8. Miranda and Prospero are characters from Shakespeare's *The Tempest*.

J. D. CARNEY AND R. K. SCHEER. *Fundamentals of Logic,* Second Edition. New York: Macmillan; London: Collier-Macmillan, 1974, pp. xi + 428, $9.95 hardbound. LC 73-4052; ISBN 0-02-319430-8.

JOHN KOZY, JR. *Understanding Natural Deduction.* Encino, Ca: Dickenson, 1974, pp. ix + 236, $7.95 paperbound. LC 73-88122; ISBN 0-8221-0128-9.

HUGHES LEBLANC and WILLIAM A. WISDOM. *Deductive Logic.* Boston: Allyn and Bacon, 1972, pp. xii + 367, $9.95 hardbound. LC 70-132801.

Students are taught how to argue in two ways: by explicit discussion of argument and the example of the instructor. *Fundamentals of Logic* gives the instructor a rich opportunity to give arguments as opposed to discussing them. For what must be regularly argued against are the positions of Carney and Scheer.

They tell us that a correct argument is one in which "the premises provide good grounds for affirming the conclusion" (p.9). Affirming is an illocutionary act of an agent, requiring special effort. Persons getting married often affirm their love. Good grounds for affirming a belief might be that it is called into question. Where C is that terrible consequences will befall someone if he does not affirm S, C provides good grounds for affirming S, yet as an argument for S, C provides no grounds. Nor does the definition provide necessary conditions. That a guage reads in a section marked red may provide good grounds for the conclusion that a boiler is overpressured, but in itself this is no reason to affirm it. A good reason might be that an attendant doesn't realize the conclusion and correct the pressure. What makes an argument correct is not that the premises provide good grounds for X-ing the conclusion, where X-ing is an act of an agent. No solace is provided by changing "affirming" to "believing" or even "concluding". Correct arguments provide good grounds for the (truth of the) conclusion, purely and simply.

Carney and Scheer tell us that the irrelevancy of premises to a conclusion "means . . . that the premises should not be considered in determining whether the conclusion is true" (p. 12). Yet ethical considerations can imply that logically relevant information should not be considered (e.g. sex), and the causal consequences of failing to consider irrelevant premises sometimes argues we should consider them. What makes premises irrelevant is simply that their truth or falsity doesn't affect the probability the conclusion is true.

In the section on *ad ignorantium*, they claim that in law courts "if it is not proved that A is guilty, it follows that A is not guilty", as if a prosecutor by failing to prove guilt thereby makes a person not guilty. The maxim "a person is innocent until proven guilty" is not, despite appearances, a claim about innocence. What it says is that until found guilty, a person has the rights of the non-criminal.

As examples of different expressions with the same intension, Carney and Scheer give "ascend" and "climb" (p. 68), oblivious to the fact that ascent refers to resultant directional motion, whereas climbing requires effort, and in the same sense one can climb not only up but down and over.

They tell us that definition by enumeration consists of a list of things in the extension of an expression (p.69). But one of their examples is that "word" as used in their chapter consists of general terms and singular terms, confusing kinds of words with the extension of "word". Moreover, they tell us that expressions with infinite extensions cannot be defined by enumeration, yet English has an infinite number of singular terms!

The opening section of the text, on informal logic, contains these and other errors. The section on formal logic is better, and covers propositional, syllogistic, and predicate logic. However the chapter on predicate logic is cursory, making the treatment unsuitable for anything but a survey introduction. There is a chapter on giving proofs in propositional logic. Unfortunately, ten replacement rules are adopted which, while intuitively true, do not correspond to natural proof strategies, making the rules difficult to remember and the proofs correspondingly artificial. Two errors are that double negation is cited in a proof (line 8) where modus tollens should be (p. 211), and an exercise (#2) asks the students to prove an inference which is not valid (p. 217).

The final third of the book concerns the logic of science, but little will be said of it since few will get to it in logic courses. The use of brief case histories is interesting, but there are inaccuracies concerning Galen, Harvey, and astronomy. On p. 347 Bacon's *Novum Organum* is ascribed to Newton. The worst mistake is in the depiction of the phases of Venus predicted by the Ptolemaic system (p. 370). At the point where Venus is nearest Earth, the prediction is that none, not all, of Venus will be visible, and the diagram fails to show that the proportion of Venus contained in the visible sliver first increases then decreases as Venus travels from maximum to minimum distance from Earth.

For a course that covers just informal logic or just the logic of science, Carney and Scheer's treatment is of insufficient length and quality. For courses on just formal logic, there are better texts. While the book has a good number of definitions and claims that are not well thought out, the mistakes seldom make the sections in which they occur useless. As noted earlier, students can learn as much from arguments given by the instructor as from a text. Textbook exercises are "set-ups" for students, no more serious than soldier drills with wooden guns. But when the instructor parries with the text, students see the blood flow. For an instructor of a course covering both informal and formal logic, who wants to do more than blindly follow a text, but teach logical and critical thinking by example, *Fundamentals of Logic* is one of those rare books that is valuable, not in spite of its flaws, but because they are corrigible.

Understanding Natural Deduction has the avowed purpose of teaching persons to think logically (p. viii). To professional logicians, such a concern is indicative of a dubious pedagogy combined with a watered-down content. But for those who teach logic to students who do not include becoming logicians among their cherished aspirations, only such practical accomplishments stand between their course and nothing.

However, thinking logically consists of giving good reasons, as Kozy himself notes. What follows is not a general discussion of reasoning, but only a discussion of proof. The bulk of reasoning in life, law, and science is not deductive. As far as educating persons to reason better, a discussion of fallacies is better, with emphasis on informal rather than formal fallacies.

Moreover, even within the realm of practical proof, Kozy's treatment could be better conceived. The real life problem is whether or not a conclusion follows. Only in the last and shortest section does Kozy touch techniques of disproof, and the treatment is sketchy. The text proper spends the bulk of time in the propositional calculus, with a section on the monadic predicate calculus. Only a compressed appendix discusses the predicate calculus with relations. Students do not emerge with tools adequate to the business of giving proofs. What Kozy's book teaches is neither reasoning in general nor practical proofs, but the rudiments of proof.

There are some misprints and slips. In the rule for generating a tableau with negated disjunction (p. 157) the horizontal line should be drawn between the first and second line. The definition on p. 185 should read that R/S is the relative product of R and S if and only if (x) (y) (R/S (x,y) ≡ (∃ z) (R(x,z) · S(z,y)). On p. 109 "um" is cited as a prefix with the force of negation, yet it is not even a prefix. The definition of argument (p. 9) has the consequence that virtually none of the formal proofs given in the book are arguments (all lines other than the conclusion have to be premises).

Less understandably, the definition of a formula for the monadic predicate calculus (p. 122) fails to include predicates with free variables, so that the quantification clauses fail to generate any formulae. Further, the intended definition entails that all formulae are finite, yet a universal assertion is supposed to abbreviate a conjunction which would be infinite in length (p. 125). Worse, Kozy correctly defines (p. 183) a (weakly) connected relation, but then says that "is smaller than (in size)" for objects is connected, thereby making the common mistake of confusing "is smaller than" in the domain of physical objects with "is less than" in the domain of sizes. Finally, Kozy hopelessly confuses (p. 168) what it is for a theory to be complete with what it is for a system of inference rules to be complete. From his definition it follows his system is incomplete because neither p nor ~ p is provable. (In the proper sense, his system is complete.)

Despite its faults, this book is a good one. Often texts in formal logic are written so that they make sense only to persons who already understand the material, and serve as a reference book for lectures. Kozy's text is one of the few from which students actually learn. The order of the material is good, and minimizes the amount of supplementary teaching necessary. The exercises are integrated into the text, and at the end of the chapter a list of key concepts is provided. The book is eminently suitable for self-study, and is valuable for instructors who want to teach formal logic but do not have a command of it. As intimated earlier, the text is suitable only for courses that take students from no knowledge of formal logic to the beginnings of the predicate calculus: but for this coverage, it is excellent.

Deductive Logic is a first-class text, limited in use mainly by what it fails to cover. The book does not discuss informal, traditional, or philosophical logic, nor is it an advanced text. What it does cover, with equal emphasis, is the logic of truth functional connectives, predicate logic, and elementary metatheory for the propositional and predicate calculi. For a text on formal logic, it is unusually rich in explanation, enabling students with no background to understand it. The proofs in the section on metalogic are detailed enough for students to follow.

The emphasis in the sections on the propositional and predicate calculi is on teaching practical skills within formal proof techniques. Teachers whose interest in proof techniques is theoretical and not practical would probably want a different text, as too little would be left once the sections on trees and natural deduction were deleted. Nor is there much emphasis on semantical techniques that work with interpretations.

On the level of detailed exposition, the book is well written, and I have only one piddling objection. On p. 16 English conditionals are given which are "probably" truth functional, yet all lack the required entailments. (For example, "The car is safe to drive if it has good brakes" does not follow from "The car doesn't have good brakes" as it must for the truth functional conditional.)

A universal assertion is defined to be true if and only if each instance is true (p. 145). A few pages later, the authors tell us exactly why this definition is wrong: it works only when everything in the domain is named by a singular term, which is not only sometimes false but sometimes impossible. But they stick to their definition, for the theory of logic ensures us we still get the correct extension for logical truth, inconsistency, and entailment.

As a result, the student is not taught the elegant way in which logicians succeed in reducing the truth of quantified formulae to the truth or falsity of unquantified *formulae*. Mates' notion of a ß-variant (*Elementary Logic*, Oxford, 1972, p. 60) is a particularly beautiful and clever notion that all logic students should be exposed to and appreciate the need for. In addition, the notion of truth is no longer closely tied with practice. In order to show that an entailment fails, one gives an interpretation in which the assumptions are true and the conclusion false. From the viewpoint of giving interpretations, the definition of truth is just wrong. Wisdom and Leblanc define truth only to accord with a theoretical interest, not to mesh with the widespread and powerful practice of giving interpretations.

Some amends are made in the section on metalogic when the ß-variant approach is adopted. What should have been done earlier was to have ignored the syntactical reduction to atomic formulae, and said, intuitively, that (∀x) A is true if and only if what A asserts of x is true of everything in the domain—talking directly of the things in the domain and eliminating the middlemen singular terms (instances).

One of the outstanding features of this book is its system of natural deduction. The technique of subordinate derivation and the use of vertical lines to keep track of the scope of assumptions are visually perspicuous, promote orderly thinking, and correspond to the practice of indentation. The rules governing inferences have a rationale, so they can be remembered without memorization, and all correspond to natural and powerful strategies of proof.

My only criticism of the system of deduction is that it should be altered to make it more efficient and practical. Reiteration is needlessly restricted to assumptions, and assumptions can be reiterated (strictly) into subordinate derivations only as assumptions of them! (The changes would necessitate a slight change in existential elimination and universal generalization.) When neither disjunct is provable, only reductio generally works. The universal practice of assuming that one disjunct is false and proving the other should be allowed and encouraged. Finally, by the time students give proofs in the predicate calculus, use of propositional rules becomes a hindrance, not only slowing students but failing to challenge them to become more efficient. All truth functional inferences within a derivation should be combined into one rule (as in Mates' system), so that the only applications left for propositional rules are strategies employing subordinate derivations.

By working his way through the entire book, the student will have a firm foundation in logic, from which he could easily begin to study advanced logic. The book is ideal for a serious upper-level undergraduate course in formal logic, especially for a year-long course. Given less than a year, the material short of metatheory could be covered. With a quicker pace, the book could also serve as a text for introductory graduate courses in logic. All in all, *Deductive Logic* is one of the best textbooks available in elementary formal logic.

— *William K. Goosens*

HOWARD POSPESEL. *Propositional Logic*. Englewood Cliffs, NJ: Prentice-Hall, 1974, pp. xii + 211, $4.95 paperbound. LC 73-17397; ISBN 0-13-486217-1.

To most of us, the prospect of examining yet another new logic text is likely to ruin a perfectly good day. But things are looking up. *Propositional Logic*, Howard Pospesel's new book from Prentice-Hall, is different. Just reading the (paper) cover makes that point; thumb through the text, glance at some examples—crossword puzzles, cartoons, billboards, greeting card verses—and you wonder what logic is coming to. Gimmicky? Perhaps; but also refreshing. Importantly, by drawing examples from every aspect of the student's