

every proposition as either true or false. For the sake of the course of doing so, he laid out the logical connectives present in natural deduction, treated

Leibniz, relatively little creative work (ca. 1699) developed the theory of the part philosophers confined to Aristotle and Chrysippus. Boe-

Abelard (1079–1142). Abelard treated Chrysippus as communicated by him. He traced the universal character of “natures” existing outside the world of guished arguments that are valid in the use of their content, but he held a variety. The present text follows

The Middle Ages blossomed and flourished. It attained its final expression in the work of William of Ockham (ca. 1285–1349). Ockham devoted his logic to the study of such notions as truth and falsehood. He conducted an exhaustive study of the language used to discuss linguistic concepts.

His work set in against the logic of the Middle Ages. The primary focus of attention; the use of its unique identity in the Middle Ages. Aristotle was studied only in highly abbreviated form until two hundred years later (1466–1716).

Leibniz developed a symbolic language for the purpose of disputes, whether in theology or philosophy. In this work, Leibniz is sometimes referred to as the founder of symbolic logic. Leibniz's efforts to symbolize logic were continued by Immanuel Kant and Bernard Bolzano (1781–1848).

In the nineteenth century, logic commenced and has continued to this day. Work in sym-

(1855–1882), and John Venn (1854–1925), some of whom are popularly known today by the logical theorems and techniques that bear their names. 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 9 of this text.

Toward the end of the nineteenth century, the foundations of modern mathematical logic were laid by Gottlob Frege (1848–1925). His *Begriffsschrift* sets forth the theory of quantification presented in Chapter 8 of this text. Frege's work was continued 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. The *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 formalization 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



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 first and conclusion last. List the premises in the order in which they make the most sense, 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. The exercises marked with a star are answered in the back of the text.

1. Titanium combines readily with oxygen, nitrogen, and hydrogen, all of which have an adverse effect 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

which the citizens of other countries are concerned.

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

- ★4. When individuals voluntarily abandon property, they forfeit any expectation of privacy in it that they might have had. Therefore, 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 find relationships between different objects and events. To express the order they find, they create hypotheses and theories. Thus the great scientific theories are easily compared to great art and great literature.

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

- 6. The 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 different. 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. The psychological impact and crisis created by birth of a defective infant is devastating. Not only is the mother denied the normal tension release from the stress of pregnancy, but both parents feel a crushing blow to their dignity, self-esteem, and self-confidence. In a very short time, they feel grief for the loss of the normal expected child, anger at fate, numbness, disgust, waves of helplessness and disbelief.

(John A. Robertson, "Involuntary Euthanasia of Defective Newborns")

- 8. The classroom teacher is crucial to the development and academic success of the average student, and administrators simply are ancillary to this effort. 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 specific, may suppress undesirable behavior, but it cannot teach or encourage desirable alternatives. Therefore, 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. Profit serves a very crucial function in a free enterprise economy, such as our own. High profits are the signal that consumers want more of the output of the industry. High profits provide the incentive for firms to expand output and for more firms to enter the industry in the long run. For a firm of above-average efficiency, profits represent the reward for greater efficiency.

(Dominic Salvatore, *Managerial Economics*, 3rd edition)

12. Cats can think circles around dogs! My cat regularly used to close and lock the 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 define themselves, since it frees people from mundane cares of daily subsistence, and since it is finite, no individual should accumulate so much property that others are prevented from accumulating 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. The 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 aftermath of nuclear explosions. The 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 edition)

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 edition)

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*, 1099b32-1100a1)