

## BOOK REVIEWS

*Contributions to the theory of games.* Ed. by H. W. Kuhn and A. W. Tucker. (Annals of Mathematics Studies, no. 24.) Princeton University Press, 1950. 16+201 pp.

The modern theory of games had its inception in von Neumann's paper in the *Mathematische Annalen* for 1928, and was developed and popularized in the book by von Neumann and Morgenstern. Its great popularity is due to its mathematical interest and to two other reasons. One of these is the connection between the theory of games and the theory of statistical decision functions initiated independently by Wald in 1939. The other is the unhappy state of the world in these last years, and the abundance of wars, hot and cold. To the mathematician confronted with a problem in strategy it is very appealing to have recourse to a theory and an established procedure like seeking a minimax solution. Much of what is now called (military) operations analysis seems to be simply an application of the theory of games.

The present study comprises a number of diverse papers on the theory of games, with a comprehensive introduction by the editors. In this introduction the editors give a brief description of each paper and conclude with a list of questions for which, in their opinion, it is very important to have answers forthcoming. Both the summary and list of questions are very clearly and adequately put, and can serve the busy reader as a guide to further reading in this volume and elsewhere. The excellent introduction and the general theme furnish the bonds of unity for the papers in the volume, many of which were originally submitted to the *Annals of Mathematics* and transferred here by common consent. Since the individual papers will be reviewed in *Mathematical Reviews*, it seems best to this reviewer to content himself here with a rather general description of the contents of the volume.

The first paper, by Weyl, is a reprint of his 1935 paper on the equivalence of the two definitions of the convex closure of a finite set of points in Euclidean space. The second paper, also by Weyl, gives a proof of the Main Theorem (of von Neumann) when all elements of the payoff matrix lie in an ordered field. (The Main Theorem is the one which asserts that a finite game is determined when mixed strategies are admitted.)

Continuing Part I, on finite games, Shapley and Snow give a characterization of the optimal (mixed) strategies in terms of submatrices of the payoff matrix. In principle this characterization gives