

INTRODUCTION TO LOGIC



MICHAEL T. CARLSEN-JONES



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Michael T. Carlsen-Jones
Eastern Michigan University

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INTRODUCTION

TO LOGIC

For Christine,
David, and Karen

TO THE STUDENT

This text has been organized and written for you. To get the most out of your course in logic, and out of this book, you should keep the following things in mind:

1. Logic is fun, but it does involve some work. In the text, that work is broken down into “bite-size” pieces, each of which is understandable. If you have questions about the material, bring them up in class. Also consider asking someone else who may understand what you are confused about—perhaps a friend who is in your class, your instructor, a teaching assistant, or a tutor.
2. Whenever you are given a reading assignment, do it as soon as possible. Each section of the text covers a small part of the whole of logic theory and its applications. Read that small part and do the exercises, and you should have no major difficulties with the course.
3. The text includes a great many exercises. When the time for examinations rolls around, you are going to be asked to work problems which are very much like those contained in the exercises. As a result, one of the most important ways to ensure your success in the course is to do the exercises and be sure that you understand why each problem is solved in the way that it is. The solutions to many of the problems are provided at the back of the text. If you do not understand what you are to do, check there to see what the answers look like, and then attack the problem.
4. All the kinds of arguments which are discussed in the text are worked out in step-by-step detail. If you are having difficulty with any exercise, turn back to the worked-out examples to see how those problems were solved. On the other hand, if you understand the basic concepts and how the exercises are worked, you need not read through all the sample arguments and problems discussed in the text. Instead, turn to the exercises, do them, check your answers in the back of the book, and, if you have done them correctly, celebrate.

5. There is a Student Study Guide at the end of each chapter. Included in this study guide is a Chapter Summary which lists all the important points raised in the chapter, along with references to the sections in which these points are discussed. If you do not understand any of the summary remarks, reread the full discussions in the text.
6. Also included in the study guide is a list of key terms—important concepts which you should understand. I suggest that you first provide, in your own words, an explanation of each of these terms. Then check the Chapter Summary to see if you do understand the terms. If not, reread the sections in which the terms are explained. You may also find it helpful to check the index; the page number given in boldface indicates where the term or expression is defined or explained in detail.
7. Each study guide also contains a Self-Test/Exercise section whose questions and problems cover much of the material discussed in the chapter. It is unlikely that any examination will cover all the problems in this section, but if you can do those problems and understand what you are doing you should have no difficulty with exams. The answers to all the self-test problems are included in the back of the text. If you make a mistake in any of these problems, check the section of the text where its subject is discussed. To help you refer back, section numbers are included with the problems and questions.

Use the text to get the most that you can out of your introduction to logic. Keep up with the course by doing the reading and the exercises, ask questions when you are confused or do not understand what is going on, and, most of all, enjoy!

Michael T. Carlsen-Jones

TO THE INSTRUCTOR

This text is designed to be used in a one-semester terminal course in logic, although it will serve very well in any course which is a prerequisite for advanced work in logic. Additionally, if all the chapters are covered in detail, the text may be used in a two-semester sequence of courses; however, in that case you may wish to supplement the material with additional readings on logic theory and induction.

Most introductory logic texts available today tend to fall into either of two groups: those which emphasize formal logic and symbolism and those which emphasize "good reasoning." Those in the former group tend toward a more systematic approach, with an emphasis on proof and rigor. With such an approach the text often does not contain sufficient explanations of key concepts, students are often unable to apply the material and techniques discussed to new and different situations, and students often leave the course feeling that the material discussed was somewhat interesting but not of much value. Texts in the latter group tend to miss in the other direction: At the conclusion of the course most students have gained very little understanding of logical systems or appreciation for the power and usefulness of such systems. They may come away with the feeling that logic is a "shotgun" approach to the analysis of arguments, retaining little knowledge of logic theory or organizational principles which might be used to analyze other arguments.

This text is aimed between these two approaches, although admittedly with more of a traditional emphasis on theory, the development of logical techniques, and the recognition and evaluation of the structure, or form, of arguments. An effort has been made throughout the text to show that the theories and techniques are applicable to a wide range of arguments and to develop the student's ability to recognize arguments and determine which techniques are appropriate for their analysis. The rationale for this approach, and the steps which have been taken to achieve it, are as follows:

1. Almost no students come to a logic course with any background at all in logic, and many come with rather weak quantitative skills. Moreover, a large percentage of such students identify logic with mathematics and, as a result, are initially inclined to be intimidated by logic.

I have attempted to write a text which is easy to read and not intimidating, a major portion of which is devoted to explanations of the basic concepts in logic, followed first by examples of the concepts and then by exercises that allow students to work with the concepts. Moreover, reference is continually made to these concepts so that they become second nature to the students. Because concepts are introduced in this way, and not in a barrage, students quickly see that logic need not be intimidating, is comprehensible, and does have application to at least some of their concerns.

2. Logic is a rigorous discipline, and any text which gives the contrary impression has not succeeded in providing an introduction to *logic*, whatever other virtues the text might have.

As a result, this text does emphasize formal concepts and procedures. It does so, however, by introducing new concepts and techniques only when they are needed, and typically by introducing new problems or arguments which cannot be handled with the concepts already discussed. Logical notation is not treated as an end in itself, but as a means of simplifying the task of analyzing arguments. This approach has the advantage of treating both theory and technique as a natural and easily understood extension of problems and arguments already discussed.

3. "Doing logic" ultimately reduces to a form of problem-solving, and, given the goal of improving the analytical skills of students, a good text should help students to "do logic."

To meet this need, more than 250 examples and arguments are discussed in detail throughout the text. More than one-third of these are presented in step-by-step fashion, with explanations of both how and why the steps are performed. This approach provides something not found in any other text: guidelines and suggestions, along with specific examples, of how to analyze arguments. In using portions of the text in my own course, I have found that I no longer hear comments like, "I understand the problems when you do them in class, but when I try to do them myself, I don't know what to do."

4. Logic should be, and is, fun. But it is fun for students only when they feel they are on the right path every step of the way.

The step-by-step discussions mentioned above provide a means of ensuring that students are on this path. Moreover, the text contains numerous references to previously discussed material, so that students are reminded that they are on the right path, and each new topic or procedure is seen as a natural, small step along that path. To help students keep to this path and to reinforce their understanding of the material, nearly 2000 problems are interspersed throughout the text. The problems deal with such topics as politics, science, campus life, ethics, personal relations, and philosophy. They test students' mastery of the key concepts and the techniques for analyzing arguments, as well as their ability to apply these concepts and techniques to new and sometimes different

arguments. Each chapter also ends with a self-test/study guide section with exercises covering all the material discussed in the chapter. In addition, the text includes solutions to more than 35 percent of the exercises so that students know when they are on the path and when they may have gotten lost.

The points raised above might well be summed up by saying that this is a text designed with the student in mind. The readability of the text, the problems worked out in detail, the frequent summaries, the gradual building to new concepts and techniques, and the frequent exercises and their solutions all serve to ensure students that logic is worth studying, that they can understand and apply the material, and that doing so is fun.

The organization of this text, like the organization of any text, reflects the author's pedagogical biases. Of the two basic organizational approaches—less rigorous to more rigorous and more rigorous to less rigorous—I have chosen the latter. My own classroom experience has shown that most students are more comfortable with deductive logic than with induction or informal logic (perhaps this is a part of the “right-answer syndrome”). Instead of fighting this comfort, I have chosen to treat deduction first, then induction, and finally to show that informal fallacies fail to meet the criteria for acceptability of either of these two kinds of support. I have found that by the time students have mastered deductive techniques and have become accustomed to the distinction between the form and content of an argument, they are prepared to deal with the relatively inconclusive nature of inductive arguments. Having explored these two kinds of arguments, they are then better able to handle the traditional informal fallacies.

As a result, the text is organized into four main sections. Chapters 1 and 2 contain introductory material on what logic is (and is not), the use of language, and the differences between inductive and deductive support. These chapters serve as the groundwork for following chapters, though portions of these chapters may be skipped, depending on the emphasis the instructor wishes to give to the course. Chapters 3 through 7 are devoted to deductive logic, including a rather informal introduction to proof procedures (including conditional and indirect proofs), truth tables, natural deduction, categorical syllogisms, and predicate logic. Chapters 8 and 9 discuss induction, including the criteria for acceptable inductive arguments, hypotheses and their role in induction, and Mill's methods. Chapter 10 is a treatment of informal fallacies. The approach in this last chapter is to build on the earlier discussion of deductive and inductive support and emphasize the fact that every acceptable argument has both an acceptable structure and all true premises. Informal fallacies are shown to fail to meet one or both of these criteria.

This organization allows the text to be used successfully in a variety of course structures with varying emphases. Among these structures are the following:

- Option 1: A standard introductory course without natural deduction or predictive logic: Chapters 1 to 4, 6, and 8 to 10. Chapter 3 may

be omitted if one does not wish to cover basic proof procedure and conditional and indirect proofs.

Option 2: An introduction to deductive logic through predicate logic: Chapters 1 to 7. Here, most of Chapter 3 may be eliminated (with the exception of the discussion on conditional and indirect proofs).

Option 3: An introduction to language, induction, and informal logic: Chapters 1, 2, and 8 to 10. This option may be augmented by including either or both of Chapters 4 and 5 if some introduction to deductive support is desired.

Other options are available, and all are discussed in more detail in the Instructor's Manual. It is worth mentioning, however, that the student-oriented features of this text have enabled me to cover more material in a semester than I could with any other text. Ordinarily I must spend a great deal of class time working problems and explaining how certain problems are solved. Since much of this is done in the examples discussed in this text, the amount of time which I could devote to explaining concepts and logical theory was greatly increased, with a concomitant increase in the amount of material I could cover.

In addition to detailed explanations of the course options, the Instructor's Manual includes course outlines and syllabi and suggestions for constructing quizzes and exams. Also included are section-by-section comments regarding teaching strategy, and those solutions which do not appear in the text.

A project of this scope would never have been completed without the help of many people. Although it is impossible to enumerate all of them here, the following have been especially helpful: The students in my classes who have willingly used handouts, parts of chapters, and whole chapters and who have so kindly told me when it was good and when it was bad; perhaps to them I owe the greatest debt, since they were the ones who ultimately gave form to this final product. The people who read the manuscript in whole or in part during the course of its development: Dr. Scott Arnold, North Carolina State University; Prof. Christopher Boorse, University of Delaware; Prof. Sidney Chapman, Richland College; Prof. James J. Fletcher, George Mason University; Prof. Edward A. Hacker, Northeastern University; Prof. Alan Hausman, Ohio State University; Prof. Walter E. Lockhart, Schoolcraft College; Dean J. M. Orenduff, Weber State College; Prof. John E. Parks-Clifford, University of Missouri-St. Louis; Prof. Philip A. Pecorino, Queensborough Community College; Prof. David H. Richards, Cayuga Community College; Prof. Stephen E. Rosenbaum, Illinois State University; Prof. Eileen Z. Silbermann, Essex Community College; Dr. K. Sundaram, Lake Michigan College; Prof. Ron G. Williams, Colorado State University; and Prof. Gerald K. Wuori, Wilkes College. I also wish to thank my colleagues, Sidney Gendin and William Miller, who generously used earlier drafts of the text in their own courses and made several valuable suggestions for its improvement, with a special thanks to Bill for

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Michael T. Carlsen-Jones

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CHAPTER I

LOGIC AND LANGUAGE

While browsing in a bookstore some time ago, I came across a book entitled *Love Is a Special Way of Feeling*.¹ Well, I thought, that's certainly true; but if I didn't already know what love is, it wouldn't help very much to be told it's a special way of feeling. After all, having a headache is a special way of feeling too, and that's not love. There was some reason to suppose, however, that the author was going to write about love, and that she had some things to say about this special feeling. Of course, to find out what she meant by love, I was going to have to read the book.

It has since occurred to me that if someone does not already know what logic is, it's not very helpful merely to tell him or her that **logic** is the study of the relationships between the premises and the conclusions of arguments. This characterization of logic, like Anglund's characterization of love, is certainly true. But to really know what logic is, you have to do with this book what I had to do with Anglund's: read it. When you are done, you should have a very good understanding of the topics discussed by logicians; you should be aware of the uses and limitations of logic theory as applied to everyday reasoning; and you should have developed a variety of skills which will enable you both to determine when a good or a bad argument has been offered for some position and to present your own good arguments. We shall begin to address these issues in the present chapter, and in subsequent chapters you will learn more and more about this thing called logic.

1:1 THE SUBJECT MATTER OF LOGIC

One way to distinguish one discipline from another is to ask, "What do the practitioners of this discipline study and write about that those in other disciplines do not?" In the case of logic the answer is that logicians study and write about *arguments*. As a result, the essential topic we shall be discussing in this text is arguments. Viewed broadly, our task is one of developing skills in recognizing

¹ Joan Walsh Anglund, *Love Is a Special Way of Feeling*, Harcourt Brace Jovanovich, Inc., New York (1960).

and analyzing arguments, along with developing an assortment of methods which will aid us in our analysis. Since arguments are given in a language, we shall also have occasion to examine some of the features of language which have a bearing on the acceptability of arguments. Before turning to these topics, let's look at what logic is and what it can and cannot do for us.

Although the study of logic and language is interesting and rewarding in its own right (as well as being fun), other benefits are derivable from such study. One of the more obvious ones is that an understanding of logic helps us with decision making and problem solving. Daily, each of us confronts a diversity of situations in which we must choose from two or more available options. Such situations range from relatively inconsequential ones ("Shall I have a piece of toast or an English muffin with my breakfast?"), to interpersonal ones ("Should I spend Christmas vacation with my family or should I accept the invitation to spend that time with my best friend?"), to situations involving decisions about our own life or those of others ("Should I spend four years in the armed forces before I go to college?" or "Should groups of people who have been discriminated against in the past be given preferential treatment now?"). Of course, there are many more kinds of cases than those mentioned.

To make decisions or to solve problems, we have to do at least two things: First, we must try to gather as much relevant information as we can, both for and against each of the several options, and, second, we must consider this information and see which of the options is best supported by it. Studying logic will not provide too much help with the first task, but it is of great benefit in the second task. In particular, the skills you will develop will enable you to determine, for a great many cases, whether what is offered as reasons for doing something or for accepting some particular position really supports the position. Additionally, the skills will enable you to determine how strong the support is.

The process of giving reasons in support of a position (or of determining whether the reasons that have been given are good ones) involves the difference between reasoning well and reasoning badly. And what does logic have to do with this difference? A great deal. Insofar as possible, we all want to make the best decisions we can and to do so in a rational manner. This is true whether the decision is made in the course of our chosen profession, in the course of exercising our rights and responsibilities as citizens, or in adopting or living a certain "life-style." In all these cases, and in a great many others as well, the decisions we make or the solutions we propose can be arrived at by reasoning well or by reasoning badly. By studying logic and by understanding a few basic procedures and principles, we can increase the number of good decisions we make, and decrease the number of bad ones.

Like so many other things we learn, however, logic will be of no real lasting benefit unless we are able to apply outside the classroom what is learned in the classroom—apply it to situations in which we are making *our* decisions or solving *our* problems. For this reason, the examples discussed in the text and those included in the exercises are not, in themselves, of primary importance.