lation. A beginning student might also well appreciate having exercises that would test his understanding of the techniques under discussion.

The chapters on macro-econometrics deal with an elementary discussion of the interpretations of the numerical coefficients of Kleins' model of economic fluctuation in the U. S., a description of planning models of the Dutch economy, and a discussion of the method of least squares as applied to the functional form $y = ax$. Based on these chapters, a beginning student interested in econometrics would derive little appreciation of the techniques, the computational methods involved, and the usefulness and limitation of the discipline.

The authors do not achieve their intended integration of operations research and econometrics. This book attests to the difficulties involved in attempting to present at an elementary level the concepts, their applications, and their limitations of two relatively sophisticated disciplines. However, this should not frustrate the non-specialist. As already indicated if he is willing to invest his time in becoming familiar with certain fundamental topics, he would be in a position to gain a fuller appreciation of the potentialities of the techniques of operations research and economic theory.

Colloquium on Applications of Mathematics to Economics (Budapest, 1963), *Edited by András Prékopa.* Budapest: Akadémiai Kiadó, 1965. $12.00.

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THIS book is a collection of the papers presented at the Colloquium on the Applications of Mathematics to Economics organized by the János Bolyai Mathematical Society and held in Budapest during June, 1963. A total of 41 papers appear in this volume of which 24 are in the English language, 11 in German, 4 in Russian, and 2 in French.

In the editor's preface it is claimed that "this was the first scientific meeting on an international scale organized in a socialist country dealing with the subject which we call at present 'The application of mathematics to economics.' " Since most of the participants at the Colloquium are from the socialist countries of Eastern Europe, one might have expected that much of the research presented would be in the area of national economic planning. Actually, however, most of the papers included in this volume are in the areas of operations research, management science, and mathematical programming. Thus the composition of this volume raises an interesting question for the student of comparative economic systems. Why is there not in the planned economies themselves relatively more research effort devoted to the mathematical theory and techniques of national economic planning? Is it perhaps because it is believed that what the American economist might term the sociological and political aspects of economic development are of overriding importance? Also, the specialist in the theory of optimal economic growth might wonder why his field has received more attention in nonsocialist societies than in socialist societies. In fact, why is the "Ramsey problem" so interesting to American mathematical economists? Do we think that, while the market place may be well-suited for making coffee-tea decisions, it may be poorly suited for making consumption-investment decisions?

I now exercise my prerogative of selecting from the forty-one papers those that I personally found most interesting. The first of these is the paper by H. W. Kuhn on the Steiner-Weber problem. This problem is that of finding a point in the plane that minimizes the weighted sum of distances to n given points in the plane. Necessary and sufficient conditions for a solution are derived. A problem which is dual to the Steiner-Weber problem is formulated. The dual problem has a linear objective function and quadratic constraints and possesses all the desirable properties of the dual

problem in linear programming. Kuhn points out that the method of "feasible directions" due to Zoutendijk and the "gradient projection" method due to Rosen are applicable to the problem or its dual. A new algorithm is presented which utilizes the simplicity of the Steiner-Weber problem. The general convergence properties of this algorithm are as yet unknown.

The contribution entitled "Two-Level Programming" by Th. Lipták is closely related to the joint work on this subject by Lipták and his colleague J. Kornai. In fact the paper in this volume is a further developed version of the model that was treated in an article in *Econometrica* (Vol. 33). The two-level programming technique is based on the fact that certain linear two-stage constrained optimization problems may be reduced to the solution of polyhedral game problems. Under certain conditions, the polyhedral games are solvable by fictitious play. This method is applicable to the solution of a large-scale LP problem within a prescribed degree of accuracy. Since the procedure, although slow, does not require large memory capacity, it is attractive from a computational point of view. In the present paper, the analysis is extended to treat more general (concave and convex) programming problems.

I found the paper by E. Theiss, "Interrelation of Programming and Demographic Models," to be most intriguing. Although the analysis is somewhat informal, the author stresses the important consequences for over-all planning of changing demographic variables. If, for example, the age structure of the population is expected to be changing through time, demand for consumption goods and the supply of labor can be expected to change. From a formal point of view, age-specific labor force and population models should be quite similar to the well-known vintage capital models. Elaboration of such models should prove to be very helpful for purposes of description and planning. Further, this type of model is virtually essential for a sensible discussion of optimal "population policy."

Three papers in the field of statistical inference are included in this volume. In their contribution "$\frac{5}{16}$ Replication of a 4^4 Factorial Experiment" G. Bánkövi and K. Sarkadi report on the solution of a problem arising during a chemical research project. Since their problem required 4 factors to be investigated at 4 levels, a total of 256 treatment combinations was involved. Interactions of second and higher order were ignored, so that the number of constraints was reduced from 256 to 67. T. Dalenius offers a tract on "potential research objects" in sample survey theory and methods. J. Hájek elaborates his earlier work on rejective sampling from finite populations and derives rejection estimators with asymptotically normal distributions.

As a reviewer in this circumstance must, I had to select rather arbitrarily those papers to include in my discussion. Of those that I was unable to include, some are abstracts of work appearing elsewhere and some are accounts of rather well-known results. Yet many of the papers I have been unable to include in this review are interesting contributions in their own right. Included among these are papers dealing with stochastic processes, stochastic programming, linear programming, the theory of graphs, and economic planning.

Applied Combinatorial Mathematics. *Edwin F. Beckenbach, Editor.* John Wiley and Sons, New York, 1964.

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IF ONE looks at mathematical journals of 40 or more years ago one cannot help but be envious of the writers of that time who were afforded ample space to exposit some of the history and background of their subjects, and to pursue interesting sidelines if they desired. In contrast, a glance at a paper in a current journal is a discourag-