

Basic Concepts

Everyone thinks. Everyone **reasons.** Everyone **argues.** And everyone is subjected to the reasoning and arguing of others. We are bombarded daily with reasoning from many sources: books, speeches, radio, TV newspapers, employers, friends, and family.

Some people think well, reason well, and argue well. Some do not. The ability to think, reason, and argue well is partly a matter of natural gifts. But whatever our natural gifts, they can be refined and sharpened. And the study of logic is one of the best ways to refine one's natural ability to reason and argue. Through the study of logic, one learns strategies for thinking well, common errors in reasoning to avoid, and effective techniques for evaluating arguments.

But what is logic? Roughly speaking, **logic** is the study of methods for evaluating arguments. More precisely, logic is the study of methods for evaluating whether the premises of an argument adequately support (or provide good evidence for) its conclusion. To get a better grasp of what logic is, then, we need to understand the key concepts invoked in this definition: *argument*, *premise*, *conclusion*, and *support*. This chapter will give you an initial understanding of these basic concepts.

An argument is a set of statements, one of which, called the **conclusion**, is affirmed on the *basis* of the others, which are called the **premises**. The premises of an argument are offered as support (or evidence) for the conclusion, and that support (or evidence) may be adequate or inadequate in a given case. But **the set of statements counts as an argument as long as one statement is affirmed on the basis of others**. Here is an example of an argument:

1. All Quakers are pacifists. Jane is a Quaker. So, Jane is a pacifist

The word "so" indicates that the conclusion of this argument is "Jane is a pacifist." And the argument has **two premises--"All Quakers are pacifists" and "Jane is a Quaker"**

An argument is a set of statements, one of which, called the **conclusion**, is affirmed on the *basis* of the others, which are called the **premises**.

What is a statement? **A statement is a sentence that is either true or false.**

For example:

2. Some dogs are collies.
3. No dogs are collies.
4. Some dogs weigh exactly 124.379 pounds.

Statement (2) is true-that is, it describes things as they are. And (3) is false, because it describes things as other than they are. Truth and falsehood are the two possible **truth values**. So, we can say that a **statement is a sentence that has truth value**. The **truth value of (2) is true** while the **truth value of (3) is false**, but (2) and (3) are both statements. Is (4) a statement? Yes. You may not know its truth value, and perhaps no one does, but **(4) is either true or false**, and **hence it is a statement**.

Are any of the following items statements?

5. Get your dog off my lawn!
6. How many dogs do you own?
7. Let's get a dog.

Item **(5) is a command**, and one may obey or disobey a command, but it makes no sense to pronounce it true or false. So, although (5) is a sentence, it is **not a statement**. Item **(6) is a question**, and as such it is neither true nor false; hence, it is not a statement. Finally, **item (7) is a proposal**, and proposals are neither true nor false, so (7) is not a statement.¹

The **premises** of an argument are **the statements on the basis** of which the **conclusion is affirmed**.

To put it the other way around, the **conclusion** is the statement that is affirmed on the basis of the premises. In a well-constructed argument, the premises give good reasons for believing that the conclusion is true. But a poorly constructed argument is still an argument. For example, compare the following arguments:

8. All uncles are male. Chris is an uncle. Hence, Chris is male.
9. Some uncles are skinny. Chris is an uncle. So, Chris is skinny.

The premises of argument (8) support (or provide a basis for) the conclusion in this sense: If they are true, then the conclusion must be true. But the premises of (9) fail to support the conclusion adequately: Even if true, they do not provide good reason to believe that the conclusion is true. So, (9) is a bad argument, but it is still an argument.

Arguments are used frequently in our verbal and written interactions with others. And we may use arguments either to persuade others or to discover truth. For example, we often use arguments to persuade others to believe our political or ethical views. But we also use arguments as tools for discovering truth. Suppose a detective is investigating a crime: Who shot Alvin Smith? There are only two suspects, Griggs and Brooks. The detective establishes that Brooks was out of town at the time of the shooting and argues as follows:

10. Either Brooks or Griggs shot Smith. Brooks did not shoot Smith. Therefore, Griggs shot Smith.

In this case, the argument is used to discover truth. Of course, a given argument can be used both to discover truth and to persuade others to believe the conclusion. Persuasion and truth seeking are often compatible goals. Sometimes, however, one of these goals interferes with the other. For example, in a political campaign, one candidate might try to persuade the voters that his opponent is dishonest even though he knows his opponent is honest.

We now have a preliminary understanding of what logic is. We can gain a deeper understanding by taking a closer look at what it means for the conclusion of an argument to be adequately based on or supported by the premises. And we can best do this by exploring the basic concepts introduced in the remaining sections of this chapter—concepts such as validity, soundness, argument form, strength, and cogency.

Logic is the study of methods for evaluating whether the premises of an argument adequately support (or provide good evidence for) its conclusion.

1.1 Validity and Soundness

A valid argument is one in which the premises support the conclusion completely. More formally, a valid argument has this essential feature: It is necessary that if the premises are true, then the conclusion is true. Two key aspects of this definition should be noted immediately. First, note the important word “necessary.” In a valid argument, there is a necessary connection between the premises and the conclusion. The conclusion doesn't just happen to be true given the premises; rather, the truth of the conclusion is absolutely guaranteed given the truth of the premises. We could put this negatively by saying that a valid argument has this characteristic: It is impossible for the conclusion to be false assuming that the premises are true. Second, note the conditional (if-then) aspect of the definition. It does not say that the premises and conclusion of a valid argument are in fact true. Rather, the definition says that, necessarily, if the premises are true, then the conclusion is true. In other words, if an argument is valid, then on the assumption that its premises are true, its conclusion must be true also. Each of the following arguments is valid:

11. All biologists are scientists, John is not a scientist. So, John is not a biologist.

12. If Alice stole the diamonds, then she is a thief. And Alice did steal the diamonds; Hence, Alice is a thief.

13. Either Bill has a poor memory or he is lying. Bill does not have a poor memory. Therefore, Bill is lying.

In each case, it is necessary that if the premises are true, then the conclusion is true. Notice that one doesn't have to know whether the premises of an argument actually *are* true in order to determine its validity. One simply has to ascertain that the conclusion must be true *assuming* the premises are true.

In everyday English, the word *valid* is often used simply to indicate one's overall approval of an argument. But logicians focus their attention on the linkage between the premises and the conclusion rather than on the actual truth or falsity of the statements composing the argument. Thus, *valid* has a less precise meaning in ordinary English than it does for logicians.

The following observations about validity may help to prevent some common misunderstandings. First, notice that an argument can have one or more *false* premises and still be valid. For instance:

14. All birds have beaks. Some cats are birds. So, some cats have beaks.

Here, the second premise is plainly false, and yet the argument is valid, for *on the assumption* that the premises are true, the conclusion must be true also. And in the following argument, both premises are false, but the argument is still valid:

15. All sharks are birds. All birds are politicians. So, all sharks are politicians.

Although the premises of argument (15) are in fact false, if they *were* true, the conclusion would *have* to be true as well. It is *impossible* for the conclusion to be false *assuming that* the premises are true. So, the argument is valid.

Second, we cannot rightly conclude that an argument is valid simply on the grounds that its premises are all true. For example:

16. Some Americans are women. Clint Eastwood is an American. Therefore, Clint Eastwood is a woman.

The premises here are true, but the conclusion is in fact false. So, obviously, it is *possible* that the conclusion of argument (16) is false while its premises are true; hence, (16) is not valid. Is the following argument valid?

17. Some Americans work in the movie industry. Meryl Streep is an American, Hence, Meryl Streep works in the movie industry.

Here, we have true premises and a true conclusion. But it is *not necessary* that if the premises are true, then the conclusion is true. (Streep could switch to another line of work while remaining an American.) So, even if an argument has true premises and a true conclusion, it isn't necessarily valid, for the premises may not support the conclusion in the right way. (of course, in many cases, we simply do not know whether the premises of an argument are true or false, and yet we may know that the argument is valid.) Thus, the question "Are the premises actually true?" is distinct from the question "Is the argument valid?"

Third, suppose an argument is valid and has a false conclusion. Does it necessarily have at least one false premise? Yes. If it had true premises, then it would have to have a true conclusion,

since it is valid. **Validity preserves truth**; that is, if we start with truth and reason in a valid fashion, we will always wind up with truth.

Fourth, does validity also preserve falsehood? In other words, if we start with false premises and reason validly, are we bound to wind up with a false conclusion? It is tempting to answer yes, because "error in its own right breeds error— if the first step in an argument is wrong, everything that follows will be wrong."² But the correct answer is no. Consider the following argument:

18. All dogs are ants. All ants are mammals. So, all dogs are mammals.

Is argument (18) valid? Yes. It is impossible for the conclusion of (18) to be false *assuming that its premises are true*. However, the premises here are false while the conclusion is true. So, *validity does not preserve falsehood*. In fact, false premises plus valid reasoning may lead to either truth or falsity, depending on the case. Here is a valid argument with false premises and a false conclusion:

19. All birds are cats. Some dogs are birds. So, some dogs are cats.

The lesson here is that although valid reasoning guarantees that we will end up with truth if we start with it, we may wind up with either truth or falsehood if we reason validly from false premises.

A **valid argument** has this essential feature: It is necessary that if the premises are true, then the conclusion is true.

An **invalid argument** has this essential feature: It is *not necessary* that if the premises are true, then the conclusion is true. In other words, even on the assumption that the premises are true, the conclusion could still be false. Each of the following arguments is invalid:

20. All dogs are animals. All cats are animals. Hence, all dogs are cats.

21. If Pat is a wife, then Pat is a woman. But Pat is not a wife. So, Pat is not a woman,

22. Bill likes Sue. Therefore, Sue likes Bill.

The premises of argument (20) are in fact true, but its conclusion is false; so, (20) is obviously invalid. Argument (21) is invalid because its premises leave open the possibility that Pat is an unmarried woman. And (22) is invalid because even if Bill does like Sue, that is no guarantee that she likes him. In each of these cases, then, the conclusion could be false while (i.e., assuming that) the premises are true.

An **invalid argument** has this essential feature: It is not necessary that if the premises are true, then the conclusion is true.

Validity matters because true premises by themselves do not make good arguments. But we obviously want our arguments to have true premises. A **sound argument** has two essential features: *It is valid, and all its premises are true*. Notice that a sound argument cannot have a false conclusion. Because a sound argument is valid and has only true premises, it must have a true conclusion. Here are two sound arguments:

23. All collies are dogs. All dogs are animals. So, all collies are animals.

24. If Akron is in Ohio, then Akron is in the United States. Akron is in Ohio. Hence, Akron is in the United States.

Valid + All Premises True = Sound

An unsound **argument** falls into one of the following three categories:

It is valid but has at least one false premise.

It is invalid, but all its premises are true.

It is invalid *and* has at least one false premise.

In other words, an unsound argument is one that either is invalid or has at least one false premise.

For example, both of the following arguments are unsound:

25. All birds are animals. Some grizzly bears are not animals. Therefore, some grizzly bears are not birds.

26. All birds are animals. All grizzly bears are animals. So, all grizzly bears are birds.

Argument (25) is unsound, because although it is valid, it has a false (second) premise. And (26) is unsound, because although it has true premises, it is invalid. We can easily construct an unsound argument of the third type—that is, one that both is invalid and has at least one false premise—by replacing "birds" in (26) with "trees":

27. All trees are animals. All bears are animals. So, all bears are trees.

An **unsound argument** is one that either is invalid or has at least one false premise.

Here is a map of the main concepts we've discussed so far:

Arguments		
Valid Arguments		Invalid Arguments
Valid arguments with all premises true are sound.	Valid arguments with at least one false premise are unsound.	All invalid arguments are unsound.

Deductive logic is the part of logic that is concerned with tests for validity and invalidity.³ And much of this book is devoted to an exploration of deductive logic. In fact, the next two sections will provide us with some initial tests for establishing the validity and invalidity of arguments.

A note on terminology is in order at the close of this section. Given our definitions, **arguments** are neither true nor false, but each **statement** is either true or false. On the other hand, **arguments** can be valid, invalid, sound, or unsound; but **statements** cannot be valid, invalid, sound, or unsound. Therefore, a **given premise (or conclusion)** is either true or false, but it cannot be valid, invalid, sound, or unsound.

Summary of Definitions

An **argument** is a set of statements, one of which, called the *conclusion*, is affirmed on the basis of the others, which are called the *premises*.

Logic is the study of methods for evaluating whether the premises of an argument adequately support (or provide good evidence for) its conclusion.

A **valid argument** has this **essential feature**: it is necessary that if the premises are true, then the conclusion is true.

An **invalid argument** has this **essential feature**: It is not necessary that if the premises are true, then the conclusion is true.

A **sound argument** has **two essential** features: It is valid, and all its premises are true.

An **unsound argument** is one that either is invalid or has at least one false premise.

Deductive logic is the part of logic that concerns tests for validity and invalidity.

The following exercises provide you with an opportunity to explore the concepts introduced in this section.

Exercise 1.1

Note: For each exercise item preceded by an asterisk, the answer appears in the Answer Key at the end of the book.

Part A: Recognizing Statements: Which of the following are sentences? Which are statements?

- | | |
|--|--|
| * 1. The sky is blue. | 12. How are you? |
| 2. Let's paint the table red. | * 13. If seven is greater than six,
then six is greater than seven. |
| 3. Please close the window! | |
| * 4. Murder is wrong. | 14. Let's have lunch. |
| 5. Abraham Lincoln was born in 1983. | 15. Ouch! |
| 6. If San Francisco is in California,
then San Francisco is in the U.S.A. | * 16. Trees or. |
| * 7. It is not the case that Ben Franklin. | 17. Patrick Henry said,
"Give me liberty or give me death." |
| 8. "Why?" asked Socrates. | 18. If punishment deters crime. |
| 9. Table not yes if. | * 19. "Stand at attention!" ordered
General Bradley. |
| * 10. Either humans evolved from apes,
or apes evolved from humans. | 20. Despite the weather |
| 11. Davy Crockett died at the Alamo. | |

Part B: True or False? Which of the following statements are true? Which are false?

- * 1. All valid arguments have at least one false premise.
- 2. An argument is a set of statements, one of which, called the *conclusion*, is affirmed *on the basis* of the others, which are called the *premises*.
- 3. Every valid argument has true premises and *only* true premises.
- * 4. Logic is the study of methods for evaluating whether the premises of an argument adequately support its conclusion.
- 5. Some statements are invalid.
- 6. Every valid argument has true premises and a true conclusion.
- * 7. A sound argument can have a false conclusion.

8. Deductive logic is the part of logic that is concerned with tests for validity and invalidity.
9. If a valid argument has only true premises, then it must have a true conclusion.
- *10. Some arguments are true.
11. If a valid argument has only false premises, then it must have a false conclusion.
12. Some invalid arguments have false conclusions but (all) true premises.
- *13. Every sound argument is valid.
14. Every valid argument with a true conclusion is sound.
15. Every valid argument with a false conclusion has at least one false premise.
- *16. Every unsound argument is invalid.
17. Some premises are valid.
18. If all of the premises of an argument are true, then it is sound.
- *19. If an argument has (all) true premises and a false conclusion, then it is invalid.
20. If an argument has one false premise, then it is unsound.
21. Every unsound argument has at least one false premise.
- *22. Some statements are sound.
23. Every valid argument has a true conclusion.
24. Every invalid argument is unsound.
- *25. Some arguments are false.
26. If an argument is invalid, then it must have true premises and a false conclusion.
27. Every valid argument has this feature: Necessarily if its premises are true, then its conclusion is true.
- *28. Every invalid argument has this feature: It is possibly false that if its premises are true, then its conclusion is true.
29. Every sound argument has a true conclusion.
30. Every valid argument has this feature: Necessarily if its premises are false, then its conclusion is false.

Part C: Valid or Invalid? Much of this text concerns methods of testing arguments for validity. While we have not yet discussed any particular methods of testing arguments for validity, we do have definitions of "valid argument" and "invalid argument." Based on your current understanding, which of the following arguments are valid? Which are invalid?

- * 1. If Lincoln was killed in an automobile accident, then Lincoln is dead. Lincoln was killed in an automobile accident. Hence, Lincoln is dead.
2. If Lincoln was killed in an automobile accident, then Lincoln is dead. Lincoln was not killed in an automobile accident. Therefore, Lincoln is not dead.

3. If Lincoln was killed in an automobile accident, then Lincoln is dead. Lincoln is dead. So, Lincoln was killed in an automobile accident.

* 4. If Lincoln was killed in an automobile accident, then Lincoln is dead. Lincoln is not dead. Hence, Lincoln was not killed in an automobile accident.

5. Either 2 plus 2 equals 22 or Santa Claus is real. But 2 plus 2 does not equal 22. Therefore, Santa Claus is real.

6. Either we use nuclear power or we reduce our consumption of energy. If we use nuclear power, then we place our lives at great risk. If we reduce our consumption of energy then we place ourselves under extensive governmental control. So, either we place our lives at great risk or we place ourselves under extensive governmental control.

* 7. All birds are animals. No tree is a bird. Therefore, no tree is an animal.

8. Some humans are comatose. But no comatose being is rational. So, not every human is rational.

9. All animals are living things. At least one cabbage is a living thing. So, at least one cabbage is an animal.

* 10. Alvin likes Jane. Jane likes Chris. So, Alvin likes Chris.

11. All murderers are criminals. Therefore, all nonmurderers are noncriminals.

12. David is shorter than Saul. Saul is shorter than Goliath. It follows that David is shorter than Goliath.

* 13. It is possible that McGraw will win the next presidential election. It is possible that Lambert will win the next presidential election. Thus, it is possible that both McGraw and Lambert will win the next presidential election.

14. All physicians are singers. Madonna is a physician. Therefore, Madonna is a singer.

15. Samuel Morse invented the telegraph. Alexander Graham Bell did not invent the telegraph. Consequently, Morse is not identical with Bell.

Part D: Soundness Which of the following arguments are sound? Which are unsound? If an argument is unsound, explain why.

* 1. All cats are mammals. All mammals are animals. So, all cats are animals.

2. All collies are dogs. Some animals are not dogs. So, some animals are not collies.

3. All citizens of Nebraska are Americans. All citizens of Montana are Americans. So, all citizens of Nebraska are citizens of Montana.

* 4. "Let's party!" is either a sentence or a statement (or both). "Let's party!" is a sentence. So, "Let's party!" is not a statement.

5. No diamonds are emeralds. The Hope Diamond is a diamond. So, the Hope Diamond is not an emerald.

6. All planets are round. The earth is round. So, the earth is a planet.

*7. If the Taj Mahal is in Kentucky, then the Taj Mahal is in the U.S.A. But the Taj Mahal is not in the U.S.A. So, the Taj Mahal is not in Kentucky.

8. All women are married. Some executives are not married. So, some executives are not women.

9. All mammals are animals. No reptiles are mammals. So, no reptiles are animals.

*10. All mammals are cats. All cats are animals. So, all mammals are animals.

11. Wilber Wright invented the airplane. Therefore, Orville Wright did not invent the airplane.

12. All collies are dogs. Hence, all dogs are collies.

* 13. William Shakespeare wrote *Hamlet*. Leo Tolstoy is identical with William Shakespeare. It follows that Leo Tolstoy wrote *Hamlet*.

14. If San Francisco is in Saskatchewan, then San Francisco is in Canada. But it is not true that San Francisco is in Saskatchewan. Hence, it is not true that San Francisco is in Canada.

15. Either Thomas Jefferson was the first president of the U.S.A. or George Washington was the first president of the U.S.A., but not both. George Washington was the first president of the U.S.A. So, Thomas Jefferson was not the first president of the U.S.A.

1.4 Strength and Cogency

Our discussion to this point may leave the impression that, from a logical point of view, each argument is either valid or not, and if an argument is not valid, then it is entirely without logical merit. But matters are not quite this simple. Even if an argument is not valid, its premises may still provide significant support for its conclusion. A strong argument is one in which the premises provide *partial* support for the conclusion. More precisely, a **strong argument** has this essential feature: It is probable (but not necessary) that if its premises are true, then its conclusion is true. In other words, it is improbable (but possible) that the conclusion is false on *the assumption that the premises are true*. For example:

79. Ninety percent of American males over 50 years of age cannot run a mile in less than 6 minutes. Thomas is an American male over 50 years of age. So, Thomas cannot run a mile in less than 6 minutes.

The premises of argument (79) do not absolutely guarantee the truth of the conclusion. Possibly Thomas belongs to that small percentage of American men over 50 who can run a mile in less than 6 minutes. Nevertheless, it is probable that if the premises of (79) are true, then its conclusion is true also.

Now, let's alter argument (79) systematically to clarify the concept of strength. Suppose we replace "ninety" with "ninety-nine." Does the argument remain strong? Yes, of course. In fact, it is even stronger. This indicates that *strength*, unlike validity, is very much a matter of degree. Suppose we replace "ninety" with "fifty-one." Is the argument then strong? Strictly speaking, yes, because the conclusion remains *slightly* more probable than not. Of course, once we replace "ninety" with "fifty-one," the argument is of little value: The amount of support given to the conclusion is scarcely worth mentioning. But the important point to keep in mind is that because strength comes in degrees, we can legitimately speak of arguments that are *slightly* strong, *moderately* strong, or *very* strong. By contrast, it would make no sense to speak of "slightly valid" or "moderately valid" arguments. Validity is an all-or-nothing affair.

What if we replace "ninety" with "fifty" in argument (79)? Then the argument is not strong, but weak. A **weak argument** has this essential feature: *It is not probable that if its premises are true, then its conclusion is true*. If we replace "ninety" with "fifty," then it is as probable, given the premises, that Thomas *can* run the mile in less than 6 minutes as that he *cannot*. So, the argument is weak. And, of course, the argument becomes progressively weaker as we replace "ninety" with "forty," "thirty," and so on.

At the other end of the scale, what if we replace "Ninety percent of" with "all" in argument (79)? Does the argument remain strong? No. At that point, the argument becomes valid-necessarily, if its premises are true, its conclusion is true also. But, by definition, in a strong argument, it is *possible*

that the conclusion is false while the premises are true. Thus, no valid argument is strong, and no strong argument is valid.

A strong argument has this essential feature: It is probable (but not necessary) that if the premises are true, then the conclusion is true.

A weak argument has this essential feature: It is not probable that if its premises are true, then its conclusion is true.

We will explore the concept of strength more fully in subsequent chapters, but it will be helpful at this point to consider some additional examples of strong arguments, in order to underscore the fact that they come in very different types. For instance, **arguments from authority can be strong**. They have the following structure:

80. 1. *R* is a reliable authority regarding *S*.

2. *R* sincerely asserts that *S*.

So, 3. *S*.

(Here, "R" stands for a person or reference work, while "S" stands for any statement.) For example:

81. According to historian Howard Zinn, by 1933, the worst year of America's Great Depression, one-fourth to one-third of America's labor force was out of work. Therefore, one-fourth to one-third of American workers were unemployed in 1933.⁷

This appeal to authority is legitimate, but authorities can make mistakes, so it is possible that the conclusion of (81) is false while its premises are true-possible, but unlikely. Hence, the argument is strong. Yet it would be impossible to state the degree of strength with numerical precision.

Like arguments from authority, arguments from analogy are very common, and they, too, can be strong. The structure of an argument from analogy is as follows:

82. 1. Object (event or situation) *A* is similar to object (event or situation) *B* in certain relevant respects.

2. *B* has property *P*

So, 3. *A* has property *P* also.

Here is an example. Suppose Jack and Jill are riding horseback. Jill's horse jumps a fence, but Jack is unsure whether his horse can jump the fence. Jill points out that his horse is very similar to hers in size, speed, strength, and training. She adds that because Jack is an experienced rider and weighs no more than she does, Jack's horse is not operating with a handicap. She concludes that Jack's horse can jump the fence too. We could outline Jill's reasoning as follows:

83. Jack's horse is similar in relevant respects to Jill's horse (and is similarly situated).
Jill's horse is able to jump the fence. Hence, Jack's horse is able to jump the fence also.

This argument is not valid, because its conclusion can be false while its premises are true. For example, unknown to Jill, Jack's horse may have been given a drug that renders it unable to jump well today. Still, it is more probable than not that if the premises of (83) are true, then the conclusion is true, and hence the argument is at least slightly strong.

To say that an argument is strong is not to say that its premises are in fact true (just as to say that an argument is valid is *not* to say that its premises are in fact true). Let us use the phrase **cogent argument** to refer to any argument that is both strong and has only true premises (just as we use the phrase *sound argument* to refer to any argument that is both valid and has only true premises). Here is an example of a cogent argument:

84. All or nearly all lemons that have been tasted were sour. So, all or nearly all lemons are sour.

This argument is not valid, because the conclusion concerns not merely the lemons that have been tasted but lemons in general, *including* those that *have not been tasted*. And the premise does not rule out the *possibility* that a large percentage of untasted lemons are not sour. Nevertheless, it is unlikely that the conclusion is false given that the premise is true. And the premise is true. So, the argument is cogent.

A cogent argument can have a false conclusion, for its premises do not absolutely guarantee the truth of its conclusion. In this respect, cogent arguments differ markedly from sound arguments. A sound argument cannot have a false conclusion, because it is valid and all its premises are true. (And if a valid argument has only true premises, its conclusion must be true also.)

Strong + All Premises True = Cogent

An **uncogent argument** is one that is either (a) weak or (b) strong with at least one false premise. (Note that by this definition a weak argument with a false premise counts as uncogent.) Here is an example of an argument that is uncogent because it is weak:

85. Slightly less than 50 percent of Americans are men. Julia Roberts is an American. Therefore, Julia Roberts is a man.

Although argument (85) has true premises, the premises do not provide even partial support (in our technical sense) for the conclusion: It is *not* probable that if the premises are true, then the conclusion is true. (Note: This is not because Julia Roberts is a woman. If we replace "Julia Roberts" with "Woody Allen," the argument is still weak, even though its conclusion is true.) Here is an example of an argument that is uncogent because it is strong but has a false premise:

86. There is intelligent life on all of the following planets: Mercury, Venus, Earth, Jupiter, Uranus, Neptune, and Pluto. So, there is intelligent life on Mars.⁸

As far as we know, the premise of argument (86) is false, and so is the conclusion. But it is improbable that the conclusion is false on *the assumption that* the premise is true. So, the argument is strong but uncogent.

An **cogent argument** has two essential features:
It is strong, and all its premises are true.

An **uncogent argument** is one that is either
(a) weak or (b) strong with at least one false premise.

Note that according to our definitions, no sound argument is cogent, for no valid argument is strong. Similarly, no cogent argument is sound, since no strong argument is valid. Note also that a valid argument with a false premise is unsound, but it is not uncogent, because a valid argument is neither strong nor weak.

We have defined *deductive logic* as the part of logic that is concerned with methods of evaluating arguments for validity and invalidity. Let us now add that **inductive logic** is the part of logic that is concerned with methods of evaluating arguments for strength and weakness. Thus, we have defined deductive and inductive logic not in terms of the kinds of arguments they treat but in terms of the standards and methods employed. And indeed, we might use methods from both branches of logic on the same argument. For example, we might use a method from deductive logic to determine that an argument is invalid and then use a method from inductive logic to determine that the same argument is strong (or that it is weak). Since, by definition, any argument that is either strong or weak is invalid, we can draw a map of the main concepts discussed in this section as follows:

Invalid Arguments

Strong Arguments		Weak Arguments
Strong arguments with all premises true are cogent	Strong arguments with at least one false premise are uncogent .	Weak arguments are all uncogent

Note that strong arguments with at least one false premise are unsound (as well as uncogent). They are unsound for two reasons: (a) They are invalid, and (b) they have a false premise. Of course, weak arguments are also unsound, for every weak argument is invalid. And if a weak argument has at least one false premise, then it is unsound both because it is invalid and because it has a false premise.

A strong argument has this essential feature: It is probable (but not necessary) that if the premises are true, then the conclusion is true.

A weak argument has this essential feature: It is not probable that if its premises are true, then its conclusion is true.

A cogent argument has two essential features:
It is strong, and all its premises are true.

An **uncogent argument** is one that is either
(a) weak or (b) strong with at least one false premise.

Inductive logic is the part of logic that concerns tests for strength and weakness.

Some general remarks on terminology are in order. Notice that given our definitions, *arguments* can be strong, weak, cogent, or uncogent. But *arguments* are never true, and they are never false. Both *premises* and *conclusions* are either true or false. But neither *premises* nor *conclusions* are ever strong, weak, cogent, or uncogent.

Exercise 1.4

Part A: Matching In the space provided, write the letter of the item listed below best characterizes the numbered item..

- ___ 1. Valid
- ___ 2. Invalid
- ___ 3. Strong
- ___ 4. Weak
- ___ 5. Sound
- ___ 6. Cogent
- ___ 7. Statement
- ___ 8. Unsound
- ___ 9. Uncogent

- ___ 10. Deductive logic
- ___ 11. Inductive logic
- ___ 12. Logic
- ___ 13. Argument
- ___ 14. Arguments by analogy
- ___ 15. Arguments from authority

- A. A sentence that is either true or false.
- B. An argument that is either invalid or has a false premise.
- C. A strong argument with (all) true premises.
- D. The part of logic concerned with tests for validity and invalidity.
- E. It is not probable that if the premises are true, then the conclusion is true.
- F. A valid argument with (all) true premises.
- G. The part of logic concerned with tests for strength and weakness.
- H. The study of methods for testing whether the premises of an argument adequately support its conclusion.
- I. It is necessary that if the premises are true, then the conclusion is true.
- J. A set of statements, one of which, called the *conclusion*, is affirmed on the *basis* of the others, which are called the *premises*.
- K. R is a reliable authority regarding S. R sincerely asserts that S. So, S.
- L. An argument with the following essential feature: It is possible that the conclusion is false while the premises are true.
- M. Object *A* is similar to object *B* in certain relevant respects. *B* has property *P*. So, *A* has property *P* also.
- N. It is probable (but not necessary) that if the premises are true, then the conclusion is true.
- O. An argument that is either (a) weak or (b) strong but has a false premise.

Part B: True or False?

- * 1. All arguments having only true premises are cogent.
- 2. All strong arguments are cogent.
- 3. All weak arguments are uncogent.
- * 4. All arguments with a false premise are uncogent.
- 5. Some cogent arguments have a false conclusion.

6. Some sound arguments have a false conclusion.
- * 7. The following argument is true: "Over 90 percent of Americans speak English. Hank Williams is an American. So, Hank Williams speaks English."
8. The following argument is an argument from analogy: "According to *Flew's Dictionary of Philosophy*, the British philosopher Bertrand Russell died in 1970. So, Bertrand Russell died in 1970."
9. A strong argument has this essential feature: It is impossible for its conclusion to be false while its premises are true.
- * 10. Every uncogent argument has at least one false premise.
11. Every uncogent argument is weak.
12. Some arguments have valid premises, and some do not.
- * 13. The following argument is an argument from authority: "Scholars are like the Roman emperor Nero. Nero, you'll recall, played his violin while Rome burned. Similarly, scholars play with ideas while civilization is threatened by the 'flames' of greed, poverty, racism, and violence. Now, plainly, Nero was morally irresponsible. Hence, scholars are morally irresponsible also."
14. A strong argument has these two features: (a) It is possible that if its premises are true, its conclusion is false, and (b) it is probable that if its premises are true, then its conclusion is true.
15. A weak argument has this essential feature: It is not likely that if its premises are true, then its conclusion is true.

Part C: Valid or Invalid? Strong or Weak? As best you can determine, which of the following arguments are valid? Which invalid? Which are strong? Which weak?

- * 1. Fifty percent of serial killers were abused as children. Ted Bundy was a serial killer. Therefore, Bundy was abused as a child.
2. This lovely china plate is similar in size, weight, and composition to the one I just dropped. The one I just dropped broke. So, if I drop this lovely china plate, it will break.
3. According to Lillian Roxon's *Rock Encyclopedia*, Buddy Holly, who wrote "Peggy Sue," "That'll Be the Day," and other early rock hits, died in an airplane crash on February 3, 1959. So, Buddy Holly died in an airplane crash in 1959.
- * 4. One hundred percent of the frogs that have been dissected had hearts.
Therefore, 100 percent of the entire frog population have hearts.
5. It is always wrong to kill an innocent human intentionally. A fetus is an innocent human. So, it is always wrong to kill a fetus intentionally.
6. Research based on Gallup polls indicates that a random sample of 4000 is sufficient to support highly accurate conclusions about large populations—conclusions having a margin of error of only two percentage points. And according to a recent poll, 83 percent of a random sample of 4000 American voters favors Jones for president. Thus, approximately 83 percent of American voters favor Jones for president.
- * 7. A porpoise is similar to a human being. It has lungs rather than gills. It is warm-blooded rather than cold-blooded. And porpoises nurse their young with milk. Therefore, porpoises, like humans, are capable of speaking languages.
8. Every serial killer is a psychopath. Some criminals are not psychopaths. So, some criminals are not serial killers.
9. Ninety percent of the cars in the parking lot were vandalized, and your car was in the parking lot. Therefore, your car was vandalized.
- * 10. No spiders are humans. Dawn is a human. Thus, Dawn is not a spider.
11. AU observed emeralds have been green. Therefore, the next emerald to be observed

will be green.

12. Linda is younger than Maria. Hence, Maria is older than Linda.

* 13. According to H. W. Janson, professor of fine arts at New York University, the Norwegian artist Edward Munch painted *The Scream* in 1893. So, Munch painted *The Scream* prior to 1900. (See Janson's *History of Art* [New York: Abrams, 1971], p. 513.)

14. Sixty-five percent of the students at St. Ambrose College are Democrats. Joan is a student at St. Ambrose College. Therefore, Joan is a Democrat.

15. Mark Twain is identical with Samuel Clemens. Mark Twain wrote *Huckleberry Finn*. It follows that Samuel Clemens wrote *Huckleberry Finn*.

* 16. No circles are squares. All circles are figures. So, no figures are squares.

17. According to Lewis Hopfe, a noted authority on world religions, the religion called Jainism originated in India in the sixth century B.C.E. It is the goal of Jainism to liberate the soul from matter. All life, but especially animal life, is sacred to the Jains. And the Jains hold that the gods cannot help humans attain salvation. Therefore, at least one religion does not teach humans to rely on the gods for salvation. (See Hopfe's *Religions of the World*, 4th ed. [New York: Macmillan, 1987], pp. 134-138.)

18. In a certain factory, there is a machine that produces tin cans. Quality-control inspectors examine (in a random fashion) one-tenth of the tin cans produced by the machine. Of the tin cans examined by the inspectors, 5 percent are malformed. So, approximately 5 percent of all the tin cans produced by the machine are malformed.

* 19. Computers are similar to humans in that both are capable of complex calculations. Humans generally feel ashamed if they make a mistake. Hence, computers generally feel ashamed if they make a mistake.

20. According to the *Encyclopedia Britannica*, the first use of poison gas as a weapon in modern warfare occurred on April 22, 1915, when the Germans launched a highly successful chlorine gas attack against the Allied positions at Ypres, Belgium. So, the first use of poison gas as a weapon in modern warfare occurred on April 22, 1915.

Part D: Cogency Which of the following are cogent? Which are uncogent? (If the argument is uncogent, explain why.) Which of the arguments are neither cogent nor uncogent?

* 1. Most humans fear death. Woody Allen (the famous comedian and filmmaker) is a human. Therefore, Woody Allen fears death.

2. Fifty percent of the students at Seattle Pacific University are Republicans. Kathy is a student at Seattle Pacific University. So, Kathy is a Republican.

3. All humans are mortal. Socrates is a human. Hence, Socrates is mortal.

* 4. All of the birds that have been observed (in the entire history of the world) can fly. Therefore, all birds can fly.

5. War is similar to playing a game of chess. For instance, in both war and chess, strategy is important. And in both war and chess, there is a struggle for victory. Now, when one is losing a game of chess, one should not attack one's opponent with lethal weapons. So, when a nation is losing a war, it should not attack its opponent with lethal weapons.

6. Ninety percent of Americans speak Chinese. Harrison Ford (the famous actor) is an American. Thus, Harrison Ford speaks Chinese.

* 7. Sue is taller than Tom. Tom is taller than Fred. It follows that Sue is taller than Fred.

8. The vast majority of Americans are fluent speakers of English. The Queen of England is an American. So, the Queen of England is a fluent speaker of English.

9. Most Americans live in Nevada. Aretha Franklin (the famous singer) is an American. Hence, Aretha Franklin lives in Nevada.

* 10. Forty percent of students at Reed College are from the Northwest. Sally is a student at

Reed College. So, Sally is from the Northwest.

Notes

1. I have said that arguments are composed of statements. Some logicians would prefer to say that arguments are composed of *propositions*. For more about this issue, see section 3.1.
2. C. S. Lewis, *The Problem of Pain* (New York: Macmillan, 1962), p.116.
3. My characterizations of deductive and inductive logic are borrowed from Brian Skyrms, *Choice and Chance*, 3rd ed. (Belmont, CA: Wadsworth, 1986), p. 12.
4. Some logicians would qualify this statement. These logicians are not convinced that validity is always due to form. Their views are based on such examples as the following: "Some things are green. So, some things have a color." This argument is clearly valid, but it is difficult to specify any valid form for which it is a substitution instance. Of course, one might reply that the argument has an unstated premise: "All green things have a color." But some logicians would counter that the argument already seems to be valid without *adding* a premise, so why insist that validity is always determined by form? From this perspective, validity is sometimes due to specific content, even if it is typically determined by form.
5. A more complete list of stylistic variants for "if-then" is provided in chapter 7. The intent here is to provide a short list of the more common stylistic variants.
6. For a useful discussion of these issues, see P. C. W. Davies, *The Physics of Time Asymmetry* (Berkeley and Los Angeles: University of California Press, 1977), chap. 7, pp185-200
7. Howard Zinn, *A People's History of the United States*, (New York: HarperCollins, 1995), p. 378.
8. This example is borrowed from Skyrms, *Choice and Chance*, p.9.

Answer Key p511

Chapter 1

Exercise 1.1

Part A: Recognizing Statements

1. A sentence and a statement
4. A sentence and a statement
7. Neither a sentence nor a statement
10. A sentence and a statement
13. A Sentence and a statement
16. Neither a sentence nor a statement
19. A sentence and a statement

Part B: True or False?

- | | | |
|-------|-------|-------|
| 1. F | 13. T | 25. F |
| 4. T | 16. F | 28. T |
| 7. F | 19. T | |
| 10. F | 22. F | |

Part C: Valid or Invalid?

- | | |
|------------|-------------|
| 1. Valid | 10. Invalid |
| 4. Valid | 13. Invalid |
| 7. Invalid | |

Part D: Soundness

1. Sound
4. Unsound. The argument is invalid.
7. Sound
10. Unsound. Valid, but the first premise is false.
13. Unsound. Valid, but the second premise is false.

Exercise 1.2: Counterexamples

1. Form: No A are B. Some C are not B. So, some C are A.
Counterexample: No fish are cats. Some collies are not cats. So, some collies are fish.
4. Form: No A are B. Some C are B. So, no C are A.
Counterexample: No collies are cocker spaniels. Some dogs are cocker spaniels. So, no dogs are collies.
7. Form: Some A are B. All B are C. So, some C are not A.
Counterexample: Some animals are collies. All collies are dogs. So, some dogs are not animals.

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- A
B
4. You will win the chess tournament if you are very good at chess.
- not B*
not A
- Unfortunately, you are not very good at chess. Hence, you will not win the chess tournament.
1. If B, then A.
 2. Not B.

- So, 3. Not A. denying the antecedent, invalid
- A B
7. If God can arbitrarily decide what is morally right, then God can make cruelty right.
- C
- And if God cannot arbitrarily decide what is morally right, then
- D
- morality is not entirely in God's control.

- A C
- But either God can arbitrarily decide what is morally right, or God cannot arbitrarily decide what is morally right.

- Therefore, either God can make cruelty right, or morality is not entirely in God's control.
1. If A, then B.
 2. If C, then D.
 3. Either A or C.
- So, 4. Either B or D. constructive dilemma, valid

- A
10. The death penalty is inequitably applied to the poor and minorities.
- A
- And given that the death penalty is inequitably applied to the poor
- B
- and to minorities, it is unjust.

- B
- Therefore, the death penalty is unjust.
- 1.A.
2. If A, then B.
- So, 3. B. *modus ponens, valid*

A B

13. Mercy killing is morally permissible only if it promotes a greater amount of happiness for everyone affected than the alternatives do.

B

And mercy killing does promote a greater amount of happiness for everyone affected than the alternatives do.

A

Therefore, mercy killing is morally permissible.

1. If A, then B.

2. B.

So, 3. A.

affirming the consequent, invalid

Exercise 1.4

Part 5: True or False?

1. F 10. F

4. F 13. F

7. F

Part C: Valid or Invalid? Strong or Weak?

1. Invalid and weak 13. Invalid but strong

4. Invalid but strong 16. Invalid and weak

7. Invalid and weak 19. Invalid and weak

10. Valid

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Part D: Cogency

1. Cogent.

4. Uncogent. The premise is false (for example, penguins and ostriches cannot fly).

7. Valid, and hence neither cogent nor uncogent.

10. Uncogent. The argument is weak.

Chapter 2

Exercise 2.1

Part A: Arguments and Nonarguments

1. Nonargument (explanation)

4. Argument. Conclusion: Waging war is always wrong.

7. Argument. Conclusion: Without us, light does not exist.

10. Nonargument (explanation)

13. Nonargument (report)

16. Nonargument (illustration)

19. Nonargument (conditional)

22. Argument. Conclusion: The good don't always die young.

Part B: Constructing Arguments

1. *Premises:* If it is not morally permissible to experiment on nonhuman animals, then all new medical treatments must be tried out initially on human subjects. But surely not all new medical treatments must be tried out initially on human subjects.

Conclusion: It is morally permissible to experiment on nonhuman animals.

4. *Premise:* Sending people to prison tends to make them worse, and there are ways of controlling nonviolent criminals without sending them to prison.

Conclusion: Only violent criminals should be imprisoned.

7. *Premise:* Most Americans insist on using their own vehicles as opposed to public transportation, and this pattern of behavior causes severe damage to the environment.

Conclusion: Americans are too individualistic.

10. *Premise:* People often disagree about whether a given person or work of art is beautiful, whereas they seldom disagree about the shape or weight of an object.

Conclusion: Beauty is in the eye of the beholder.

13. *Premise:* Lying is wrong, and misrepresenting one's income on a tax form is lying.

Conclusion: It is wrong to misrepresent one's income on a tax form.

Exercise 2.2

Part A: Identifying Arguments

1. 1. The defendant is insane. So, 2. The defendant is not guilty.
 4. 1. The intelligence can only be led by desire.
 2. For there to be desire, there must be pleasure and joy in the work. So, 3. Will power has practically no place in study.
 7. 1. Affirmative action involves giving a less qualified person the job.
 2. The most qualified person deserves the job. So, 3. Affirmative action is unjust.
- Not an argument
1. The statement "God cannot be proved" may mean that God's existence cannot be proved beyond the shadow of a doubt, but it may also mean, and often does mean, that there is no valid evidence for the existence of God.