ultimately, in distinguishing the rational from the irrational, the sane from the insane. Th is book is written with the aim of securing these benefi ts. 

Every Book Has a Story

When I fi rst began teaching introductory logic many years ago, I selected a textbook that was widely used and highly regarded. Yet, my students often had a hard time understanding it. Th e book tended to be overly wordy and the main points were oft en lost amid a welter of detail. Also, I found that much of the book’s content was only peripherally related to the central concepts of logic. Using this book provided the happy and unanticipated result that my students always came to class so they could hear me explain the textbook. But aft er I tired of doing this, I decided to write a textbook of my own that would address the defi ciencies of the one I had been using. Specifi cally, my goal was to write a book in which the main points were always presented up front so students could not possibly miss them, the prose was clear and uncomplicated, and excess verbiage and peripheral subject matter was avoided. 

To accomplish these and other related goals, I incorporated the following pedagogi

cal devices:

• Relevant and up-to-date examples were used extensively throughout the book.

• Key terms were introduced in bold face type and defi ned in the glossary/index.

• Central concepts were illustrated in graphic boxes.

• Numerous exercises—today there are over 2,600—were included to perfect student skills.

• Many exercises were drawn from real-life sources such as textbooks, newspapers, and magazines.

• Typically every third exercise was answered in the back of the book so students could check their work.

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• Chapters were organized so that earlier sections provided the foundation for later ones. Later sections could be skipped by instructors opting to do so.

• Important rules and tables were printed on the inside covers for ready access.

In its fi rst edition, the book was so well received that plans were quickly begun for a second edition. With the completion of that and later editions, the book grew to incor porate many new features:

• Venn diagrams for syllogisms were presented in a novel and more eff ective way using color to identify the relevant areas.

• Dialogue exercises were included to depict the commission of fallacies in real life. • Predicate logic was extended to include relational predicates and identity.

• Th e Eminent Logicians feature was introduced to enhance the human element: it presented the lives of historically prominent logicians.

• “Truth Trees” and “Critical Th inking and Writing” were written as supplements.

*• Learning Logic,* a multimedia program that includes an additional 2,000 exercises and that practically teaches the course by itself, was included in the package.

• A series of videos dealing with topics that students fi nd diffi cult, including the con cept of validity, indirect truth tables, and natural deduction, were off ered with the last edition.

I am convinced that with each successive edition the book has become a more eff ective teaching tool. I am also convinced that the current, eleventh edition, is the best and most accurate one to date.

New To This Edition

• Five new biographical vignettes of prominent logicians are introduced. Th e new logicians include Ruth Barcan Marcus, Alice Ambrose, Ada Byron (Countess of Lovelace), Willard Van Orman Quine, and Saul Kripke.

• Six new dialogue exercises are introduced to help affi rm the relevance of formal logic to real-life. Th ey can be found in Sections 5.6, 6.4, 6.6, 7.3, 7.4, and 8.2.

• Th e end-of-chapter summaries now appear in bullet format to make them more useful for student review.

• Many new and improved exercises and examples appear throughout the book.

• In Section 1.4, the link between inductive reasoning and the principle of the unifor mity of nature is explained. Cogent inductive arguments are those that accord with this principle, while weak ones violate it. Such violations are always accompanied by an element of surprise.

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• Th e connection between the Boolean Standpoint and the Aristotelian standpoint is explained more completely.

• Th e existential fallacy as it occurs in immediate inferences is explained in greater detail. All infer ences that commit this fallacy have a universal premise and a particular conclusion. Th e meaning of “universal” and “particular” are extended to cover statements that are given as false.

• A new exercise set is introduced in Section 4.5 that involves testing immediate inferences for soundness.

• An improved defi nition of the “main operator” of a compound statement is given.

• A new subsection is introduced in Section 6.5 giving preliminary instruction on how to work backward from the truth values of the simple propositions to the truth values of the operators. A new exercise set provides practice with this technique.

• Section 7.1 has been rewritten, emphasizing the strategy of trying to “fi nd” the conclusion in the premises.

• Margin of error in Chapter 12 is now explained in terms of level of expectation. A more informa tive table illustrates this change.

A complete list of all improvements is given at the beginning of the Instructor’s Manual.

Note to the Student

Imagine that you are interviewing for a job. Th e person across the desk asks about your strengths, and you reply that you are energetic, enthusiastic, and willing to work long hours. Also, you are creative and innovative, and you have good leadership skills. Th en the interviewer asks about your weak nesses. You hadn’t anticipated this question, but aft er a moment’s thought you reply that your reason ing skills have never been very good.

The interviewer quickly responds that this weakness could create big problems.

“Why is that?” you ask.

“Because reasoning skills are essential to good judgment. And without good judgment your creativity will lead to projects that make no sense. Your leadership skills will direct our other employees in circles. Your enthusiasm will undermine everything we have accomplished up until now. And your working long hours will make things even worse.”

“But don’t you think there is some position in your company that is right for me?” you ask.

The interviewer thinks for a moment and then replies, “We have a competitor on the other side of town. I hear they are hiring right now. Why don’t you apply with them?”

Th e point of this little dialogue is that good reasoning skills are essential to doing anything right. Th e business person uses reasoning skills in writing a report or preparing a presentation; the scientist uses them in designing an experiment or clinical trial, the department manager uses them in maxi mizing worker effi ciency, the lawyer uses them in composing an argument to a judge or jury. And that’s where logic comes in. Th e chief purpose of logic is to develop good reasoning skills. In fact, logic is so important that when the liberal arts program of studies was formulated fi ft een hundred years

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ago, logic was selected as one of the original seven liberal arts. Logic remains to this day a central component of a college or university education.

From a more pragmatic angle, logic is important to earning a good score on any of the several tests required for admission to graduate professional schools—the LSAT, GMAT, MCAT, and so on. Obviously, the designers of these tests recognize that the ability to reason logically is a prerequisite to success in these fi elds. Th e appendix in the back of the book contains sample questions and cues on answering them. Also, logic is a useful tool in relieving what has come to be called math anxiety. For whatever reason, countless students today are terrifi ed of any form of reasoning that involves abstract symbols. If you happen to be one of these students, you should fi nd it relatively easy to master the use of logical symbols, and your newly found comfort with these symbols will carry over into the other, more diffi cult fi elds.

To improve your performance in logic, I strongly urge you to take full advantage of a multimedia program called *Learning Logic*. Th is is an interactive tutorial that teaches the essentials of this text book in a very user-friendly way. However, your computer must be equipped

with loudspeakers or headphones, because the audio component is essential.

*Learning Logic* is available both on CD and online at the Logic CourseMate site.

If the CD version or a passcode for the website did not come with your text

book, it can be purchased separately through your campus bookstore if your instructor has ordered it. You can also order it directly at www.cengagebrain.com. In addition to Learning Logic, an eBook and other quizzes and self-study material are available on the Logic CourseMate site.

Also available online through the Logic CourseMate site are brief video lectures on key topics. Th e videos include pointers on how to work the pertinent exercises in the textbook. Th ey cover topics such as the concept of validity, conversion, obversion, and contraposition, indirect truth tables, and natural deduction. If, as you work through the content of this book, you encounter a subject that you have trouble understanding, one of these videos may solve the problem.

Additionally, a set of audio summaries for each chapter in the book is available. Th ese are designed so that you can download them onto your iPod, mp3 player, or computer and listen to them before taking a test.

Because profi ciency in logic involves developing a skill, it helps to work through the practice prob lems in *Learning Logic* and the exercises in the textbook more than once. Th is will help you see that good reasoning (and bad reasoning, too) follows certain patterns whose identifi cation is crucial to success in logic. As you progress, I think you will fi nd that learning logic can be lots of fun, and work ing with the online resources should enhance your overall learning experience.

Note to the Instructor

With this eleventh edition, *Learning Logic* is available both on CD and online. Th e CD comes free if ordered with a new book, or it can be ordered separately at www.cengagebrain.com. Online, *Learning Logic* it is available through the Logic CourseMate site, a password protected website (www. cengage.com/sso). Th is website off ers the benefi t of being able to check a student’s “time on task,” that is, how much time the student has spent using a particular supplement. “Critical Th inking and Writing” and “Truthtrees” are available free on the website, and they can also be selected as modules in a custom version of the textbook. Th e videos, which cover topics students oft en have trouble with, are also available on Logic CourseMate.

Th is edition also features Aplia, one of the Cengage Learning CourseMaster digital solutions. Aplia established a name for itself in the fi eld of economics, where it off ers interactive online homework

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assignments with continuous feedback to students. Providing automatic grading, Aplia increases student effort and keeps students accountable for course material while adding no additional paperwork to the instructor’s workload, leaving instruc tors with more time to prepare lectures and work with students. As Aplia expands its off erings to include additional subjects, it has won widespread acclaim from thousands of instructors across numerous disciplines. Now, Aplia off ers its signature benefi ts to logic students and instructors with a program specifi cally designed to enhance student engagement. Th e Aplia assignments build on the exercises in this textbook, and they conform to the language, style, and structure of the book.

Let me now turn to alternate ways of approaching the textbook. In general, the mate rial in each chapter is arranged so that certain later sections can be skipped without aff ecting subsequent chapters. For example, those wishing a brief treatment of natural deduction in both propositional and predicate logic may want to skip the last three sec tions of Chapter 7 and the last four (or even fi ve) sections of Chapter 8. Chapter 2 can be skipped altogether, although some may want to cover the fi rst section of that chapter as an introduction to Chapter 3. Finally, Chapters 9 through 14 depend only slightly on earlier chapters, so these can be treated in any order one chooses. However, Chapter 14 does depend in part on Chapter 13.

**Type of Course**

**Recommended material**

**Optional**

**material**

**Traditional logic course**

Chapter 1

Chapter 3

Chapter 4

Chapter 5

Chapter 6

Sections 7.1–7.4

Chapter 2

Sections 7.5–7.7 Chapters 9–14

**Informal logic course, critical reasoning course**

Chapter 1

Chapter 2

Chapter 3

Chapter 4

Sections 5.1–5.3

Sections 5.5–5.6

Sections 6.1–6.4

Section 6.6

Chapter 9

Chapter 12

Chapter 13

Chapter 14

Writing Supplement

Section 5.4

Section 5.7

Section 6.5

Chapter 10

Chapter 11

**Course emphasizing modern formal**

**logic**

Chapter 1

Sections 4.1–4.3

Section 4.7

Sections 6.1–6.5

Chapter 7

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1 

Basic Concepts 



**1.1** Arguments, Premises, and Conclusions 

**1.2** Recognizing Arguments

**1.1**

**1.3** Deduction and Induction 

**1.4** Validity, Truth, Soundness, Strength, Cogency

**1.5** Argument Forms: Proving Invalidity 

**1.6** Extended Arguments

Arguments, Premises, and Conclusions 

**Logic** may be defi ned as the organized body of knowledge, or science, that evaluates arguments. All of us encounter arguments in our day-to-day experience. We read them in books and newspapers, hear them on television, and formulate them when commu nicating with friends and associates. Th e aim of logic is to develop a system of methods and principles that we may use as criteria for evaluating the arguments of others and as guides in constructing arguments of our own. Among the benefi ts to be expected from the study of logic is an increase in confi dence that we are making sense when we criticize the arguments of others and when we advance arguments of our own.

An **argument,** in its most basic form, is a group of statements, one or more of which (the premises) are claimed to provide support for, or reasons to believe, one of the oth ers (the conclusion). All arguments may be placed in one of two basic groups: those in which the premises really do support the conclusion and those in which they do not, even though they are claimed to. Th e former are said to be good arguments (at least to that extent), the latter bad arguments. Th e purpose of logic, as the science that evalu ates arguments, is thus to develop methods and techniques that allow us to distinguish good arguments from bad.

As is apparent from the given definition, the term *argument* has a very specific meaning in logic. It does not mean, for example, a mere verbal fi ght, as one might have with one’s parent, spouse, or friend. Let us examine the features of this defi nition in

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**1** greater detail. First of all, an argument is a group of statements. A **statement** is a sen tence that is either true or false—in other words, typically a declarative sentence or a sentence component that could stand as a declarative sentence. Th e following sentences are statements:

Chocolate truffl es are loaded with calories.

Melatonin helps relieve jet lag.

Political candidates always tell the complete truth.

No wives ever cheat on their husbands.

Tiger Woods plays golf and Maria Sharapova plays tennis.

The first two statements are true, the second two false. The last one expresses two statements, both of which are true. Truth and falsity are called the two possible **truth values** of a statement. Th us, the truth value of the fi rst two statements is true, the truth value of the second two is false, and the truth value of the last statement, as well as that of its components, is true.

Unlike statements, many sentences cannot be said to be either true or false. Questions,

proposals, suggestions, commands, and exclamations usually cannot, and so are not usually classifi ed as statements. Th e following sentences are not statements:

Where is Khartoum? (question)

Let’s go to a movie tonight. (proposal)

I suggest you get contact lenses. (suggestion)

Turn off the TV right now. (command)

Fantastic! (exclamation)

Th e statements that make up an argument are divided into one or more premises

and one and only one conclusion. Th e **premises** are the statements that set forth the reasons or evidence, and the **conclusion** is the statement that the evidence is claimed to support or imply. In other words, the conclusion is the statement that is claimed to follow from the premises. Here is an example of an argument:

All fi lm stars are celebrities.

Halle Berry is a fi lm star.

Therefore, Halle Berry is a celebrity.

Th e fi rst two statements are the premises; the third is the conclusion. (Th e claim that the premises support or imply the conclusion is indicated by the word “therefore.”) In this argument the premises really do support the conclusion, and so the argument is a good one. But consider this argument:

Some fi lm stars are men.

Cameron Diaz is a fi lm star.

Therefore, Cameron Diaz is a man.

In this argument the premises do not support the conclusion, even though they are claimed to, and so the argument is not a good one.

One of the most important tasks in the analysis of arguments is being able to distin

guish premises from conclusions. If what is thought to be a conclusion is really a prem ise, and vice versa, the subsequent analysis cannot possibly be correct. Many  arguments

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contain indicator words that provide clues in identifying premises and conclusion. **1** Some typical **conclusion indicators** are

therefore accordingly entails that

wherefore we may conclude hence

thus it must be that it follows that

consequently for this reason implies that

we may infer so as a result

Whenever a statement follows one of these indicators, it can usually be identifi ed as the conclusion. By process of elimination the other statements in the argument are the premises. Example:

Tortured prisoners will say anything just to relieve the pain. Consequently, torture is not a reliable method of interrogation.

Th e conclusion of this argument is “Torture is not a reliable method of interrogation,” and the premise is “Tortured prisoners will say anything just to relieve the pain.”

Premises Conclusion

Claimed

evidence

What is claimed to follow from the evidence

If an argument does not contain a conclusion indicator, it may contain a premise

indicator. Some typical **premise indicators** are

since in that seeing that

as indicated by may be inferred from for the reason that

because as in as much as

for given that owing to

Any statement following one of these indicators can usually be identifi ed as a premise. Example:

Expectant mothers should never use recreational drugs, since the use of these drugs

can jeopardize the development of the fetus.

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

In reviewing the list of indicators, note that “for this reason” is a conclusion

indicator, whereas “for the reason that” is a premise indicator. “For this reason” (except

**Section 1.1** Arguments, Premises, and Conclusions 3

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**1** when followed by a colon) means for the reason (premise) that was just given, so what  follows is the conclusion. On the other hand, “for the reason that” announces that a premise is about to be stated.

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

Consider the following argument:

It is vitally important that wilderness areas be preserved, for wilderness provides

essential habitat for wildlife, including endangered species, and it is a natural

retreat from the stress of daily life.

Th e premise indicator “for” goes with both “Wilderness provides essential habitat for wildlife, including endangered species,” and “It is a natural retreat from the stress of daily life.” Th ese are the premises. By method of elimination, “It is vitally important that wilderness areas be preserved” is the conclusion.

Some arguments contain no indicators. With these, the reader/listener must ask

such questions as: What single statement is claimed (implicitly) to follow from the others? What is the arguer trying to prove? What is the main point in the passage? Th e answers to these questions should point to the conclusion. Example:

The space program deserves increased expenditures in the years ahead. Not only

does the national defense depend on it, but the program will more than pay for

itself in terms of technological spinoff s. Furthermore, at current funding levels the

program cannot fulfi ll its anticipated potential.

Th e conclusion of this argument is the fi rst statement, and all of the other statements

are premises. Th e argument illustrates the pattern found in most arguments that lack indicator words: the intended conclusion is stated fi rst, and the remaining statements are then off ered in support of this fi rst statement. When the argument is restructured accord ing to logical principles, however, the conclusion is always listed *aft er* the premises:

P1: The national defense is dependent on the space program.

P2: The space program will more than pay for itself in terms of technological

spinoff s.

P3: At current funding levels the space program cannot fulfi ll its anticipated

potential.

C: The space program deserves increased expenditures in the years ahead.

When restructuring arguments such as this, one should remain as close as possible

to the original version, while at the same time attending to the requirement that prem ises and conclusion be complete sentences that are meaningful in the order in which they are listed.

Note that the fi rst two premises are included within the scope of a single sentence

in the original argument. For the purposes of this chapter, compound arrangements of statements in which the various components are all claimed to be true will be consid ered as separate statements.

Passages that contain arguments sometimes contain statements that are neither

premises nor conclusions. Only statements that are actually intended to support the conclusion should be included in the list of premises. If, for example, a statement

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serves merely to introduce the general topic, or merely makes a passing comment, it **1** should not be taken as part of the argument. Examples:

The claim is often made that malpractice lawsuits drive up the cost of health care. But

if such suits were outlawed or severely restricted, then patients would have no

means of recovery for injuries caused by negligent doctors. Hence, the availability

of malpractice litigation should be maintained intact.

Massive federal defi cits push up interest rates for everyone. Servicing the debt

gobbles up a huge portion of the federal budget, which lowers our standard of

living. And big defi cits also weaken the value of the dollar. For these reasons,

Congress must make a determined eff ort to cut overall spending and raise taxes.

Politicians who ignore this reality imperil the future of the nation.

In the fi rst argument, the opening statement serves merely to introduce the topic, so it

is not part of the argument. Th e premise is the second statement, and the conclusion is

the last statement. In the second argument, the fi nal statement merely makes a passing

comment, so it is not part of the argument. Th e premises are the fi rst three statements,

and the statement following “for these reasons” is the conclusion.

Closely related to the concepts of argument and statement are those of inference

and proposition. An **inference,** in the narrow sense of the term, is the reasoning pro

cess expressed by an argument. In the broad sense of the term, “inference” is used

interchangeably with “argument.” Analogously, a **proposition,** in the narrow sense,

is the meaning or information content of a statement. For the purposes of this book,

however, “proposition” and “statement” are used interchangeably.

Note on the History of Logic

Th e person who is generally credited as the father of logic is the ancient Greek phi

losopher Aristotle (384–322 b.c.). Aristotle’s predecessors had been interested in the

art of constructing persuasive arguments and in techniques for refuting the arguments

of others, but it was Aristotle who fi rst devised systematic criteria for analyzing and

evaluating arguments.

Aristotle’s chief accomplishment is called **syllogistic logic,** a kind of logic in which

the fundamental elements are *terms,* and arguments are evaluated as good or bad

depending on how the terms are arranged in the argument. Chapters 4 and 5 of this

textbook are devoted mainly to syllogistic logic. But Aristotle also deserves credit for

originating **modal logic,** a kind of logic that involves such concepts as possibility,

necessity, belief, and doubt. In addition, Aristotle catalogued several informal fallacies,

a topic treated in Chapter 3 of this book.

Aft er Aristotle’s death, another Greek philosopher, Chrysippus (280–206 b.c.), one of

the founders of the Stoic school, developed a logic in which the fundamental elements were

*whole propositions.* Chrysippus treated every proposition as either true or false and devel

oped rules for determining the truth or falsity of compound propositions from the truth or

falsity of their components. In the course of doing so, he laid the foundation for the truth

functional interpretation of the logical connectives presented in Chapter 6 of this book and

introduced the notion of natural deduction, treated in Chapter 7.

**Section 1.1** Arguments, Premises, and Conclusions 5

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**1** For thirteen hundred years aft er the death of Chrysippus, relatively little creative  work was done in logic. Th e physician Galen (a.d. 129–ca. 199) developed the theory of the compound categorical syllogism, but for the most part philosophers confi ned themselves to writing commentaries on the works of Aristotle and Chrysippus. Boethius (ca. 480–524) is a noteworthy example.

Th e fi rst major logician of the Middle Ages was Peter Abelard (1079–1142). Abelard

reconstructed and refi ned the logic of Aristotle and Chrysippus as communicated by Boethius, and he originated a theory of universals that traced the universal charac ter of general terms to concepts in the mind rather than to “natures” existing outside the mind, as Aristotle had held. In addition, Abelard distinguished arguments that are valid because of their form from those that are valid because of their content, but he held that only formal validity is the “perfect” or conclusive variety. Th e present text follows Abelard on this point.

Aft er Abelard, the study of logic during the Middle Ages fl ourished through the work

of numerous philosophers. A logical treatise by William of Sherwood (ca. 1200–1271) contains the fi rst expression of the “Barbara, Celarent . . .” poem quoted in Section 5.1 of this book, and the *Summulae Logicales* of Peter of Spain (ca. 1205–1277) became the standard textbook in logic for three hundred years. However, the most original contributions from this period were made by William of Ockham (ca. 1285–1347). Ockham extended the theory of modal logic, conducted an exhaustive study of the forms of valid and invalid syllogisms, and further developed the idea of a metalan guage, a higher-level language used to discuss linguistic entities such as words, terms, and propositions.

Toward the middle of the fifteenth century, a reaction set in against the logic of

the Middle Ages. Rhetoric largely displaced logic as the primary focus of attention; the logic of Chrysippus, which had already begun to lose its unique identity in the Middle Ages, was ignored altogether, and the logic of Aristotle was studied only in highly simplistic presentations. A reawakening did not occur until two hundred years later through the work of Gottfried Wilhelm Leibniz (1646–1716).

Leibniz, a genius in numerous fi elds, attempted to develop a symbolic language or

“calculus” that could be used to settle all forms of disputes, whether in theology, phi losophy, or international relations. As a result of this work, Leibniz is sometimes cred ited with being the father of symbolic logic. Leibniz’s eff orts to symbolize logic were carried into the nineteenth century by Bernard Bolzano (1781–1848).

In the middle of the nineteenth century, logic commenced an extremely rapid

period of development that has continued to this day. Work in symbolic logic was done by many philosophers and mathematicians, including Augustus De Morgan (1806–1871), George Boole (1815–1864), William Stanley Jevons (1835–1882), and John Venn (1834–1923). Th e rule bearing De Morgan’s name is used in Chapter 7 of this book. Boole’s interpretation of categorical propositions and Venn’s method for diagramming them are covered in Chapters 4 and 5. At the same time a revival in inductive logic was initiated by the British philosopher John Stuart Mill (1806–1873), whose methods of induction are presented in Chapter 10.

Across the Atlantic, the American philosopher Charles Sanders Peirce (1839–

1914) developed a logic of relations, invented symbolic quantifi ers, and suggested the

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truth-table method for formulas in propositional logic. Th ese topics are covered in **1** Chapters 6 and 8 of this book. Th e truth-table method was completed independently  by Emile Post (1897–1954) and Ludwig Wittgenstein (1889–1951).

Toward the end of the nineteenth century, the foundations of modern mathemati

cal logic were laid by Gottlob Frege (1848–1925). His *Begriffsschrift* sets forth the

theory of quantifi cation presented in Chapter 8 of this text. Frege’s work was contin

ued into the twentieth century by Alfred North Whitehead (1861–1947) and Bertrand

Russell (1872–1970), whose monumental *Principia Mathematica* attempted to reduce

the whole of pure mathematics to logic. Th e *Principia* is the source of much of the

symbolism that appears in Chapters 6, 7, and 8 of this text.

During the twentieth century, much of the work in logic has focused on the formaliza

tion of logical systems and on questions dealing with the completeness and consistency of

such systems. A now-famous theorem proved by Kurt Gödel (1906–1978) states that in any

formal system adequate for number theory there exists an undecidable formula—that is,

a formula such that neither it nor its negation is derivable from the axioms of the system.

Other developments include multivalued logics and the formalization of modal logic. Most

recently, logic has made a major contribution to technology by providing the conceptual

foundation for the electronic circuitry of digital computers.

Exercise 1.1

**I.** Each of the following passages contains a single argument. Using the letters “P”

and “C,” identify the premises and conclusion of each argument, writing premises

fi rst and conclusion last. List the premises in the order in which they make the

most sense (usually the order in which they occur), and write both premises and

conclusion in the form of separate declarative sentences. Indicator words may be

eliminated once premises and conclusion have been appropriately labeled. Th e

exercises marked with a star are answered in the back of the book.

★**1.** Titanium combines readily with oxygen, nitrogen, and hydrogen, all of which

have an adverse eff ect on its mechanical properties. As a result, titanium must

be processed in their absence.

(*Illustrated World of Science Encyclopedia*)

**2.** Since the good, according to Plato, is that which furthers a person’s real

interests, it follows that in any given case when the good is known, men will

seek it.

(Avrum Stroll and Richard *Popkin, Philosophy and the Human Spirit*)

**3.** As the denial or perversion of justice by the sentences of courts, as well as

in any other manner, is with reason classed among the just causes of war, it

will follow that the federal judiciary ought to have cognizance of all causes in

which the citizens of other countries are concerned.

(Alexander Hamilton, *Federalist Papers,* No. 80)

**Section 1.1** Arguments, Premises, and Conclusions 7

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**1** ★**4.** When individuals voluntarily abandon property, they forfeit any expectation of  privacy in it that they might have had. Th erefore, a warrantless search or seizure

of abandoned property is not unreasonable under the Fourth Amendment.

(Judge Stephanie Kulp Seymour, *United States v. Jones*)

**5.** Artists and poets look at the world and seek relationships and order. But they translate their ideas to canvas, or to marble, or into poetic images. Scientists

try to fi nd relationships between diff erent objects and events. To express the

order they fi nd, they create hypotheses and theories. Th us the great scientifi c

theories are easily compared to great art and great literature.

(Douglas C. Giancoli, *The Ideas of Physics,* 3rd ed.)

**6.** Th e fact that there was never a land bridge between Australia and mainland Asia is evidenced by the fact that the animal species in the two areas are very

diff erent. Asian placental mammals and Australian marsupial mammals have

not been in contact in the last several million years.

(T. Douglas Price and Gary M. Feinman, *Images of the Past*)

★**7.** It really does matter if you get enough sleep. We need sleep to think clearly,

react quickly, and create memories. Studies show that people who are taught

mentally challenging tasks do better aft er a good night’s sleep. Other research

suggests that sleep is needed for creative problem solving.

(*U.S. National Institutes of Health, “Your Guide to Healthy Sleep”*)

**8.** Th e classroom teacher is crucial to the development and academic success of the average student, and administrators simply are ancillary to this eff ort.

For this reason, classroom teachers ought to be paid at least the equivalent of

administrators at all levels, including the superintendent.

(Peter F. Falstrup, letter to the editor)

**9.** An agreement cannot bind unless both parties to the agreement know what they are doing and freely choose to do it. This implies that the seller who

intends to enter a contract with a customer has a duty to disclose exactly what

the customer is buying and what the terms of the sale are.

(Manuel G. Velasquez, “The Ethics of Consumer Production”)

★**10.** Punishment, when speedy and specifi c, may suppress undesirable behavior,

but it cannot teach or encourage desirable alternatives. Th erefore, it is crucial

to use positive techniques to model and reinforce appropriate behavior that the

person can use in place of the unacceptable response that has to be suppressed.

(Walter Mischel and Harriet Mischel, *Essentials of Psychology*)

**11.** Profi t serves a very crucial function in a free enterprise economy, such as our own. High profi ts are the signal that consumers want more of the output of

the industry. High profi ts provide the incentive for fi rms to expand output

and for more fi rms to enter the industry in the long run. For a fi rm of above

average effi ciency, profi ts represent the reward for greater effi ciency.

(Dominic Salvatore, *Managerial Economics,* 3rd ed.)

8 **Chapter 1** Basic Concepts

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**12.** Cats can think circles around dogs! My cat regularly used to close and lock the **1** door to my neighbor’s doghouse, trapping their sleeping Doberman inside.  Try telling a cat what to do, or putting a leash on him—he’ll glare at you and

say, “I don’t think so. You should have gotten a dog.”

(Kevin Purkiser, letter to the editor)

★**13.** Since private property helps people defi ne themselves, since it frees people

from mundane cares of daily subsistence, and since it is fi nite, no individual

should accumulate so much property that others are prevented from accumu

lating the necessities of life.

(Leon P. Baradat, *Political Ideologies, Their Origins and Impact*)

**14.** To every existing thing God wills some good. Hence, since to love any thing

is nothing else than to will good to that thing, it is manifest that God loves

everything that exists.

(Thomas Aquinas, *Summa Theologica*)

**15.** Women of the working class, especially wage workers, should not have

more than two children at most. Th e average working man can support no

more and the average working woman can take care of no more in decent

fashion.

(Margaret Sanger, *Family Limitations*)

★**16.** Radioactive fallout isn’t the only concern in the aft ermath of nuclear explo

sions. Th e nations of planet Earth have acquired nuclear weapons with an

explosive power equal to more than a million Hiroshima bombs. Studies

suggest that explosion of only half these weapons would produce enough

soot, smoke, and dust to blanket the Earth, block out the sun, and bring on a

nuclear winter that would threaten the survival of the human race.

(John W. Hill and Doris K. Kolb, *Chemistry for Changing Times,* 7th ed.)

**17.** An ant releases a chemical when it dies, and its fellows then carry it away

to the compost heap. Apparently the communication is highly effective; a

healthy ant painted with the death chemical will be dragged to the funeral

heap again and again.

(Carol R. Ember and Melvin Ember, *Cultural Anthropology,* 7th ed.)

**18.** Every art and every inquiry, and similarly every action and pursuit, is thought

to aim at some good; and for this reason the good has rightly been declared to

be that at which all things aim.

(Aristotle, *Nicomachean Ethics*)

★**19.** Poverty off ers numerous benefi ts to the nonpoor. Antipoverty programs pro

vide jobs for middle-class professionals in social work, penology, and public

health. Such workers’ future advancement is tied to the continued growth of

bureaucracies dependent on the existence of poverty.

(J. John Palen, *Social Problems*)

**Section 1.1** Arguments, Premises, and Conclusions 9

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**1 20.** Corn is an annual crop. Butcher’s meat, a crop which requires four or fi ve years to grow. As an acre of land, therefore, will produce a much smaller

quantity of the one species of food than the other, the inferiority of the quan

tity must be compensated by the superiority of the price.

(Adam Smith, *The Wealth of Nations*)

**21.** Neither a borrower nor lender be

For loan oft loses both itself and friend,

And borrowing dulls the edge of husbandry.

(William Shakespeare, *Hamlet* I, 3)

★**22.** Th e stakes in whistleblowing are high. Take the nurse who alleges that phy

sicians enrich themselves in her hospital through unnecessary surgery; the

engineer who discloses safety defects in the braking systems of a fl eet of new

rapid-transit vehicles; the Defense Department offi cial who alerts Congress

to military graft and overspending: all know that they pose a threat to those

whom they denounce and that their own careers may be at risk.

(Sissela Bok, “Whistleblowing and Professional Responsibility”)

**23.** If a piece of information is not “job relevant,” then the employer is not enti tled qua employer to know it. Consequently, since sexual practices, political

beliefs, associational activities, etc., are not part of the description of most

jobs, that is, since they do not directly aff ect one’s job performance, they are

not legitimate information for an employer to know in the determination of

the hiring of a job applicant.

(George G. Brenkert,“ Privacy, Polygraphs, and Work”)

**24.** Many people believe that a dark tan is attractive and a sign of good health, but mounting evidence indicates that too much sun can lead to health problems.

One of the most noticeable eff ects is premature aging of the skin. Th e sun also

contributes to certain types of cataracts, and, what is most worrisome, it plays

a role in skin cancer.

(Joseph M. Moran and Michael D. Morgan, *Meteorology,* 4th ed.)

★**25.** Contrary to the tales of some scuba divers, the toothy, gaping grin on the

mouth of an approaching shark is not necessarily anticipatory. It is gener

ally accepted that by constantly swimming with its mouth open, the shark is

simply avoiding suff ocation. Th is assures a continuous fl ow of oxygen-laden

water into their mouths, over their gills, and out through the gill slits.

(Robert A. Wallace et al., *Biology: The Science of Life*)

**26.** Not only is the sky blue [as a result of scattering], but light coming from it is also partially polarized. You can readily observe this by placing a piece of

Polaroid (for example, one lens of a pair of Polaroid sunglasses) in front of

your eye and rotating it as you look at the sky on a clear day. You will notice a

change in light intensity with the orientation of the Polaroid.

(Frank J. Blatt, *Principles of Physics,* 2nd ed.)

10 **Chapter 1** Basic Concepts

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**27.** Since the secondary light [from the moon] does not inherently belong to the **1** moon and is not received from any star or from the sun, and since in the  whole universe there is no other body left but the earth, what must we con

clude? What is to be proposed? Surely we must assert that the lunar body (or

any other dark and sunless orb) is illuminated by the earth.

(Galileo Galilei, *The Starry Messenger*)

★**28.** Anyone familiar with our prison system knows that there are some inmates

who behave little better than brute beasts. But the very fact that these prison

ers exist is a telling argument against the effi cacy of capital punishment as a

deterrent. If the death penalty had been truly eff ective as a deterrent, such

prisoners would long ago have vanished.

(“The Injustice of the Death Penalty,” *America*)

**29.** Th ough it is possible that REM sleep and dreaming are not necessary in the

adult, REM deprivation studies seem to suggest otherwise. Why would REM

pressure increase with deprivation if the system is unimportant in the adult?

(Herbert L. Petri, *Motivation: Theory and Research,* 2nd ed.)

**30.** We say that an end pursued in its own right is more complete than an end

pursued because of something else, and that an end that is never choicewor

thy because of something else is more complete than ends that are choice

worthy both in their own right and because of this end. Hence, an end that is

always choiceworthy in its own right, and never because of something else, is

complete without qualifi cation.

(Aristotle, *Nicomachean Ethics*)

**II.** Th e following arguments were taken from magazine and newspaper editorials and

letters to the editor. In most instances the main conclusion must be rephrased to

capture the full intent of the author. Write out what you interpret the main con

clusion to be.

★**1.** University administrators know well the benefi ts that follow notable success

in college sports: increased applications for admissions, increased income

from licensed logo merchandise, more lucrative television deals, post-season

game revenue and more successful alumni fund drives. Th e idea that there is

something ideal and pure about the amateur athlete is self-serving bunk.

(Michael McDonnell, letter to the editor)

**2.** In a nation of immigrants, people of diverse ethnic backgrounds must have

a common bond through which to exchange ideas. How can this bond be

accomplished if there is no common language? It is those who shelter the

immigrant from learning English by encouraging the development of a mul

tilingual society who are creating a xenophobic atmosphere. Th ey allow the

immigrant to surround himself with a cocoon of language from which he can

not escape and which others cannot penetrate.

(Rita Toften, letter to the editor)

**Section 1.1** Arguments, Premises, and Conclusions 11

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**1 3.** Th e health and fi tness of our children has become a problem partly because of our attitude toward athletics. Th e purpose of sports, especially for children,

should be to make healthy people healthier. Th e concept of team sports has

failed to do this. Rather than learning to interact and cooperate with oth

ers, youngsters are taught to compete. Team sports have only reinforced

the notion that the team on top is the winner, and all others are losers. Th is

approach does not make sports appealing to many children, and some, espe

cially among the less fi t, burn out by the time they are twelve.

(Mark I. Pitman, “Young Jocks”)

★**4.** College is the time in which a young mind is supposed to mature and acquire

wisdom, and one can only do this by experiencing as much diverse intellec

tual stimuli as possible. A business student may be a whiz at accounting, but

has he or she ever experienced the beauty of a Shakespearean sonnet or the

boundless events composing Hebrew history? Most likely not. While many of

these neoconservatives will probably go on to be fi nancially successful, they

are robbing themselves of the true purpose of collegiate academics, a sacrifi ce

that outweighs the future salary checks.

(Robert S. Griffi th, *“Conservative College Press”*)

**5.** History has shown repeatedly that you cannot legislate morality, nor does anyone have a right to. Th e real problem is the people who have a vested interest in sus

taining the multibillion-dollar drug industry created by the laws against drugs.

Th e legalization of drugs would remove the thrill of breaking the law; it would

end the suff ering caused by unmetered doses, impurities, and substandard para

phernalia. A huge segment of the underground and extralegal economy would

move into a legitimate economy, taking money away from criminals, eliminating

crime and violence, and restoring many talented people to useful endeavor.

(Thomas L. Wayburn, letter to the editor)

**6.** Infectious disease is no longer the leading cause of death in this country, thanks to antibiotics, but there are new strains of bacteria that are resistant

to—and others that grow only in the presence of—antibiotics. Yet Congress

wants to cut the National Institutes of Health budget. Further cuts would

leave us woefully unprepared to cope with the new microbes Mother Nature

has cooking in her kitchen.

(Valina L. Dawson, letter to the editor)

★**7.** At a time when our religious impulses might help heal the pains and strains in

our society, today’s television pulpiteers preach intolerance, censure, and dis

crimination. Th ey package a “believer life-style,” and rail against everyone who

doesn’t fi t it—homosexuals, communists, Jews and other non-Christians, sex

educators, and so on. Such intolerance threatens to undermine the pluralism

that marks our heritage. Th e packaging of that intolerance in slick Hollywood

programming or under the guise of patriotic fervor is skillfully accomplished

on many fronts. Th at, however, does not make it right.

(Peter G. Kreitler, “TV Preachers’ Religious Intolerance”)

12 **Chapter 1** Basic Concepts

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**8.** Ideally, decisions about health care should be based on the doctor’s clinical **1** judgment, patient preference, and scientifi c evidence. Patients should always  be presented with options in their care. Elective cesarean section, however, is

not used to treat a problem but to avoid a natural process. An elective surgery

like this puts the patient at unnecessary risk, increases the risk for complica

tions in future deliveries, and increases health care costs.

(Anne Foster-Rosales, M.D., letter to the editor)

**9.** Parents who feel guilty for the little time they can (or choose to) spend with

their children “pick up” aft er them—so the children don’t learn to face the

consequences of their own choices and actions. Parents who allow their chil

dren to fail are showing them greater love and respect.

(Susan J. Peters, letter to the editor)

★**10.** Most of the environmental problems facing us stem, at least in part, from the

sheer number of Americans. Th e average American produces three quarters

of a ton of garbage every year, consumes hundreds of gallons of gasoline, and

uses large amounts of electricity (oft en from a nuclear power plant, coal burn

ing, or a dam). Th e least painful way to protect the environment is to limit

population growth.

(Craig M. Bradley, letter to the editor)

**III.** Defi ne the following terms:

logic conclusion inference

argument conclusion indicator proposition

statement premise indicator truth value

premise

**IV.** Answer “true” or “false” to the following statements:

**1.** Th e purpose of the premise or premises is to set forth the reasons or evidence

given in support of the conclusion.

**2.** Some arguments have more than one conclusion.

**3.** All arguments must have more than one premise.

**4.** Th e words “therefore,” “hence,” “so,” “since,” and “thus” are all conclusion

indicators.

**5.** The words “for,” “because,” “as,” and “for the reason that” are all premise

indicators.

**6.** In the strict sense of the terms, *inference* and *argument* have exactly the same

meaning.

**7.** In most (but not all) arguments that lack indicator words, the conclusion is

the fi rst statement.

**8.** Any sentence that is either true or false is a statement.

**9.** Every statement has a truth value.

**10.** Th e person usually credited with being the father of logic is Aristotle.

**Section 1.1** Arguments, Premises, and Conclusions 13

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**1** Recognizing Arguments

**1.2**

Not all passages contain arguments. Because logic deals with arguments, it is impor tant to be able to distinguish passages that contain arguments from those that do not. In general, a passage contains an argument if it purports to prove something; if it does not do so, it does not contain an argument. Two conditions must be fulfi lled for a pas sage to purport to prove something:

**1.** At least one of the statements must claim to present evidence or reasons.

**2.** Th ere must be a claim that the alleged evidence supports or implies something—

that is, a claim that something follows from the alleged evidence or reasons.

As we have seen, the statements that claim to present the evidence or reasons are

the premises, and the statement that the evidence is claimed to support or imply is the conclusion. It is not necessary that the premises present actual evidence or true reasons nor that the premises actually support the conclusion. But at least the premises must *claim* to present evidence or reasons, and there must be a *claim* that the evidence or reasons support or imply something.

Th e fi rst condition expresses a **factual claim,** and deciding whether it is fulfi lled

oft en falls outside the domain of logic. Th us, most of our attention will be concen trated on whether the second condition is fulfi lled. Th is second condition expresses what is called an **inferential claim.** Th e inferential claim is simply the claim that the passage expresses a certain kind of reasoning process—that something supports or implies something or that something follows from something. Also, you should rec ognize that this claim is not equatable with the intentions of the arguer. Intentions are subjective and, as such, are usually not accessible to the evaluator. Rather, the inferen tial claim is an objective feature of an argument grounded in its language or structure. An inferential claim can be either explicit or implicit. An *explicit* inferential claim is

usually asserted by premise or conclusion indicator words (“thus,” “since,” “because,” “hence,” “therefore,” and so on). Example:

Mad cow disease is spread by feeding parts of infected animals to cows, and this

practice has yet to be completely eradicated. Thus, mad cow disease continues to

pose a threat to people who eat beef.

Th e word “thus” expresses the claim that something is being inferred, so the passage is an argument.

An *implicit* inferential claim exists if there is an inferential relationship between the

statements in a passage, but the passage contains no indicator words. Example:

The genetic modifi cation of food is risky business. Genetic engineering can introduce

unintended changes into the DNA of the food-producing organism, and these

changes can be toxic to the consumer.

Th e inferential relationship between the fi rst statement and the other two constitutes an implicit claim that evidence supports something, so we are justifi ed in calling the passage an argument. Th e fi rst statement is the conclusion, and the other two are the premises.

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**1** 

****

Eminent Logicians

Aristotle 384–322 B.C.

**A**ristotle was born in Stagira, a small  

Greek town situated on the northern

coast of the Aegean sea. His father was

a physician in the court of King Amyntas II of

Macedonia, and the young Aristotle was a friend

of the King’s son Philip, who was later to become 

king himself and the father of Alexander the 

Great. When he was about seventeen, Aristotle

was sent to Athens to further his education in

Plato’s Academy, the finest institution of higher

learning in the Greek world. After Plato’s death

Aristotle left for Assos, a small town on the coast 

of Asia Minor, where he married the niece of the local ruler. 

Six years later Aristotle accepted an invitation 

to return to Macedonia to serve as tutor of the

young Alexander. When Alexander ascended

the throne following his father’s assassina

tion, Aristotle’s tutorial job was finished, and he

departed for Athens where he set up a school

near the temple of Apollo Lyceus. The school 

came to be known as the Lyceum, and Alexander

supported it with contributions of money and 



specimens of flora and fauna derived from his

far-flung conquests. After Alexander’s death, an

anti-Macedonian rebellion forced Aristotle to

leave Athens for Chalcis, about thirty miles to the

north, where he died one year later at the age of

sixty-two.

Aristotle is universally recognized as the origi

nator of logic. He defined *logic* as the study of

the process by which a statement follows by

necessity from one or more other statements.

The most fundamental kind of statement, he

thought, is the categorical proposition, and he 

classified the four kinds of categorical proposi

tions in terms of their being universal, particular,

affirmative, and negative. He also developed the 

square of opposition, which shows how one such

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His crowning achievement is the theory of the categorical syllogism, a kind of argument consist ing of three categorical propositions. He showed 

how categorical syllogisms can be catalogued in terms of mood and figure, and he developed a set of rules for determining the validity of cat egorical syllogisms. Also, he showed how the  modal concepts of possibility and necessity apply to categorical propositions. In addition to the theory of the syllogism, Aristotle advanced the theory of definition by genus and difference, and he showed how arguments could be defec 

tive in terms of thirteen forms of informal fallacy. Aristotle made profound contributions to  many areas of human learning including biology, physics, metaphysics, epistemology, psychol ogy, aesthetics, ethics, and politics. However, his accomplishments in logic were so extensive and enduring that two thousand years after his death, the great philosopher Immanuel Kant said that Aristotle had discovered everything that could be known about logic. His logic was not superseded until the end of the nineteenth century when Frege, Whitehead, and Russell developed modern mathematical logic. 

**Section 1.2** Recognizing Arguments 15 

**Section 1.2** Recognizing Arguments 15

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**1** In deciding whether there is a claim that evidence supports or implies some thing, keep an eye out for (1) indicator words and (2) the presence of an inferential relationship between the statements. In connection with these points, however, a word of caution is in order. First, the mere occurrence of an indicator word by no means guarantees the presence of an argument. For example, consider the following passages:

Since Edison invented the phonograph, there have been many technological

developments.

Since Edison invented the phonograph, he deserves credit for a major technological

development.

In the fi rst passage the word “since” is used in a *temporal* sense. It means “from the time that.” Th us, the fi rst passage is not an argument. In the second passage “since” is used in a *logical* sense, and so the passage *is* an argument.

Th e second cautionary point is that it is not always easy to detect the occurrence of

an inferential relationship between the statements in a passage, and one may have to review a passage several times before making a decision. In reaching such a decision, one may fi nd it helpful to mentally insert the word “therefore” before the various state ments to see whether it makes sense to interpret one of them as following from the others. Even with this mental aid, however, the decision whether a passage contains an inferential relationship (as well as the decision about indicator words) oft en involves a heavy dose of interpretation. As a result, not everyone will agree about every passage. Sometimes the only answer possible is a conditional one: “*If* this passage contains an argument, then these are the premises and that is the conclusion.”

To assist in distinguishing passages that contain arguments from those that do not,

let us now investigate some typical kinds of nonarguments. Th ese include simple non inferential passages, expository passages, illustrations, explanations, and conditional statements.

Simple Noninferential Passages

Simple noninferential passages are unproblematic passages that lack a claim that any thing is being proved. Such passages contain statements that could be premises or con clusions (or both), but what is missing is a claim that any potential premise supports a conclusion or that any potential conclusion is supported by premises. Passages of this sort include warnings, pieces of advice, statements of belief or opinion, loosely associ ated statements, and reports.

A **warning** is a form of expression that is intended to put someone on guard against

a dangerous or detrimental situation. Examples:

Watch out that you don’t slip on the ice.

Whatever you do, never confi de personal secrets to Blabbermouth Bob.

If no evidence is given to prove that such statements are true, then there is no argument.

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A **piece of advice** is a form of expression that makes a recommendation about some **1** future decision or course of conduct. Examples:

You should keep a few things in mind before buying a used car. Test drive the car at

varying speeds and conditions, examine the oil in the crankcase, ask to see service

records, and, if possible, have the engine and power train checked by a mechanic.

Before accepting a job after class hours, I would suggest that you give careful con

sideration to your course load. Will you have suffi cient time to prepare for classes

and tests, and will the job produce an excessive drain on your energies?

As with warnings, if there is no evidence that is intended to prove anything, then there

is no argument.

A **statement of belief** or **opinion** is an expression about what someone happens to

believe or think about something. Examples:

We believe that our company must develop and produce outstanding products that

will perform a great service or fulfi ll a need for our customers. We believe that our

business must be run at an adequate profi t and that the services and products we

off er must be better than those off ered by competitors.

(Robert D. Hay and Edmund R. Gray, “Introduction to Social Responsibility”)

When I can read the latte menu through the hole in my server’s earlobe, something

is seriously out of whack. What happened to an earring, maybe two, in each lobe?

Now any surface is game. Brow, lip, tongue, cheek, nose. I’ve adjusted to untied

shoelaces and pants that make mooning irrelevant. But when it comes to pierc

ings, I just can’t budge.

(Debra Darvick, “Service with a Smile, and Plenty of Metal”)

Because neither of these authors makes any claim that his or her belief or opinion is

supported by evidence, or that it supports some conclusion, there is no argument.

**Loosely associated statements** may be about the same general subject, but they

lack a claim that one of them is proved by the others. Example:

Not to honor men of worth will keep the people from contention; not to value goods

that are hard to come by will keep them from theft; not to display what is desir

able will keep them from being unsettled of mind.

(Lao-Tzu, *Thoughts from the Tao Te Ching*)

Because there is no claim that any of these statements provides evidence or reasons for

believing another, there is no argument.

A **report** consists of a group of statements that convey information about some

topic or event. Example:

The period of 1648–1789 was one of competition among the primary monarchs of

Europe. Wars among the great powers were frequent but limited. France made

major eff orts to become paramount, but the balance of power operated to block

French expansion.

(Steven L. Spiegel, *World Politics in a New Era*)

**Section 1.2** Recognizing Arguments 17

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**1** These statements could serve as the premises of an argument, but because the  author makes no claim that they support or imply anything, there is no argument. Another type of report is the news report:

Witnesses said they heard a loud crack before a balcony gave way at a popular night

spot, dropping dozens of screaming people fourteen feet. At least eighty people

were injured at the Diamond Horseshoe casino when they fell onto broken glass

and splintered wood. Investigators are waiting for an engineer’s report on the

deck’s occupancy load.

(Newspaper clipping)

Again, because the reporter makes no claim that these statements imply anything, there is no argument.

One must be careful, though, with reports *about* arguments:

“The Air Force faces a serious shortage of experienced pilots in the years ahead,

because repeated overseas tours and the allure of high paying jobs with commer

cial airlines are winning out over lucrative bonuses to stay in the service,” says a

prominent Air Force offi cial.

(Newspaper clipping)

Properly speaking, this passage is not an argument, because the author of the pas sage does not claim that anything is supported by evidence. Rather, the author reports the claim by the Air Force offi cial that something is supported by evidence. If such passages are interpreted as “containing” arguments, it must be made clear that the argument is not the author’s but one made by someone about whom the author is reporting.

Expository Passages

An **expository passage** is a kind of discourse that begins with a topic sentence fol lowed by one or more sentences that develop the topic sentence. If the objective is not to prove the topic sentence but only to expand it or elaborate it, then there is no argu ment. Examples:

There are three familiar states of matter: solid, liquid, and gas. Solid objects ordinarily

maintain their shape and volume regardless of their location. A liquid occupies a

defi nite volume, but assumes the shape of the occupied portion of its container.

A gas maintains neither shape nor volume. It expands to fi ll completely whatever

container it is in.

(John W. Hill and Doris K. Kolb, *Chemistry for Changing Times,* 7th ed.)

There is a stylized relation of artist to mass audience in the sports, especially in

baseball. Each player develops a style of his own—the swagger as he steps to

the plate, the unique windup a pitcher has, the clean-swinging and hard-driving

hits, the precision quickness and grace of infi eld and outfi eld, the sense of surplus

power behind whatever is done.

(Max Lerner, *America as a Civilization*)

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In each passage the topic sentence is stated fi rst, and the remaining sentences merely **1** develop and fl esh out this topic sentence. Th ese passages are not arguments, because  they lack an inferential claim. However, expository passages diff er from simple non

inferential passages (such as warnings and pieces of advice) in that many of them can

also be taken as arguments. If the purpose of the subsequent sentences in the passage

is not only to fl esh out the topic sentence but also to prove it, then the passage is an

argument. Example:

Skin and the mucous membrane lining the respiratory and digestive tracts serve as

mechanical barriers to entry by microbes. Oil gland secretions contain chemicals

that weaken or kill bacteria on skin. The respiratory tract is lined by cells that

sweep mucus and trapped particles up into the throat, where they can be swal

lowed. The stomach has an acidic pH, which inhibits the growth of many types of

bacteria.

(Sylvia S. Mader, *Human Biology,* 4th ed.)

In this passage the topic sentence is stated fi rst, and the purpose of the remaining

sentences is not only to *show how* the skin and mucous membranes serve as barriers to

microbes but also to *prove* that they do this. Th us, the passage can be taken as both an

expository passage and an argument.

In deciding whether an expository passage should be interpreted as an argument,

try to determine whether the purpose of the subsequent sentences in the passage

is merely to develop the topic sentence or also to prove that it is true. In borderline

cases, ask yourself whether the topic sentence makes a claim that everyone accepts

or agrees with. If it does, the passage is probably not an argument. In real-life situ

ations authors rarely try to prove something is true when everyone already accepts

it. However, if the topic sentence makes a claim that many people do not accept or

have never thought about, then the purpose of the remaining sentences may be both

to prove the topic sentence is true as well as to develop it. If this be so, the passage is

an argument.

Finally, if even this procedure yields no defi nite answer, the only alternative may be

to say that *if* the passage is taken as an argument, then the fi rst statement is the conclu

sion and the others are the premises.

Illustrations

An **illustration** is an expression involving one or more examples that is intended

to show what something means or how it is done. Illustrations are often confused

with arguments because many illustrations contain indicator words such as “thus.”

Examples:

Chemical elements, as well as compounds, can be represented by molecular formu

las. Thus, oxygen is represented by “O2,” water by “H2O,” and sodium chloride by

“NaCl.”

A deciduous tree is any tree that loses its leaves during the winter. For example,

maples are deciduous. And so are elms, poplars, hawthorns, and alders.

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**1** Th ese selections are not arguments, because they make no claim that anything is being  proved. In the first selection, the word “thus” indicates how something is done— namely, how chemical elements and compounds can be represented by formulas. In the second, the examples cited are intended to illustrate the meaning of the word “deciduous.” It pins down the meaning by providing concrete instances.

However, as with expository passages, many illustrations can be taken as argu

ments. Such arguments are oft en called **arguments from example.** Here is an instance of one:

Although most forms of cancer, if untreated, can cause death, not all cancers are

life-threatening. For example, basal cell carcinoma, the most common of all skin

cancers, can produce disfi gurement, but it almost never results in death.

In this passage the example given is intended to prove the truth of “Not all cancers are life-threatening.” Th us, the passage is best interpreted as an argument.

In deciding whether an illustration should be interpreted as an argument, deter

mine whether the passage merely shows how something is done or what something means, or whether it also purports to prove something. In borderline cases it helps to note whether the claim being illustrated is one that practically everyone accepts or agrees with. If it is, the passage is probably not an argument. As already noted, in real

life situations authors rarely attempt to prove what everyone already accepts. But if the claim being illustrated is one that many people do not accept or have never thought about, then the passage may be interpreted as an argument.

Th us, in reference to the fi rst two examples we considered, most people are aware

that elements and compounds can be expressed by formulas—practically everyone knows that water is H2O—and most people have at least a vague idea of what a decidu ous tree is. But they may not have ever considered whether some forms of cancer are not life-threatening. Th is is one of the reasons for evaluating the fi rst two examples as mere illustrations and the last one as an argument.

Explanations

One of the most important kinds of nonargument is the explanation. An **explanation** is an expression that purports to shed light on some event or phenomenon. Th e event or phenomenon in question is usually accepted as a matter of fact. Examples:

The sky appears blue from the earth’s surface because light rays from the sun are

scattered by particles in the atmosphere.

Golf balls have a dimpled surface because the dimples reduce air drag, causing the

ball to travel farther.

Naval oranges are called by that name because they have a growth that resembles a

human naval on the end opposite the stem.

Every explanation is composed of two distinct components: the explanandum and

explanans. Th e **explanandum** is the statement that describes the event or phenom enon to be explained, and the **explanans** is the statement or group of statements that

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purports to do the explaining. In the fi rst example, the explanandum is the statement **1** “Th e sky appears blue from the earth’s surface” and the explanans is “Light rays from  the sun are scattered by particles in the atmosphere.”

**Argument** Premises

Accepted facts

Claimed to prove

**Explanation** Explanans

Claimed to shed light on

Conclusion

Explanandum Accepted fact

Explanations are sometimes mistaken for arguments because they oft en contain

the indicator word “because.” Yet explanations are not arguments, because in an explanation the purpose of the explanans is to shed light on, or to make sense of, the explanandum event—not to prove that it occurred. In other words, the purpose of the explanans is to show *why* something is the case, whereas in an argument, the purpose of the premises is to prove *that* something is the case.

In the fi rst example given, the fact that the sky is blue is readily apparent to everyone.

Th e statement that light rays from the sun are scattered by particles in the atmosphere is not intended to prove *that* the sky is blue, but rather to show *why* it is blue. In the second example, practically everyone knows that golf balls have a dimpled surface. Th e purpose of the passage is to explain *why* they have a dimpled surface—not to prove *that* they do. Similarly, in the third example, it is obvious that naval oranges are called naval oranges. Th e purpose of the passage is to shed light on why they have this name.

Th us, to distinguish explanations from arguments, identify the statement that is

either the explanandum or the conclusion (usually this is the statement that precedes the word “because”). If this statement describes an accepted matter of fact, and if the remaining statements purport to shed light on this statement, then the passage is an explanation.

Th is method usually works to distinguish arguments from explanations. However,

some passages can be interpreted as both explanations and arguments. Examples:

Women become intoxicated by drinking a smaller amount of alcohol than men

because men metabolize part of the alcohol before it reaches the bloodstream,

whereas women do not.

Household bleach should never be mixed with ammonia because the combination

releases chlorine gas, which is highly poisonous.

Th e purpose of these passage could be to prove the fi rst statement to those who do not accept it as fact, and to shed light on that fact to those who do accept it. Alternately, the passage could be intended to prove the fi rst statement to a person who accepts its

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**1** truth on blind faith or incomplete experience, and simultaneously to shed light on this  truth. Th us, these passages can be correctly interpreted as both an explanation and an argument.

Perhaps the greatest problem confronting the eff ort to distinguish explanations from arguments lies in determining whether something is an accepted matter of fact. Obviously, what is accepted by one person may not be accepted by another. Thus, the eff ort oft en involves determining which person or group of people the passage is directed to—the intended audience. Sometimes the source of the passage (textbook, newspaper, technical journal, etc.) will decide the issue. But when the passage is taken totally out of context, ascertaining the source may prove impossible. In those circum stances the only possible answer may be to say that *if* the passage is an argument, then such-and-such is the conclusion and such-and-such are the premises.

Conditional Statements

A **conditional statement** is an “if . . . then . . .” statement; for example:

If professional football games incite violence in the home, then the widespread

approval given to this sport should be reconsidered.

If Roger Federer has won more Grand Slams than any other contender, then he

rightfully deserves the title of world’s greatest tennis player.

Every conditional statement is made up of two component statements. Th e component statement immediately following the “if” is called the **antecedent,** and the one following the “then” is called the **consequent.** (Occasionally, the word “then” is left out, and occa sionally the order of antecedent and consequent is reversed.) In the fi rst example, the antecedent is “Professional football games incite violence in the home,” and the conse quent is “Th e widespread approval given to this sport should be reconsidered.” In both of these examples, there is a meaningful relationship between antecedent and consequent. However, such a relationship need not exist for a statement to count as conditional. Th e statement “If Janet Jackson is a singer, then Denver is in Colorado” is just as much a con ditional statement as those about professional football and Roger Federer.

**Conditional**

**statements**

Antecedent Consequent

If then .

Consequent Antecedent

if .

Conditional statements are not arguments, because they fail to meet the criteria given

earlier. In an argument, at least one statement must claim to present evidence, and there

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must be a claim that this evidence implies something. In a conditional statement, there is **1** no claim that either the antecedent or the consequent presents evidence. In other words,  there is no assertion that either the antecedent or the consequent is true. Rather, there is

only the assertion that *if* the antecedent is true, then so is the consequent. Of course, a

conditional statement as a whole may present evidence because it asserts a relationship

between statements. Yet when conditional statements are taken in this sense, there is still

no argument, because there is then no separate claim that this evidence implies anything.

Some conditional statements are similar to arguments, however, in that they express

the outcome of a reasoning process. As such, they may be said to have a certain infer

ential content. Consider the following:

If Sarah Palin loves shooting wolves from airplanes, then she has little respect for

wildlife.

The link between the antecedent and consequent resembles the inferential link

between the premises and conclusion of an argument. Yet there is a diff erence because

the premises of an argument are claimed to be true, whereas no such claim is made

for the antecedent of a conditional statement. Accordingly, conditional statements are

not arguments.\* Yet their inferential content may be reexpressed to form arguments:

Sarah Palin loves shooting wolves from airplanes.

Therefore, she has little respect for wildlife.

Finally, while no single conditional statement is an argument, a conditional state

ment may serve as either the premise or the conclusion (or both) of an argument, as

the following examples illustrate:

If Iran is developing nuclear weapons, then Iran is a threat to world peace.

Iran is developing nuclear weapons.

Therefore, Iran is a threat to world peace.

If our borders are porous, then terrorists can enter the country at will.

If terrorists can enter the country at will, then all of us are less secure.

Therefore, if our borders are porous, then all of us are less secure.

Th e relation between conditional statements and arguments may now be summa

rized as follows:

**1.** A single conditional statement is not an argument.

**2.** A conditional statement may serve as either the premise or the conclusion (or

both) of an argument.

**3.** Th e inferential content of a conditional statement may be reexpressed to form

an argument.

The first two rules are especially pertinent to the recognition of arguments.

According to the fi rst rule, if a passage consists of a single conditional statement, it is not

\*In saying this we are temporarily ignoring the possibility of these statements being enthymemes. As we shall see

in Chapter 5, an *enthymeme* is an argument in which a premise or conclusion (or both) is implied but not stated.

If, to this example, we add the premise “Sarah Palin loves shooting wolves from airplanes” and the conclusion

“Th erefore Sarah Palin has little respect for wildlife,” we have a complete argument. To decide whether a condi

tional statement is an enthymeme, we must be familiar with the context in which it occurs.

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**1** an argument. But if it consists of a conditional statement together with some other state ment, then, by the second rule, it *may* be an argument, depending on such factors as the presence of indicator words and an inferential relationship between the statements.

Conditional statements are especially important in logic (and many other fi elds)

because they express the relationship between necessary and suffi cient conditions. *A* is said to be a **suffi cient condition** for *B* whenever the occurrence of *A* is all that is needed for the occurrence of *B.* For example, being a dog is a suffi cient condition for being an animal. On the other hand, *B* is said to be a **necessary condition** for *A* when ever *A* cannot occur without the occurrence of *B.* Th us, being an animal is a necessary condition for being a dog.

Th e diff erence between suffi cient and necessary conditions is a bit tricky. So, to clar

ify the idea further, suppose you are given a large, closed cardboard box. Also, suppose you are told there is a dog in the box. Th en you know for sure there is an animal in the box. No additional information is needed to draw this conclusion. Th is means that being a dog is suffi cient for being an animal. However, being a dog is not necessary for being an animal, because if you are told that the box contains a cat, you can conclude with equal certainty that it contains an animal. In other words, it is not necessary for the box to contain a dog for it to contain an animal. It might equally well contain a cat, a mouse, a squirrel, or any other animal.

On the other hand, suppose you are told that whatever might be in the box, it is not an

animal. Th en you know for certain there is no dog in the box. Th e reason you can draw this conclusion is that being an animal is necessary for being a dog. If there is no animal, there is no dog. However, being an animal is not suffi cient for being a dog, because if you are told that the box contains an animal, you cannot, from this information alone, con

clude that it contains a dog. It might contain a cat, a mouse, a squirrel, and so on.

Th ese ideas are expressed in the following conditional statements:

If *X* is a dog, then *X* is an animal.

If *X* is not an animal, then *X* is not a dog.

Th e fi rst statement says that being a dog is a suffi cient condition for being an ani

mal, and the second that being an animal is a necessary condition for being a dog. However, a little refl ection reveals that these two statements say exactly the same thing. Th us, each expresses in one way a necessary condition and in another way a suffi cient condition. Th e terminology of suffi cient and necessary conditions will be used in later chapters to express defi nitions and causal connections.

Summary

In deciding whether a passage contains an argument, you should look for three things: (1) indicator words such as “therefore,” “since,” “because,” and so on; (2) an infer ential relationship between the statements; and (3) typical kinds of nonarguments. But remember that the mere occurrence of an indicator word does not guarantee the presence of an argument. You must check to see that the statement identifi ed as the

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conclusion is claimed to be supported by one or more of the other statements. Also **1** keep in mind that in many arguments that lack indicator words, the conclusion is the  fi rst statement. Furthermore, it helps to mentally insert the word “therefore” before

the various statements before deciding that a statement should be interpreted as a con

clusion. Th e typical kinds of nonarguments that we have surveyed are as follows:

warnings reports

pieces of advice expository passages

statements of belief illustrations

statements of opinion explanations

loosely associated statements conditional statements

Keep in mind that these kinds of nonargument are not mutually exclusive, and that,

for example, one and the same passage can sometimes be interpreted as both a report

and a statement of opinion, or as both an expository passage and an illustration. Th e

precise kind of nonargument a passage might be is nowhere near as important as cor

rectly deciding whether or not it is an argument.

Aft er working the exercises in this section, you may, if you wish, proceed directly to

Section 1.6 [“Extended Arguments”].

Exercise 1.2

**I.** Determine which of the following passages are arguments. For those that are, iden

tify the conclusion. For those that are not, determine the kind of nonargument.

★**1.** The turkey vulture is called by that name because its red featherless head

resembles the head of a wild turkey.

**2.** If public education fails to improve the quality of instruction in both primary

and secondary schools, then it is likely that it will lose additional students to

the private sector in the years ahead.

**3.** Freedom of the press is the most important of our constitutionally guaranteed

freedoms. Without it, our other freedoms would be immediately threatened.

Furthermore, it provides the fulcrum for the advancement of new freedoms.

★**4.** A mammal is a vertebrate animal that nurses its off spring. Th us, cats and dogs

are mammals, as are sheep, monkeys, rabbits, and bears.

**5.** It is strongly recommended that you have your house inspected for termite

damage at the earliest possible opportunity.

**6.** Mosquito bites are not always the harmless little irritations most of us take

them to be. For example, some mosquitoes carry West Nile virus, and people

who are infected can become very sick or even die.

★**7.** If stem-cell research is restricted, then future cures will not materialize.

If future cures do not materialize, then people will die prematurely. Th erefore,

if stem-cell research is restricted, then people will die prematurely.

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**1 8.** Fictional characters behave according to the same psychological probabilities as real people. But the characters of fi ction are found in exotic dilemmas that real

people hardly encounter. Consequently, fi ction provides us with the opportunity

to ponder how people react in uncommon situations, and to deduce moral les

sons, psychological principles, and philosophical insights from their behavior.

(J. R. McCuen and A. C. Winkler, *Readings for Writers,* 4th ed.)

**9.** I believe that it must be the policy of the United States to support free peoples who are resisting attempted subjugation by armed minorities or by outside pressures.

I believe that we must assist free peoples to work out their own destinies in their

own way. I believe that our help should be primarily through economic and fi nan

cial aid, which is essential to economic stability and orderly political processes.

(President Truman, Address to Congress, 1947)

★**10.** Five college students who were accused of sneaking into the Cincinnati Zoo

and trying to ride the camels pleaded no contest to criminal trespass yesterday.

Th e students scaled a fence to get into the zoo and then climbed another fence

to get into the camel pit before security offi cials caught them, zoo offi cials said.

(Newspaper clipping)

**11.** Mortality rates for women undergoing early abortions, where the procedure is legal, appear to be as low as or lower than the rates for normal childbirth.

Consequently, any interest of the state in protecting the woman from an

inherently hazardous procedure, except when it would be equally dangerous

for her to forgo it, has largely disappeared.

(Justice Blackmun, *Roe v. Wade*)

**12.** Th e pace of reading, clearly, depends entirely upon the reader. He may read as slowly or as rapidly as he can or wishes to read. If he does not understand

something, he may stop and reread it, or go in search of elucidation before

continuing. Th e reader can accelerate his pace when the material is easy or

less than interesting, and can slow down when it is diffi cult or enthralling.

If what he reads is moving he can put down the book for a few moments and

cope with his emotions without fear of losing anything.

(Marie Winn, *The Plug-In Drug*)

★**13.** We as a nation have been guilty of far too many excesses for too long. We

waste more than most in the rest of the world. It is time we sucked it in and

tightened our belts. Our families, our nation and the rest of the world will

only be better off .

(Prashanth Kumar, letter to the editor)

**14.** Lions at Kruger National Park in South Africa are dying of tuberculosis. “All of the lions in the park may be dead within ten years because the disease is

incurable, and the lions have no natural resistance,” said the deputy director

of the Department of Agriculture.

(Newspaper clipping)

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**15.** Economics is of practical value in business. An understanding of the over- **1** all operation of the economic system puts the business executive in a better  position to formulate policies. Th e executive who understands the causes and

consequences of infl ation is better equipped during infl ationary periods to

make more intelligent decisions than otherwise.

(Campbell R. McConnell, *Economics,* 8th ed.)

★**16.** Bear one thing in mind before you begin to write your paper: Famous liter

ary works, especially works regarded as classics, have been thoroughly studied

to the point where prevailing opinion on them has assumed the character of

orthodoxy.

(J. R. McCuen and A. C. Winkler, *Readings for Writers,* 4th ed.)

**17.** Young people at universities study to achieve knowledge and not to learn a

trade. We must all learn how to support ourselves, but we must also learn how

to live. We need a lot of engineers in the modern world, but we do not want a

world of modern engineers.

(Winston Churchill, *A Churchill Reader,* ed. Colin R. Coote)

**18.** No business concern wants to sell on credit to a customer who will prove

unable or unwilling to pay his or her account. Consequently, most business

organizations include a credit department which must reach a decision on the

credit worthiness of each prospective customer.

(Walter B. Meigs and Robert F. Meigs, *Accounting*)

★**19.** For organisms at the sea surface, sinking into deep water usually means death.

Plant cells cannot photosynthesize in the dark depths. Fishes and other ani

mals that descend lose contact with the main surface food supply and them

selves become food for strange deep-living predators.

(David H. Milne, *Marine Life and the Sea*)

**20.** Since the 1950s a malady called whirling disease has invaded U.S. fishing

streams, frequently attacking rainbow trout. A parasite deforms young fi sh,

which oft en chase their tails before dying, hence the name.

(“Trout Disease—A Turn for the Worse,” *National Geographic*)

**21.** Dachshunds are ideal dogs for small children, as they are already stretched

and pulled to such a length that the child cannot do much harm one way or

the other.

(Robert Benchley, quoted in *Cold Noses and Warm Hearts*)

★**22.** Atoms are the basic building blocks of all matter. Th ey can combine to form

molecules, whose properties are generally very different from those of the

constituent atoms. Table salt, for example, a simple chemical compound

formed from chlorine and sodium, resembles neither the poisonous gas nor

the highly reactive metal.

(Frank J. Blatt, *Principles of Physics,* 2nd ed.)

**Section 1.2** Recognizing Arguments 27

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**1 23.** Th e coarsest type of humor is the *practical joke:* pulling away the chair from the dignitary’s lowered bottom. Th e victim is perceived fi rst as a person of

consequence, then suddenly as an inert body subject to the laws of phys

ics: authority is debunked by gravity, mind by matter; man is degraded to a

mechanism.

(Arthur Koestler, *Janus: A Summing Up*)

**24.** If a man holding a belief which he was taught in childhood or persuaded of aft erwards keeps down and pushes away any doubts which arise about it in

his mind, purposely avoids the reading of books and the company of men that

call in question or discuss it, and regards as impious those questions which

cannot easily be asked without disturbing it—the life of that man is one long

sin against mankind.

(W. K. Cliff ord, “The Ethics of Belief”)

★**25.** It is usually easy to decide whether or not something is alive. Th is is because

living things share many common attributes, such as the capacity to extract

energy from nutrients to drive their various functions, the power to actively

respond to changes in their environment, and the ability to grow, to diff eren

tiate, and to reproduce.

(Donald Voet and Judith G. Voet, *Biochemistry,* 2nd ed.)

**26.** Words are slippery customers. The full meaning of a word does not appear until it is placed in its context. . . . And even then the meaning will depend

upon the listener, upon the speaker, upon their entire experience of the

language, upon their knowledge of one another, and upon the whole

situation.

(C. Cherry, *On Human Communication*)

**27.** Haydn developed the string quartet from the eighteenth century *divertimento,* giving more substance to the light, popular form and scoring it for two vio

lins, a viola, and a cello. His eighty-three quartets, written over the course of

his creative lifetime, evolved slowly into a sophisticated form. Together they

constitute one of the most important bodies of chamber music literature.

(Robert Hickok, *Exploring Music*)

★**28.** A person never becomes truly self-reliant. Even though he deals eff ectively

with things, he is necessarily dependent upon those who have taught him to

do so. Th ey have selected the things he is dependent upon and determined the

kinds and degrees of dependencies.

(B. F. Skinner, *Beyond Freedom and Dignity*)

**29.** Th ere is no doubt that some businessmen conspire to shorten the useful life of their products in order to guarantee replacement sales. Th ere is, similarly,

no doubt that many of the annual model changes with which American (and

other) consumers are increasingly familiar are not technologically substantive.

(Alvin Toffl er, *Future Shock*)

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**30.** The brain and the nervous system are composed of two types of cells— **1** neurons and glial cells. Neurons are responsible for information transmission  throughout the nervous system. Glial cells constitute the support system for

the neurons. For example, glial cells take away the waste products of neurons,

keep the neurons’ chemical environment stable, and insulate them, allowing

neurons to do their work more effi ciently.

(Richard Griggs, *Psychology: A Concise Introduction*)

★**31.** In areas where rats are a problem, it is very diffi cult to exterminate them with

bait poison. Th at’s because some rats eat enough poison to die but others eat

only enough to become sick and then learn to avoid that particular poison

taste in the future.

(Rod Plotnik, *Introduction to Psychology,* 4th ed.)

**32.** Although it is customary to think of human population as increasing con

tinuously without declines or fl uctuations, population growth has not been

a steady march. For example, great declines occurred during the time of the

Black Death, during the fourteenth century. Entire towns were abandoned,

production of food declined, and in England, one-third of the population

died within a single decade.

(Daniel B. Botkin and Edward A Keller, *Environmental Science*)

**33.** If someone avoids and is afraid of everything, standing fi rm against nothing,

he becomes cowardly; if he is afraid of nothing at all and goes to face every

thing, he becomes rash. Similarly, if he gratifi es himself with every pleasure

and abstains from none, he becomes intemperate; if he avoids them all, he

becomes some sort of insensible person. Temperance and bravery, then, are

ruined by excess and defi ciency, but preserved by the mean.

(Aristotle, *Nicomachean Ethics*)

★**34.** Nations are made in two ways, by the slow working of history or the galvanic

force of ideas. Most nations are made the former way, emerging slowly from

the mist of the past, gradually coalescing within concentric circles of shared

sympathies, with an accretion of consensual institutions. But a few nations

are formed and defi ned by the citizens’ assent to a shared philosophy.

(George Will, “Lithuania and South Carolina”)

**35.** One form of energy can be converted to another. For example, when an elec

tric motor is connected to a battery, chemical energy is converted to electrical

energy, which in turn is converted to mechanical energy.

(Raymond A Serway, *Physics for Scientists and Engineers,* 4th ed.)

**II.** The following selections were originally submitted as letters to the editor of

newspapers and magazines. Determine which of them can, with good reason, be

considered arguments. In those that can, identify the conclusion.

★**1.** What this country needs is a return to the concept of swift and certain jus

tice. If we need more courts, judges and prisons, then so be it. And as for

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**1** capital punishment, I say let the punishment fi t the crime. When criminals  behave more like humans, then we can start to treat them more humanely.

In the meantime, I would like to see the Night Stalkers of our society swift ly

executed rather than coddled by our courts and prisons.

(John Pearson)

**2.** Social security is not merely a retirement program. Six and a half million chil dren in the United States are kept out of poverty each year because of assistance

from Social Security’s survivors benefi ts program—which protects virtually all

American children in the tragic event of the death of a parent. Benefi ciaries

include spouses and children of workers who have died or become disabled;

grandparents raising grandchildren; severely disabled children; and families

of fallen service members.

(Donna Butts)

**3.** Is there any country in the world that worries more about its kids having fun in school, making lessons exciting and relevant, and then is more dis

appointed with the result than the United States? We think learning is

like buying a car or smoking a cigarette. Just get into the thing or draw

a breath and you will be eff ortlessly transported to lands of pleasure and

excitement.

(Charles M. Breinin)

★**4.** Aft er reading your cover story, I fi nd that cable TV has simply fl ooded our

airwaves with more sex, violence, and teen-age punk junk. Now our children

can spend even less time studying and we can spend more time in blank-space

stares at the idiot box. Cable would be fi ne with more educational channels—

and fewer cheap thrills aimed at narrow-minded bubble brains.

(Jacqueline Murray)

**5.** Once the basic necessities have been achieved, future income is only lightly connected to well-being. Democrats generally seek to tax future income to

finance programs that meet basic needs, including food, clothing shelter,

retirement security and healthcare. Republicans, in contrast, seek to protect

future income from taxation, oft en at the expense of meeting the basic needs

of the less fortunate. So which of our two main political parties is more con

cerned with achieving broad happiness, and which party is more concerned

with fulfi lling selfi shness?

(Jonathan Carey)

**6.** Animal abusers are cowards who take their issues out on “easy victims”—and their targets oft en include their fellow humans. I cannot begin to say how many

incidents I’ve seen involving animal abusers who commit violent acts against

humans, and animal neglecters who have neglected their children or other

human dependents. Treating cruelty to animals with the seriousness it deserves

doesn’t only protect animals, it also makes the entire community safer.

(Martin Mersereau)

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★**7.** Th e creation of a third political party—the independent party—would allow **1** Congressional aspirants who desire to think for themselves to claim a high  ground that is currently vacant. Th e new party would provide a more eff ective

forum to discuss the right course for this country and might compel the other

two parties to do likewise. Th e pressure such a movement would put on those

now stagnating in cozy sinecures would, at the least, prove entertaining for a

weary, frustrated public.

(Bill Cannon)

**8.** I agree that when religious institutions exclude woman from their hierar

chies and rituals, the inevitable implication is that females are inferior. But

it is important to note that when women’s voices are silenced, it is not only

the message that such discrimination sends that is damaging. Th e institutions

themselves suff er. By disempowering women, religious institutions, and the

broader societies in which they operate, lose the invaluable input of 51 per

cent of their constituents.

(Jessie Cronan)

**9.** It looks like India and China are going to compete for a manned landing on the

moon by 2020 while America is muddling along with no real future space plan.

Let’s do something signifi cant in space—say, go to Mars by 2020. We could have

done it 30 years ago. Planning for a Mars mission was well along. But the nation

turned away from space aft er we landed on the moon, even canceling the three

remaining fl ights to the moon. Th ese Saturn 5 rockets now sit in museums.

(Bill Ketchum)

★**10.** Teenage bullying is all about power. One person has it, one person does not.

Reluctant to seek help, victims feel ashamed and powerless, and they fear

retaliation should they “rat out” the bully. Strong anti-bullying programs are

needed to provide a means to report bullying anonymously, to train all school

personnel to take reports of bullying seriously, and to off er workshops for

children on how to respond to being bullied.

(Karen Schulte O’Neill)

**III.** Th e following statements represent conclusions for arguments. Each is expressed in

the form of two alternatives. Select one of the alternatives for each conclusion, and

then jot down several reasons that support it. Finally, incorporate your reasons into

a written argument of at least 100 words that supports the conclusion. Include prem

ise and conclusion indicators in some of your arguments, but not in all of them.

**1.** A constitutional amendment that outlaws fl ag burning should/should not be

adopted.

**2.** Street drugs should/should not be legalized.

**3.** Th e death penalty should/should not be abolished.

**4.** Sanctions should/should not be imposed on students for using speech that is

off ensive to minorities.

**5.** Free health care should/should not be guaranteed to all citizens.

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**1 6.** Same-sex marriages should/should not be recognized by the state. **7.** The possession, ownership, and sale of handguns should/should not be outlawed.

**8.** Cigarettes should/should not be regulated as an addictive drug.

**9.** Affi rmative action programs should/should not be abolished.

**10.** Doctors should/should not be allowed to assist terminally ill patients in com mitting suicide.

**IV.** Defi ne the following terms:

argument from example explanation

conditional statement explanandum

antecedent explanans

consequent illustration

suffi cient condition expository passage

necessary condition

**V.** Answer “true” or “false” to the following statements:

**1.** Any passage that contains an argument must contain a claim that something is supported by evidence or reasons.

**2.** In an argument, the claim that something is supported by evidence or reasons is always explicit.

**3.** Passages that contain indicator words such as “thus,” “since,” and “because” are always arguments.

**4.** In deciding whether a passage contains an argument, we should always keep an eye out for indicator words and the presence of an inferential relationship

between the statements.

**5.** Some expository passages can be correctly interpreted as arguments.

**6.** Some passages containing “for example” can be correctly interpreted as arguments.

**7.** In deciding whether an expository passage or an illustration should be inter preted as an argument, it helps to note whether the claim being developed or

illustrated is one that is accepted by everyone.

**8.** Some conditional statements can be reexpressed to form arguments.

**9.** In an explanation, the explanandum usually describes an accepted matter of fact. **10.** In an explanation, the explanans is the statement or group of statements that does the explaining.

**VI.** Fill in the blanks with “necessary” or “suffi cient” to make the following statements true. Aft er the blanks have been fi lled in, express the result in terms of conditional

statements.

★**1.** Being a tiger is a condition for being an animal.

**2.** Being an animal is a condition for being a tiger.

**3.** Drinking a coke is a condition for quenching one’s thirst.

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★**4.** Having a racket is a condition for playing tennis. **1**

**1**

**5.** Heating water is a condition for brewing coff ee.

**6.** Stepping on a cat’s tail is a condition for making the cat yowl. ★**7.** Burning leaves is a condition for producing smoke.

**8.** Paying attention is a condition for understanding a lecture. **9.** Being exactly divisible by 4 is a condition for a number being even.

★**10.** Uttering a falsehood is a condition for telling a lie.

**VII.** Page through a book, magazine, or newspaper and fi nd two arguments, one with indicator words, the other without. Copy the arguments as written, giving the appropriate reference. Th en identify the premises and conclusion of each.

**1.3**

Deduction and Induction

In the previous section we saw that every argument involves an inferential claim—the claim that the conclusion is supposed to follow from the premises. Th e question we now address has to do with the strength of this claim. Just how strongly is the conclu sion claimed to follow from the premises? If the conclusion is claimed to follow with strict certainty or necessity, the argument is said to be deductive; but if it is claimed to follow only probably, the argument is inductive.

Stated more precisely, a **deductive argument** is an argument incorporating the claim that it is *impossible* for the conclusion to be false given that the premises are true. Deductive arguments are those that involve necessary reasoning. On the other hand, an **inductive argument** is an argument incorporating the claim that it is *improb*

*able* that the conclusion be false given that the premises are true. Inductive arguments involve probabilistic reasoning. Here are two examples:

The meerkat is closely related to the suricat.

The suricat thrives on beetle larvae.

Therefore, probably the meerkat thrives on beetle larvae.

The meerkat is a member of the mongoose family.

All members of the mongoose family are carnivores.

Therefore, it necessarily follows that the meerkat is a carnivore.

Th e fi rst of these arguments is inductive, the second deductive.

In deciding whether an argument is inductive or deductive, we look to certain objective features of the argument. Th ese features include (1) the occurrence of special indicator words, (2) the *actual* strength of the inferential link between premises and conclusion, and (3) the form or style of argumentation. However, we must acknowl

edge at the outset that many arguments in ordinary language are incomplete, and **Section 1.3** Deduction and Induction 33

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**1** because of this, deciding whether the argument should best be interpreted as deduc tive or inductive may be impossible. Th e occurrence of special indicator words is illustrated in the examples we just

considered. Th e word “probably” in the conclusion of the fi rst argument suggests that the argument should be taken as inductive, and the word “necessarily” in the conclusion of the second suggests that the second argument be taken as deduc tive. Additional inductive indicators are “improbable,” “plausible,” “implausible,” “likely,” “unlikely,” and “reasonable to conclude.” Additional deductive indicators are “certainly,” “absolutely,” and “defi nitely.” (Note that the phrase “it must be the case that” is simply a conclusion indicator that can occur in either deductive or inductive argments.)

Inductive and deductive indicator words oft en suggest the correct interpretation.

However, if they confl ict with one of the other criteria (discussed shortly), we should probably ignore them. Arguers often use phrases such as “it certainly follows that” for rhetorical purposes to add impact to their conclusion and not to suggest that the argument be taken as deductive. Similarly, some arguers, not knowing the distinction between inductive and deductive, will claim to “deduce” a conclusion when their argu

ment is more correctly interpreted as inductive.

Th e second factor that bears on our interpretation of an argument as inductive or

deductive is the *actual* strength of the inferential link between premises and conclu sion. If the conclusion actually does follow with strict necessity from the premises, the argument is clearly deductive. In such an argument it is impossible for the premises to be true and the conclusion false. On the other hand, if the conclusion does not follow with strict necessity but does follow probably, it is oft en best to consider the argument inductive. Examples:

All entertainers are extroverts.

David Letterman is an entertainer.

Therefore, David Letterman is an extrovert.

The vast majority of entertainers are extroverts.

David Letterman is an entertainer.

Therefore, David Letterman is an extrovert.

In the fi rst example, the conclusion follows with strict necessity from the premises. If we assume that all entertainers are extroverts and that David Letterman is an enter tainer, then it is impossible that David Letterman not be an extrovert. Th us, we should interpret this argument as deductive. In the second example, the conclusion does not follow from the premises with strict necessity, but it does follow with some degree of probability. If we assume that the premises are true, then based on that assumption it is probable that the conclusion is true. Th us, it is best to interpret the second argument as inductive.

Occasionally, an argument contains no special indicator words, and the con

clusion does not follow either necessarily or probably from the premises; in other words, it does not follow at all. Th is situation points up the need for the third fac tor to be taken into account, which is the character or form of argumentation the arguer uses.

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**1** 

**1**

****Ruth Barcan Marcus

**R**uth Barcan was born in New York City in  

1921. Her mother was a homemaker, and her father a printer and contributor to the *Jewish Daily Forward.* After completing her pri mary and secondary education at public schools, she enrolled in New York University, where, in addition to her academic pursuits, she won praise as an outstanding fencer. In 1941 she earned a bachelor’s degree in mathematics and philosophy, and five years later she received a Ph.D. in philosophy from Yale University. In 1942 she married Jules Alexander Marcus, a physicist, and the couple had four children, two boys and two girls. 

After graduating from Yale, Barcan Marcus’s early career was spent holding several postdoctoral fellowships (including a Guggenheim) and visiting professorships. In 1959 she accepted a position 

low at Yale and 

d i s t i n g u i s h e d

visiting professor

at the University 

o f C a l i f o r n i a ,

Irvine.

Commencing

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fied modal logic. She proposed, as an axiom, the widely discussed Barcan formula, which asserts, in symbols, (*x*)□*Fx* ⊃ □(*x*)*Fx*. In English, this means that if everything is necessarily *F*, then it is necessary that everything is *F*. The formula is controversial because 



at Roosevelt University, followed by positions at the University of Illinois, Chicago (where she was founding department chair) and Northwestern

it implies that all objects that exist in every possi ble world exist in the actual world. If the formula is accepted, there are actual worlds where you have  



University. In 1973 she returned to Yale as professor of philosophy. Currently she is senior research fel

a twin brother and a twin sister, even though you have no such twins in the familiar world.

Deductive Argument Forms

Many arguments have a distinctive character or form that indicates that the premises are supposed to provide absolute support for the conclusion. Five examples of such forms or kinds of argumentation are arguments based on mathematics, arguments from defi nition, and categorical, hypothetical, and disjunctive syllogisms.

An **argument based on mathematics** is an argument in which the conclusion

depends on some purely arithmetic or geometric computation or measurement. For example, a shopper might place two apples and three oranges into a paper bag and then conclude that the bag contains fi ve pieces of fruit. Or a surveyor might measure a square piece of land and, after determining that it is 100 feet on each side, conclude that it contains 10,000 square feet. Since all arguments in pure mathematics are deductive, we can usually consider arguments that depend on mathematics to be deductive as well. A noteworthy exception, however, is arguments that depend on statistics. As we will see shortly, such arguments are usually best interpreted as inductive.

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**1** An **argument from defi nition** is an argument in which the conclusion is claimed  to depend merely on the defi nition of some word or phrase used in the premise or conclusion. For example, someone might argue that because Claudia is mendacious, it follows that she tells lies, or that because a certain paragraph is prolix, it follows that it is excessively wordy. Th ese arguments are deductive because their conclusions follow with necessity from the defi nitions of “mendacious” and “prolix.”

A *syllogism,* in general, is an argument consisting of exactly two premises and one

conclusion. Categorical syllogisms will be treated in greater depth in Chapter 5, but for now we will say that a **categorical syllogism** is a syllogism in which each statement begins with one of the words “all,” “no,” or “some.” Example:

All ancient forests are sources of wonder.

Some ancient forests are targets of the timber industry.

Therefore, some sources of wonder are targets of the timber industry.

Arguments such as these are nearly always best treated as deductive.

A **hypothetical syllogism** is a syllogism having a conditional (“if . . . then”) state

ment for one or both of its premises. Examples:

If estate taxes are abolished, then wealth will accumulate disproportionately.

If wealth accumulates disproportionately, then democracy will be threatened.

Therefore, if estate taxes are abolished, then democracy will be threatened.

If Fox News is a propaganda machine, then it misleads its viewers.

Fox News is a propaganda machine.

Therefore, Fox News misleads its viewers.

Later in this book, the fi rst of these arguments will be given the more specifi c name of pure hypothetical syllogism because it is composed exclusively of conditional (hypo thetical) statements. Th e second argument is called a mixed hypothetical syllogism because only one of its component statements is a conditional. Later in this book, the second argument will be given the more specifi c Latin name *modus ponens*.

A **disjunctive syllogism** is a syllogism having a disjunctive (“either . . . or . . .”)

statement. Example:

Either global warming will be arrested, or hurricanes will become more intense.

Global warming will not be arrested.

Therefore, hurricanes will become more intense.

As with hypothetical syllogisms, such arguments are usually best taken as deductive. Hypothetical and disjunctive syllogisms will be treated in greater depth in Chapter 6.

Inductive Argument Forms

In general, inductive arguments are such that the content of the conclusion is in some way intended to “go beyond” the content of the premises. Th e premises of such an argument typically deal with some subject that is relatively familiar, and the conclu sion then moves beyond this to a subject that is less familiar or that little is known about. Such an argument may take any of several forms: predictions about the future,

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arguments from analogy, inductive generalizations, arguments from authority, argu- **1** ments based on signs, and causal inferences, to name just a few. A **prediction** is an argument that proceeds from our knowledge of the past to a

claim about the future. For example, someone might argue that because certain mete

orological phenomena have been observed to develop over a certain region of central

Missouri, a storm will occur there in six hours. Or again, one might argue that because

certain fl uctuations occurred in the prime interest rate on Friday, the value of the dol

lar will decrease against foreign currencies on Monday. Nearly everyone realizes that

the future cannot be known with certainty; thus, whenever an argument makes a pre

diction about the future, one is usually justifi ed in considering the argument inductive.

An **argument from analogy** is an argument that depends on the existence of an

analogy, or similarity, between two things or states of aff airs. Because of the existence

of this analogy, a certain condition that aff ects the better-known thing or situation is

concluded to aff ect the similar, lesser-known thing or situation. For example, someone

might argue that because Christina’s Porsche is a great handling car, it follows that

Angela’s Porsche must also be a great handling car. Th e argument depends on the exis

tence of a similarity, or analogy, between the two cars. Th e certitude attending such an

inference is probabilistic at best.

A **generalization** is an argument that proceeds from the knowledge of a selected

sample to some claim about the whole group. Because the members of the sample have

a certain characteristic, it is argued that all the members of the group have that same

characteristic. For example, one might argue that because three oranges selected from

a certain crate were especially tasty and juicy, all the oranges from that crate are espe

cially tasty and juicy. Or again, one might argue that because six out of a total of nine

members sampled from a certain labor union intend to vote for Johnson for union

president, two-thirds of the entire membership intend to vote for Johnson. These

examples illustrate the use of statistics in inductive argumentation.

An **argument from authority** is an argument that concludes something is true

because a presumed expert or witness has said that it is. For example, a person might

argue that earnings for Hewlett-Packard Corporation will be up in the coming quarter

because of a statement to that eff ect by an investment counselor. Or a lawyer might

argue that Mack the Knife committed the murder because an eyewitness testifi ed to

that eff ect under oath. Because the investment counselor and the eyewitness could be

either mistaken or lying, such arguments are essentially probabilistic.

An **argument based on signs** is an argument that proceeds from the knowledge

of a sign to a claim about the thing or situation that the sign symbolizes. Th e word

“sign,” as it is used here, means any kind of message (usually visual) produced by an

intelligent being. For example, when driving on an unfamiliar highway one might see

a sign indicating that the road makes several sharp turns one mile ahead. Based on

this information, one might argue that the road does indeed make several sharp turns

one mile ahead. Because the sign might be misplaced or in error about the turns, the

conclusion is only probable.

A **causal inference** is an argument that proceeds from knowledge of a cause to a

claim about an eff ect, or, conversely, from knowledge of an eff ect to a claim about a

cause. For example, from the knowledge that a bottle of wine had been accidentally left

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**1** in the freezer overnight, someone might conclude that it had frozen (cause to eff ect).  Conversely, aft er tasting a piece of chicken and fi nding it dry and tough, one might conclude that it had been overcooked (eff ect to cause). Because specifi c instances of cause and eff ect can never be known with absolute certainty, one may usually interpret such arguments as inductive.

Further Considerations

It should be noted that the various subspecies of inductive arguments listed here are not intended to be mutually exclusive. Overlaps can and do occur. For example, many causal inferences that proceed from cause to eff ect also qualify as predictions. Th e pur pose of this survey is not to demarcate in precise terms the various forms of induction but rather to provide guidelines for distinguishing induction from deduction.

Keeping this in mind, we should take care not to confuse arguments in geometry,

which are always deductive, with arguments from analogy or inductive generalizations. For example, an argument concluding that a triangle has a certain attribute (such as a right angle) because another triangle, with which it is congruent, also has that attribute might be mistaken for an argument from analogy. Similarly, an argument that con

cludes that all triangles have a certain attribute (such as angles totaling two right angles) because any particular triangle has that attribute might be mistaken for an inductive generalization. Arguments such as these, however, are always deductive, because the conclusion follows necessarily and with complete certainty from the premises.

One broad classifi cation of arguments not listed in this survey is scientifi c argu

ments. Arguments that occur in science can be either inductive or deductive, depend ing on the circumstances. In general, arguments aimed at the *discovery* of a law of nature are usually considered inductive. Suppose, for example, that we want to dis cover a law that governs the time required for a falling body to strike the earth. We drop bodies of various weights from various heights and measure the time it takes them to fall. Comparing our measurements, we notice that the time is approximately proportional to the square root of the distance. From this we conclude that the time required for any body to fall is proportional to the square root of the distance through which it falls. Such an argument is best interpreted as an inductive generalization.

Another type of argument that occurs in science has to do with the *application* of

known laws to specifi c circumstances. Scientifi c laws are widely considered to be gener alizations that hold for all times and all places. As so understood, their application to a specifi c situation is always deductive, even though it might relate to the future. Suppose, for example, that we want to apply Boyle’s law for ideal gases to a container of gas in our laboratory. Boyle’s law states that the pressure exerted by a gas on the walls of its con tainer is inversely proportional to the volume. Applying this law, we conclude that when we reduce the volume of our laboratory sample by half, the pressure will double. Th is application of Boyle’s law is deductive, even though it pertains to the future.

A fi nal point needs to be made about the distinction between inductive and deduc

tive arguments. Th ere is a tradition extending back to the time of Aristotle that holds that inductive arguments are those that proceed from the particular to the general, while deductive arguments are those that proceed from the general to the particular.

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(A **particular statement** is one that makes a claim about one or more particular mem- **1** bers of a class, while a **general statement** makes a claim about *all* the members of a  class.) It is true, of course, that many inductive and deductive arguments do work in

this way; but this fact should not be used as a criterion for distinguishing induction

from deduction. As a matter of fact, there are deductive arguments that proceed from

the general to the general, from the particular to the particular, and from the particular

to the general, as well as from the general to the particular; and there are inductive

arguments that do the same. For example, here is a deductive argument that proceeds

from the particular to the general:

Three is a prime number.

Five is a prime number.

Seven is a prime number.

Therefore, all odd numbers between two and eight are prime numbers.

And here is one that proceeds from the particular to the particular:

Gabriel is a wolf.

Gabriel has a tail.

Therefore, Gabriel’s tail is the tail of a wolf.

Here is an inductive argument that proceeds from the general to the particular:

All emeralds previously found have been green.

Therefore, the next emerald to be found will be green.

Th e other varieties are easy to construct. Th us, the progression from particular to gen

eral, and vice versa, cannot be used as a criterion for distinguishing induction and

deduction.

Summary

To distinguish deductive arguments from inductive arguments, we attempt to evalu

ate the strength of the argument’s inferential claim—how strongly the conclusion is

claimed to follow from the premises. Th is claim is an objective feature of an argument,

and it may or may not be related to the subjective intentions of the arguer.

To interpret an argument’s inferential claim we look at three factors: special indica

tor words, the actual strength of the inferential link between premises and conclusion,

and the character or form of argumentation. Given that we have more than one factor

to look at, it is possible in a single argument for the occurrence of two of these fac

tors to confl ict with each other, leading to opposite interpretations. For example, in

drawing a conclusion to a categorical syllogism (which is clearly deductive), an arguer

might say “It probably follows that . . .” (which suggests induction). To help alleviate

this confl ict we can list the factors in order of importance:

**1.** Arguments in which the premises provide absolute support for the conclusion.

Such arguments are always deductive.

**Section 1.3** Deduction and Induction 39

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**1 2.** Arguments having a specifi c deductive character or form (e.g., categorical syl logism). Th is factor is oft en of equal importance to the fi rst, and, when present, it provides a clear-cut indication that the argument is deductive.

**3.** Arguments having a specific inductive character or form (e.g., a prediction).

Arguments of this sort are nearly always best interpreted as inductive.

**4.** Arguments containing inductive indicator language (e.g., “It probably follows

that . . .”). Since arguers rarely try to make their argument appear weaker than it

really is, such language can usually be trusted. But if this language confl icts with

one of the fi rst two factors, it should be ignored.

**5.** Arguments containing deductive indicator language (e.g., “It necessarily follows

that . . .”). Arguers occasionally use such language for rhetorical purposes, to make

their argument appear stronger than it really is, so such language should be eval

uated carefully.

**6.** Arguments in which the premises provide only probable support for the conclu

sion. Th is is the least important factor, and if it confl icts with any of the earlier

ones, it should probably be ignored.

Unfortunately, many arguments in ordinary language are incomplete, so it oft en

happens that none of these factors are clearly present. Determining the inductive or deductive character of such arguments may be impossible.

Exercise 1.3

**I.** Determine whether the following arguments are best interpreted as being induc tive or deductive. Also state the criteria you use in reaching your decision (i.e., the

presence of indicator words, the nature of the inferential link between premises

and conclusion, or the character or form of argumentation).

★**1.** Because triangle A is congruent with triangle B, and triangle A is isosceles, it

follows that triangle B is isosceles.

**2.** Th e plaque on the leaning tower of Pisa says that Galileo performed experi ments there with falling objects. It must be the case that Galileo did indeed

perform those experiments there.

**3.** Th e rainfall in Seattle has been more than 15 inches every year for the past thirty years. Th erefore, the rainfall next year will probably be more than 15 inches.

★**4.** No e-mail messages are eloquent creations. Some love letters are eloquent

creations. Th erefore, some love letters are not e-mail messages.

**5.** Amoco, Exxon, and Texaco are all listed on the New York Stock Exchange. It

must be the case that all major American oil companies are listed on the New

York Stock Exchange.

**6.** Th e longer a pendulum is, the longer it takes to swing. Th erefore, when the pendulum of a clock is lengthened, the clock slows down.

★**7.** Paying off terrorists in exchange for hostages is not a wise policy, since such

action will only lead them to take more hostages in the future.

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**8.** Th e Matterhorn is higher than Mount Whitney, and Mount Whitney is higher **1** than Mount Rainier. Th e obvious conclusion is that the Matterhorn is higher  than Mount Rainier.

**9.** Although both front and rear doors were found open aft er the burglary, there

were pry marks around the lock on the rear door and deposits of mud near

the threshold. It must be the case that the thief entered through the rear door

and left through the front.

★**10.** Th e *Encylopaedia Britannica* has an article on symbiosis. Th e *Encyclopedia*

*Americana,* like the *Britannica,* is an excellent reference work. Th erefore, the

*Americana* probably also has an article on symbiosis.

**11.** Cholesterol is endogenous with humans. Th erefore, it is manufactured inside

the human body.

**12.** Either classical culture originated in Greece, or it originated in Egypt. Classical

culture did not originate in Egypt. Th erefore, classical culture originated in

Greece.

★**13.** World-renowned physicist Stephen Hawking says that the condition of the

universe at the instant of the Big Bang was more highly ordered than it is

today. In view of Hawking’s stature in the scientifi c community, we should

conclude that this description of the universe is correct.

**14.** If Alexander the Great died from typhoid fever, then he became infected in

India. Alexander the Great did die from typhoid fever. Th erefore, he became

infected in India.

**15.** Crater Lake, the deepest lake in the United States, was caused by a huge volca

nic eruption 7700 years ago. Since human beings have lived around the moun

tain for more than 10,000 years, it is likely that people witnessed that eruption.

(National Park Service, “Crater Lake—Its History”)

★**16.** Each element, such as hydrogen and iron, has a set of gaps—wavelengths that

it absorbs rather than radiates. So if those wavelengths are missing from the

spectrum, you know that that element is present in the star you are observing.

(Rick Gore, “Eyes of Science”)

**17.** Because the apparent daily movement which is common to both the planets

and the fi xed stars is seen to travel from the east to the west, but the far slower

single movements of the single planets travel in the opposite direction from

west to east, it is therefore certain that these movements cannot depend on

the common movement of the world but should be assigned to the planets

themselves.

(Johannes Kepler, *Epitomy of Copernican Astronomy*)

**18.** Reserves of coal in the United States have an energy equivalent 33 times that

of oil and natural gas. On a worldwide basis the multiple is about 10. By shift -

ing to a coal-based economy, we could satisfy our energy requirements for at

least a century, probably longer.

(William L. Masterson and Emil J. Slowinski, *Principles of Chemistry*)

**Section 1.3** Deduction and Induction 41

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**1** ★**19.** When the Romans occupied England, coal was burned. Since coal produces  quite a bit of soot and sulfur dioxide, there must have been days almost 2000

years ago when the air in the larger towns was badly polluted.

(Stanley Gedzelman, The Science and Wonders of the Atmosphere)

**20.** Th e graphical method for solving a system of equations is an approximation, since reading the point of intersection depends on the accuracy with which

the lines are drawn and on the ability to interpret the coordinates of the point.

(Karl J. Smith and Patrick J. Boyle, *Intermediate Algebra for College*

*Students*)

**21.** Th at [the moons of Jupiter] revolve in unequal circles is manifestly deduced from the fact that at the longest elongation from Jupiter it is never possible to

see two of these moons in conjunction, whereas in the vicinity of Jupiter they

are found united two, three, and sometimes all four together.

(Galileo Galilei, *The Starry Messenger*)

★**22.** Lenses function by refracting light at their surfaces. Consequently, their action

depends not only on the shape of the lens surfaces, but also on the indices of

refraction of the lens material and the surrounding medium.

(Frank J. Blatt, *Principles of Physics,* 2nd ed.)

**23.** Given present growth rates in underdeveloped countries, the limited practice of birth control, and the diffi culty of slowing the current growth momentum,

it can be said with virtual certainty that none of the people now reading this

book will ever live in a world where the population is not growing.

(J. John Palen, *Social Problems*)

**24.** The interpretation of the laws is the proper and peculiar province of the courts. A constitution is, in fact, and must be regarded by the judges, as a fun

damental law. It therefore belongs to them to ascertain its meaning, as well as

the meaning of any particular act proceeding from the legislative body.

(Alexander Hamilton, *Federalist Papers,* No. 78)

★**25.** Th e Simpson incident had shown me that a dog was kept in the stables, and

yet, though someone had been in and had fetched out a horse, he had not

barked enough to arouse the two lads in the loft . Obviously the midnight visi

tor was someone whom the dog knew well.

(A. Conan Doyle, *Memoirs of Sherlock Holmes*)

**26.** Eternity is simultaneously whole. But time has a before and an aft er. Th erefore time and eternity are not the same thing.

(Thomas Aquinas, *Summa Theologica*)

**27.** Ordinary things that we encounter every day are electrically neutral. Th erefore, since negatively charged electrons are a part of everything, positively charged

particles must also exist in all matter.

(James E. Brady and Gerard E. Humiston, *General Chemistry*)

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★**28.** Animals that live on plant foods must eat large quantities of vegetation, and **1** this consumes much of their time. Meat eaters, by contrast, have no need  to eat so much or so often. Consequently, meat-eating hominines [early

humans] may have had more leisure time available to explore and manipulate

their environment; like lions and leopards, they would have time to spend

lying around and playing.

(William A. Haviland, *Cultural Anthropology,* 8th ed.)

**29.** We tell people not to speed, but equip cars with air bags in case they do. So

what’s wrong with telling kids not to have sex, but making Plan B available in

case they do?

(Susan Beck, letter to the editor)

**30.** Because the moon moves relative to the earth so that it returns to the same

position overhead aft er about 25 hours, there are two high and two low tides

at any point every 25 hours.

(Douglas C. Giancoli, *The Ideas of Physics,* 3rd ed.)

**II.** Defi ne the following terms:

deductive argument argument from analogy

inductive argument generalization

argument based on prediction

mathematics argument from authority

argument from defi nition argument based on signs

categorical syllogism causal inference

hypothetical syllogism particular statement

disjunctive syllogism general statement

**III.** Answer “true” or “false” to the following statements:

**1.** In an inductive argument, it is intended that the conclusion contain more

information than the premises.

**2.** In a deductive argument, the conclusion is not supposed to contain more

information than the premises.

**3.** The form of argumentation the arguer uses may allow one to determine

whether an argument is inductive or deductive.

**4.** Th e actual strength of the link between premises and conclusion may allow

one to determine whether an argument is inductive or deductive.

**5.** A geometrical proof is an example of an inductive argument.

**6.** Most arguments based on statistical reasoning are deductive.

**7.** If the conclusion of an argument follows merely from the defi nition of a word

used in a premise, the argument is deductive.

**8.** An argument that draws a conclusion about a thing based on that thing’s sim

ilarity to something else is a deductive argument.

**9.** An argument that draws a conclusion that something is true because some

one has said that it is, is a deductive argument.

**Section 1.3** Deduction and Induction 43

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**1 10.** An argument that presents two alternatives and eliminates one, leaving the other as the conclusion, is an inductive argument.

**11.** An argument that proceeds from knowledge of a cause to knowledge of an eff ect is an inductive argument.

**12.** If an argument contains the phrase “it defi nitely follows that,” then we know for certain that the argument is deductive.

**13.** An argument that predicts what will happen in the future, based on what has happened in the past, is an inductive argument.

**14.** Inductive arguments always proceed from the particular to the general.

**15.** Deductive arguments always proceed from the general to the particular.

**IV.** Page through a book, magazine, or newspaper and fi nd two arguments, one induc tive and the other deductive. Copy the arguments as written, giving the appropri ate reference. Th en identify the premises and conclusion of each.

**1.4**

Validity, Truth, Soundness, Strength, Cogency

This section introduces the central ideas and terminology required to evaluate arguments. We have seen that every argument makes two basic claims: a claim that evidence or reasons exist and a claim that the alleged evidence or reasons support something (or that something follows from the alleged evidence or reasons). Th e fi rst is a factual claim, the second an inferential claim. Th e evaluation of every argument centers on the evaluation of these two claims. Th e more important of the two is the inferential claim, because if the premises fail to support the conclusion (that is, if the reasoning is bad), an argument is worthless. Th us, we will always test the inferential claim fi rst, and only if the premises do support the conclusion will we test the factual claim (that is, the claim that the premises present genuine evidence, or are true). Th e material that follows considers fi rst deductive arguments and then inductive.

Deductive Arguments

Th e previous section defi ned a deductive argument as one incorporating the claim that it is impossible for the conclusion to be false given that the premises are true. If this claim is true, the argument is said to be valid. Th us, a **valid deductive argument** is an argument in which it is impossible for the conclusion to be false given that the premises are true. In these arguments the conclusion follows with strict necessity from the premises. Conversely, an **invalid deductive argument** is a deductive argument in which it *is* possible for the conclusion to be false given that the premises are true. In these arguments the conclusion does not follow with strict necessity from the premises, even though it is claimed to.

An immediate consequence of these defi nitions is that there is no middle ground between valid and invalid. Th ere are no arguments that are “almost” valid and “almost”

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invalid. If the conclusion follows with strict necessity from the premises, the argument **1** is valid; if not, it is invalid. To test an argument for validity we begin by assuming that all the premises are true,

and then we determine if it is possible, in light of that assumption, for the conclusion

to be false. Here is an example:

All television networks are media companies.

NBC is a television network.

Therefore, NBC is a media company.

In this argument both premises are actually true, so it is easy to *assume* that they are

true. Next we determine, in light of this assumption, if it is possible for the conclusion

to be false. Clearly this is not possible. If NBC is included in the group of television net

works (second premise) and if the group of television networks is included in the group

of media companies (fi rst premise), it necessarily follows that NBC is included in the

group of media companies (conclusion). In other words, assuming the premises to be

true and the conclusion false entails a strict *contradiction.* Th us, the argument is valid.

Here is another example:

All automakers are computer manufacturers.

United Airlines is an automaker.

Therefore, United Airlines is a computer manufacturer.

In this argument, both premises are actually false, but it is easy to assume that they

are true. Every automaker could have a corporate division that manufactures com

puters. Also, in addition to fl ying airplanes, United Airlines could make cars. Next,

in light of these assumptions, we determine if it is possible for the conclusion to be

false. Again, we see that this is not possible, by the same reasoning as the previous

example. Assuming the premises to be true and the conclusion false entails a contra

diction. Th us, the argument is valid.

Another example:

All banks are fi nancial institutions.

Wells Fargo is a fi nancial institution.

Therefore, Wells Fargo is a bank.

As in the fi rst example, both premises of this argument are true, so it is easy to assume

they are true. Next we determine, in light of this assumption, if it is possible for the

conclusion to be false. In this case it *is* possible. If banks were included in one part

of the group of fi nancial institutions and Wells Fargo were included in another part,

then Wells Fargo would *not* be a bank. In other words, assuming the premises to be

true and the conclusion false does not involve any contradiction, and so the argument

is invalid.

In addition to illustrating the basic idea of validity, these examples suggest an

important point about validity and truth. In general, validity is not something that is

uniformly determined by the actual truth or falsity of the premises and conclusion.

Both the NBC example and the Wells Fargo example have actually true premises and

an actually true conclusion, yet one is valid and the other invalid. Th e United Airlines

example has actually false premises and an actually false conclusion, yet the argument

**Section 1.4** Validity, Truth, Soundness, Strength, Cogency 45

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**1** is valid. Rather, validity is something that is determined by the *relationship* between  premises and conclusion. Th e question is not whether the premises and conclusion are true or false, but whether the premises *support* the conclusion. In the examples of valid arguments the premises do support the conclusion, and in the invalid case they do not. Nevertheless, there is *one* arrangement of truth and falsity in the premises and

conclusion that does determine the issue of validity. Any deductive argument having actually true premises and an actually false conclusion is invalid. Th e reasoning behind this fact is fairly obvious. If the premises are actually true and the conclusion is actually false, then it certainly is *possible* for the premises to be true and the conclusion false. Th us, by the defi nition of invalidity, the argument is invalid.

Th e idea that any deductive argument having actually true premises and a false con

clusion is invalid may be the most important point in all of deductive logic. Th e entire system of deductive logic would be quite useless if it accepted as valid any inferential process by which a person could start with truth in the premises and arrive at falsity in the conclusion.

Table 1.1 presents examples of deductive arguments that illustrate the various

combinations of truth and falsity in the premises and conclusion. In the examples hav ing false premises, both premises are false, but it is easy to construct other examples having only one false premise. When examining this table, note that the only combi nation of truth and falsity that does not allow for *both* valid and invalid arguments is true premises and false conclusion. As we have just seen, any argument having this combination is necessarily invalid.

TABLE 1.1 DEDUCTIVE ARGUMENTS

| **Valid** |
| --- |
| All wines are beverages.  Chardonnay is a wine.  Therefore, chardonnay is  a beverage.  [sound] |
| None exist. |
| All wines are soft drinks.  Ginger ale is a wine.  Therefore, ginger ale is a  soft drink.  [unsound] |
| All wines are whiskeys.  Ginger ale is a wine.  Therefore, ginger ale is  a whiskey.  [unsound] |

**Invalid**

**True** All wines are beverages.

**premises** Chardonnay is a beverage.

**True** Therefore, chardonnay is a wine. **conclusion**[unsound]

**True** All wines are beverages.

**premises** Ginger ale is a beverage.

**False**Therefore, ginger ale is a wine.

**conclusion** [unsound]

**False** All wines are whiskeys.

**premises** Chardonnay is a whiskey.

**True** Therefore, chardonnay is a wine. **conclusion**[unsound]

**False** All wines are whiskeys.

**premises** Ginger ale is a whiskey.

**False** Therefore, ginger ale is a wine.

**conclusion**[unsound]

Th e relationship between the validity of a deductive argument and the truth or falsity

of its premises and conclusion, as illustrated in Table 1.1, is summarized as follows:

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**1 Premises Conclusion Validity**

T T?

T F Invalid

F T?

F F?

Th is short summary table reinforces the point that merely knowing the truth or falsity of the premises and conclusion tells us nothing about validity except in the one case of true premises and false conclusion. Any deductive argument having true prem ises and a false conclusion is necessarily invalid.

A **sound argument** is a deductive argument that is *valid* and has *all true premises.* Both conditions must be met for an argument to be sound; if either is missing the argument is unsound. Th us, an **unsound argument** is a deductive argument that is invalid, has one or more false premises, or both. Because a valid argument is one such that it is impossible for the premises to be true and the conclusion false, and because a sound argument does in fact have true premises, it follows that every sound argument, by defi nition, will have a true conclusion as well. A sound argument, therefore, is what is meant by a “good” deductive argument in the fullest sense of the term.

Sound

argument

Valid

= + argument

All true premises

In connection with this defi nition of soundness, a single proviso is required: For

an argument to be unsound, the false premise or premises must actually be needed to support the conclusion. An argument having a conclusion that is validly supported by true premises but having a superfluous false premise would still be sound. By similar reasoning, no addition of a false premise to an originally sound argument can make the argument unsound. Such a premise would be superfl uous and should not be considered part of the argument. Analogous remarks, incidentally, extend to induction.

Inductive Arguments

Section 1.3 defi ned an inductive argument as one incorporating the claim that it is improbable that the conclusion be false given that the premises are true. If this claim is true, the argument is said to be strong. Th us, a **strong inductive argument** is an inductive argument in which it is improbable that the conclusion be false given that the premises are true. In such arguments, the conclusion does in fact follow prob

ably from the premises. Conversely, a **weak inductive argument** is an argument in which the conclusion does not follow probably from the premises, even though it is claimed to.

**Section 1.4** Validity, Truth, Soundness, Strength, Cogency 47

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**1** All inductive arguments depend on what philosophers call the uniformity of  nature. According to this principle, the future tends to replicate the past, and regulari ties that prevail in one spatial region tend to prevail in other regions. For example, in the past, sugar has always tasted sweet. According to the uniformity of nature, sugar will continue to taste sweet in the future. Also, just as sugar tastes sweet in Los Angeles, so does it in New York, London, and everywhere else. The uniformity of nature is the ultimate basis for our judgments about what we naturally expect to occur. Good inductive arguments are those that accord with the uniformity of nature. Th ey have conclusions that we naturally expect to turn out true. If the conclusion of such an argument should turn out to be false, in violation of our expectations, this occurrence would cause us to react with surprise.

Th e procedure for testing the strength of inductive arguments runs parallel to the

procedure for deduction. First we assume the premises are true, and then we deter mine whether, based on that assumption, the conclusion is probably true. Th is deter mination is accomplished by linking up the premises with regularities that exist in our experiential background. For example, if the argument is a causal inference, we link the information in the premises with known causal patterns. If the argument is an argument from signs, we connect the information in the premises with what we know about signs: some kinds of signs are trustworthy, others are not. If the argument is a generalization, we connect the information in the premises with what we know about a sample being representative of a population. All of these regularities are instance of the uniformity of nature. Here is an example of a prediction:

All dinosaur bones discovered to this day have been at least 50 million years old.

Therefore, probably the next dinosaur bone to be found will be at least 50 million

years old.

In this argument the premise is actually true. Given that all dinosaur bones discovered to date have been over 50 million years old (and that thousands of such bones have been discovered), the uniformity of nature dictates that the next one to be discovered will also be over 50 million years old. This is what we would naturally expect, and anything to the contrary would be highly surprising. Th us, the conclusion is probably true, and so the argument is strong.

Here is another example:

All meteorites found to this day have contained salt. Therefore, probably the next

meteorite to be found will contain salt.

Th e premise of this argument is clearly false; but if we assume it to be true, then we would naturally expect that the next meteorite to be found would contain salt. Th us, the argument is strong.

Th e next example is an argument from analogy:

Dom Pérignon champagne, which is made in France, sells for over 100 dollars per

bottle. Marquis de la Tour is also a French champagne. Therefore probably it, too,

sells for over 100 dollars per bottle.

In this argument the premises are actually true, but our background experience tells us that the mere fact that two wines come from the same country does not imply that

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they sell for the same price. Th us, the argument is weak. Th e conclusion, incidentally, **1** happens to be false. Another example:

During the past fi fty years, infl ation has consistently reduced the value of the

American dollar. Therefore, industrial productivity will probably increase in the

years ahead.

In this argument, the premise is actually true and the conclusion is probably true in the

actual world, but the probability of the conclusion is in no way based on the assump

tion that the premise is true. Because there is no direct connection between infl ation

and increased industrial productivity, the premise is irrelevant to the conclusion and it

provides no probabilistic support for it. Th e conclusion is probably true independently

of the premise. As a result, the argument is weak.

This last example illustrates an important distinction between strong inductive

arguments and valid deductive arguments. As we will see in later chapters, if the con

clusion of a deductive argument is necessarily true independently of the premises, the

argument is still considered valid. But if the conclusion of an inductive argument is

probably true independently of the premises, the argument is weak.

Th ese four examples show that in general the strength or weakness of an inductive

argument results not from the actual truth or falsity of the premises and conclusion,

but from the probabilistic support the premises give to the conclusion. Th e dinosaur

argument has a true premise and a probably true conclusion, and the meteorite argu

ment has a false premise and a probably false conclusion; yet both are strong because

the premise of each provides probabilistic support for the conclusion. Th e industrial

productivity argument has a true premise and a probably true conclusion, but the

argument is weak because the premise provides no probabilistic support for the con

clusion. As in the evaluation of deductive arguments, the only arrangement of truth

and falsity that establishes anything is true premises and probably false conclusion (as

in the Dom Pérignon argument). Any inductive argument having true premises and a

probably false conclusion is weak.

Before proceeding further, however, we must qualify and explain this last statement.

When we speak of the premises being true, we mean “true” in a complete sense. Th e

premises must not exclude or overlook some crucial piece of evidence that undermines

the stated premises and requires a diff erent conclusion. Th is proviso is otherwise called

the *total evidence requirement*. If the total evidence requirement is not met, an argu

ment might have literally true premises and a probably false conclusion and still be

strong. Also, when we speak of the conclusion being probably false, we mean probably

false in the actual world in light of all the known evidence.

Table 1.2 presents the various possibilities of truth and falsity in the premises

and conclusion of inductive arguments. Note that the only arrangement of truth

and falsity that is missing for strong arguments is true premises and probably false

conclusion.

**Section 1.4** Validity, Truth, Soundness, Strength, Cogency 49

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**1**

TABLE 1.2 INDUCTIVE ARGUMENTS

| **Strong** |
| --- |
| All previous U.S. presidents  were older than 40.  Therefore, probably the next U.S. president will be older than 40.  [cogent] |
| None exist |
| All previous U.S. presidents  were TV debaters.  Therefore, probably the next U.S. president will be a TV debater. [uncogent] |
| All previous U.S. presidents  died in offi ce.  Therefore, probably the next  U.S. president will die in offi ce. [uncogent] |

**True premise**

**Probably true**

**conclusion**

**True premise**

**Probably false**

**conclusion**

**False premise**

**Probably true**

**conclusion**

**False premise**

**Probably false**

**conclusion**

**Weak**

A few U.S. presidents were lawyers.

Therefore, probably the next U.S. president will be older than 40.

[uncogent]

A few U.S. presidents were unmarried.

Therefore, probably the

next U.S. president will be unmarried.

[uncogent]

A few U.S. presidents were dentists.

Therefore, probably the next U.S. president will be a TV debater. [uncogent]

A few U.S. presidents were dentists.

Therefore, probably the next U.S. president will be a dentist. [uncogent]

The relationship between the strength of an inductive argument and the truth or

falsity of its premises and conclusion, as illustrated in Table 1.2, is summarized as follows:

**Premises Conclusion Strength**

T prob. T ?

T prob. F Weak

F prob. T ?

F prob. F ?

Like the summary table for deduction, this brief table reinforces the point that

merely knowing the truth conditions of the premises and conclusion tells us nothing about the strength of an argument except in the one case of true premises and prob ably false conclusion. Any inductive argument having true premises (in the sense just explained) and a probably false conclusion is weak.

Unlike the validity and invalidity of deductive arguments, the strength and weak

ness of inductive arguments admit of degrees. To be considered strong, an inductive argument must have a conclusion that is more probable than improbable. In other words, given that the premises are true, the likelihood that the conclusion is true must be more than 50 percent, and as the probability increases, the argument becomes stronger. For this purpose, consider the following pair of arguments:

This barrel contains 100 apples.

Three apples selected at random were found to be ripe.

Therefore, probably all 100 apples are ripe.

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Eighty apples selected at random were found to be ripe. **1**

This barrel contains 100 apples.

Therefore, probably all 100 apples are ripe.

Th e fi rst argument is weak and the second is strong. However, the fi rst is not abso lutely weak nor the second absolutely strong. Both arguments would be strengthened or weakened by the random selection of a larger or smaller sample. For example, if the size of the sample in the second argument were reduced to seventy apples, the argu ment would be weakened. Th e incorporation of additional premises into an inductive argument will also generally tend to strengthen or weaken it. For example, if the prem ise “One unripe apple that had been found earlier was removed” were added to either argument, the argument would be weakened.

A **cogent argument** is an inductive argument that is *strong* and has *all true premises*. Also, the premises must be true in the sense of meeting the *total evidence requirement.* If any one of these conditions is missing, the argument is *uncogent*. Th us, an **uncogent argument** is an inductive argument that is weak, has one or more false premises, fails to meet the total evidence requirement, or any combination of these. A cogent argument is the inductive analogue of a sound deductive argument and is what is meant by a “good” inductive argument without qualifi cation. Because the conclusion of a cogent argument is genuinely supported by true premises, it follows that the conclusion of every cogent argument is probably true in the actual world in light of all the known evidence.

Cogent

argument

Strong

= + argument

All true premises

As an illustration of the need for the total evidence requirement, consider the

following argument:

Swimming in the Caribbean is usually lots of fun. Today the water is warm, the surf is

gentle, and on this beach there are no dangerous currents. Therefore, it would be

fun to go swimming here now.

If the premises refl ect all the important factors, then the argument is cogent. But

if they ignore the fact that several large dorsal fins are cutting through the water (suggesting sharks), then obviously the argument is not cogent. Thus, for cogency the premises must not only be true but also not overlook some important fact that requires a diff erent conclusion.

Summary

For both deductive and inductive arguments, two separate questions need to be

answered: (1) Do the premises support the conclusion? (2) Are all the premises true? To answer the fi rst question we begin by *assuming* the premises to be true. Th en, for deductive arguments we determine whether, in light of this *assumption*, it necessarily

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**1** 

**1** Eminent Logicians Chrysippus 280–206 B.C. 



**C**hrysippus was born in Soli, a city located  

in the south east coast of Asia Minor. Early

in life he moved to Athens, where he

studied under the Stoic philosopher Cleanthes, who in turn was a student of Zeno of Citium, the founder of Stoicism. Upon Cleanthes’ death in 232 B.C., Chrysippus took over as leader of the school, and he produced over 700 treatises that systematized Stoic teaching. All of these works have been lost, but fragments survive in the writings of Cicero, Seneca, and others. Because of his extraordinary contribution, Chrysippus 

is considered to be the second founder of Stoicism. 

Stoicism derives its name from the Greek word 

*stoa,* which means porch; stoic philosophers used to gather on a porch in the Agora (public square) in Athens to discuss their views. The stoics prized the virtue of self-suffi ciency, and they emphasized the importance of not allowing oneself to be carried away by emotions or passions such as fear or love. Emotions are considered to be false judgments about the goodness or badness of something. The 

proper therapy for those victimized by emotions is to persuade them that these judgments are indeed false because they constitute obstacles to true happiness.

Chrysippus is often considered to be the orig 

inator of propositional logic. Unlike Aristotelian logic, where the fundamental components are terms, in propositional logic the fundamental components are whole propositions or state

ments. Aristotle had overlooked this kind of logic, but his close friend and successor Theophrastus worked out some of the logic of the pure hypo thetical syllogism (If *A* then *B,* if *B* then *C;* there fore if *A* then *C*). Also, Philo of Megara introduced the truth functional interpretation of the mate rial conditional (If *A,* then *B*). Beginning at this point, Chrysippus advanced propositional logic to a high level of development. 

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C h r y s i p p u s 

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and compound,

and he intro 

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and implication, and Chrysippus showed how the truth value of a compound statement is a function of the truth  values of its simple components. Chrysippus also introduced a set of rules of inference includ ing what is today called *modus ponens, modus tollens,* disjunctive syllogism, and a rule similar to De Morgan’s rule. Finally, he introduced the theory of natural deduction by which the con 

clusion of an argument can be derived from its premises through a series of discrete steps. The broader philosophy of Chrysippus is char acterized by monism and determinism. While most of us think that the universe is made up of millions of discrete entities, Chrysippus argued that in fact only one substance exists, and what appear to be individual substances are really parts of this one primary substance. Furthermore, everything that occurs is strictly governed by fate. Yet, in the face of this rigid causal determinism Chrysippus held that humans are responsible for their actions, and he tried in many ways to prove that the two view points are in fact compatible with each other. 



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follows that the conclusion is true. If it does, the argument is valid; if not, it is invalid. **1** For inductive arguments we determine whether it probably follows that the conclusion  is true. If it does, the argument is strong; if not, it is weak. For inductive arguments we keep in mind the requirements that the premises actually support the conclusion and that they not ignore important evidence. Finally, if the argument is either valid or strong, we turn to the second question and determine whether the premises are actu ally true. If all the premises are true, the argument is sound (in the case of deduction) or cogent (in the case of induction). All invalid deductive arguments are unsound, and all weak inductive arguments are uncogent.

Th e various alternatives open to statements and arguments may be diagrammed as follows. Note that in logic one never speaks of an argument as being “true” or “false,” and one never speaks of a statement as being “valid,” “invalid,” “strong,” or “weak.”

True

Statements

False

Deductive

Arguments

Groups of statements

Deductive arguments

Inductive arguments

Exercise 1.4

Nonarguments

Valid

Invalid

(all are unsound)

Strong

Weak

(all are uncogent)

Inductive

Sound

Unsound

Cogent

Uncogent

**I.** The following arguments are deductive. Determine whether each is valid or invalid, and note the relationship between your answer and the truth or falsity

of the premises and conclusion. Finally, determine whether the argument is sound

or unsound.

★**1.** Since *Moby Dick* was written by Shakespeare, and *Moby Dick* is a science

fi ction novel, it follows that Shakespeare wrote a science fi ction novel.

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**1 2.** Since London is north of Paris and south of Edinburgh, it follows that Paris is south of Edinburgh.

**3.** If George Washington was beheaded, then George Washington died. George Washington died. Th erefore, George Washington was beheaded.

★**4.** The longest river in South America is the Amazon, and the Amazon flows

through Brazil. Th erefore, the longest river in South America fl ows through

Brazil.

**5.** Since the Spanish-American War occurred before the U.S. Civil War, and the U.S. Civil War occurred aft er the Korean War, it follows that the Spanish

American War occurred before the Korean War.

**6.** Th e Empire State Building is taller than the Statue of Liberty, and the Statue of Liberty is taller than the Eiff el Tower. Th erefore, the Empire State Building is

taller than the Eiff el Tower.

★**7.** All leopards with lungs are carnivores. Th erefore, all leopards are carnivores.

**8.** Chicago is a city in Michigan and Michigan is part of the United States. Th erefore, Chicago is a city in the United States.

**9.** If President Barack Obama was born in Massachusetts, then he is a native of New England. Barack Obama is not a native of New England. Th erefore,

Barack Obama was not born in Massachusetts.

★**10.** Every province in Canada has exactly one city as its capital. Therefore,

since there are thirty provinces in Canada, there are thirty provincial

capitals.

**11.** Since the Department of Defense Building outside Washington, D.C., has the shape of a hexagon, it follows that it has seven sides.

**12.** Since Winston Churchill was English, and Winston Churchill was a famous statesman, we may conclude that at least one Englishman was a famous

statesman.

★**13.** Since some fruits are green, and some fruits are apples, it follows that some

fruits are green apples.

**14.** All physicians are individuals who have earned degrees in political science, and some lawyers are physicians. Th erefore, some lawyers are persons who

have earned degrees in political science.

**15.** Th e United States Congress has more members than there are days in the year. Th erefore, at least two members of Congress have the same birthday.

**II.** The following arguments are inductive. Determine whether each is strong or weak, and note the relationship between your answer and the truth or falsity of the

premise(s) and conclusion. Th en determine whether each argument is cogent or

uncogent.

★**1.** Th e grave marker at Arlington National Cemetery says that John F. Kennedy

is buried there. It must be the case that Kennedy really is buried in that

cemetery.

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