the optimizing properties of the rules. The effects of introducing costs, such as inventory charges, and additional constraints, such as storage limitations, are touched upon from the standpoint of possible variations in the length of sub-horizons. A generalized approach to this class of problem is explored via the Kuhn-Tucker theorem for nonlinear programming.

The "classical" models of linear programming are presented with commendable clarity. Moreover, the adaptation of linear programming methods for solving nonlinear types of management problems is aptly demonstrated. However, this reviewer's enthusiasm was tempered by the fact that the present edition abounds with errors resulting from an apparent cursory attempt at editing and proofreading. This reviewer recommends that the publishers prepare an errata sheet; otherwise, the intolerable number of typographical errors will vitiate the intrinsic merits of this book as a textbook and reference.

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24 [X].—ROMAN JAKOBSON, Editor, *Proceedings of Symposia in Applied Mathematics*, Vol. XII, "Structure of Language and its Mathematical Aspects," American Mathematical Society, Providence, 1961, vi + 279 p., 26 cm. Price $7.80.

Sponsored by the American Mathematical Society, the Association for Symbolic Logic, and the Linguistic Society of America, and cosponsored by the Institute for Defense Analyses under an Office of Naval Research contract, the symposium, held in April, 1960, included the following papers:

W. V. Quine	Logic as a Source of Syntactical Insights
Noam Chomsky	On the Notion "Rule of Grammar"
Hilary Putnam	Some Issues in the Theory of Grammar
Henry Hiż	Congrammaticality, Batteries of Transformations and Grammatical Categories
Nelson Goodman	Graphs for Linguistics
Haskell B. Curry	Some Logical Aspects of Grammatical Structure
Yuen Ren Chao	Graphic and Phonetic Aspects of Linguistic and Mathematical Symbols
Murray Eden	On the Formalization of Handwriting
Morris Halle	On the Role of Simplicity in Linguistic Descriptions
Robert Abernathy	The Problem of Linguistic Equivalence
Hans G. Herzberger	The Joints of English
Anthony G. Oettinger	Automatic Syntactic Analysis and the Pushdown Store
Victor H. Yngve	The Depth Hypothesis
Gordon E. Peterson and Frank Harary	Foundations in Phonemic Theory
Joachim Lambek	On the Calculus of Syntactic Types
H. A. Gleason, Jr.	Genetic Relationship Among Languages
Benoit Mandelbrot	On the Theory of Word Frequencies and on Related Markovian Models of Discourse
Charles F. Hockett	Grammar for the Hearer
Rulon Wells	A Measure of Subjective Information
Roman Jakobson	Linguistics and Communication Theory

Some of the authors are concerned with preformal questions, i.e., with a discursive characterization of the substance of language; Quine, Putnam, Chao, Herzberger, and Jakobson seem to have such interests. Others are fully engaged with the construction of formal systems: Chomsky, Hiż, Curry, Halle, Abernathy, Peterson and Harary, Lambek, Mandelbrot, and Wells. Oettinger, Yngve, and Hockett aim at description of linguistic processors—natural or artificial—rather than at characterizations of language, although all three have formalisms to display. Eden, working on handwriting, might be placed with one of the latter two groups. Goodman's contribution is the exposition of a branch of mathematics in its potential application to linguistic theory. Gleason shows the application of classification theory to a major branch of linguistics, the tracing of historical connections among languages.

A cursory inspection of this volume would suggest that the "structure of language" is just its grammatical—or, more narrowly, syntactic—structure. Mandelbrot objects to the identification of "linguistics" and "grammar" (pp. 211–214), but mathematical formalization of linguistic theory is going forward more rapidly in syntax than in any other area, and it is, as Jakobson remarks (p. vi), mathematical logic and the theory of recursive functions in particular that is being applied. Mandelbrot seems to agree with his opponents that "statistical" and "grammatical" models are "contradictory." He supposes that they must remain so; a different possibility is that grammatical models will furnish a structure on which statistical models can be developed. Grammar in any case is not the whole of linguistics, and problems like Gleason's will probably be brought to computing centers more often in the future.

Computational linguistics has been hampered by lack of sufficient and sufficiently sound publications in mathematical linguistics; this volume should be studied by any linguist or mathematician who proposes to program syntactic operations, whether for research purposes or in connection with such applications as machine translation.

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25 [Z].—DONALD P. ECKMAN, Editor, *Systems: Research & Design*, John Wiley & Sons, Inc., New York, 1961, xiii + 310 p., 23 cm. Price $8.50.

This book is the Proceedings of the First Systems Symposium at Case Institute of Technology. It contains a Foreword, a Preface, and fourteen papers concerning systems research and systems design. The fourteen papers vary in style, most noticeably with regard to bibliographic reference. Some are simply advice from the author without reference to other work, others have extensive bibliographies. Only one pertains directly to the mathematics of computation, "A problem in the design of large-scale digital computer systems" by R. J. Nelson. This paper is devoted almost entirely to the problem of designing a machine which would be efficient in selecting the largest number of a set and (by implication) in other sorting problems. No specific design is arrived at, but a facility for scanning a region of the memory is suggested; the ideas may mislead some readers if they are unfamiliar with threshold search commands such as that of the Control Data Corporation 1604 computer and with the engineering details of comparison circuits.