ABSTRACTS OF PAPERS

SUBMITTED FOR PRESENTATION TO THE SOCIETY

The following papers have been submitted to the Secretary and the Associate Secretaries of the Society for presentation at meetings of the Society. They are numbered serially throughout this volume. Cross references to them in the reports of the meetings will give the number of this volume, the number of this issue, and the serial number of the abstract.

ALGEBRA AND THEORY OF NUMBERS

51. E. W. Barankin: *Bounds for the characteristic roots of a matrix.*

With the application of Schwarz's inequality (a principal tool in the more recent investigations of bounds for matrix roots) to the n linear equations $\lambda x_r = \sum_s a_{rs}x_s$, where λ is a root of the arbitrary matrix $A = \|a_{rs}\|$, and $\{x_r\}$ is an eigen-vector of A belonging to λ, it is proved that $|\lambda| \leqq \max (R_r T_r)$, where $R_r = \sum_s |a_{rs}|$, $T_r = \sum_s |a_{sr}|$. Generalizations of this theorem, to give stronger upper bounds, are indicated; and the independent result, that $|\lambda| \leqq \max R_r$, $|\lambda| \leqq \max T_r$, is established. The first theorem was recently proved for matrices of order 2 by A. B. Farnell (Bull. Amer. Math. Soc. vol. 50 (1944) pp. 789–794). (Received December 23, 1944.)

52. Garrett Birkhoff: *Lattice-ordered Lie groups.*

A Lie l-group is defined as a lattice-ordered group which is a Lie group; a Lie tl-group, as a Lie l-group whose lattice operations are continuous in the topology; a Lie l-algebra, as a lattice-ordered Lie algebra whose set of positive elements is invariant under all inner automorphisms. Conditions that the Lie algebra of a Lie group be a Lie l-algebra are found. A Lie algebra of dimension r can be made into a Lie l-algebra if and only if it has a chain of invariant subalgebras of length r; hence only if it is solvable. A simply ordered topological l-group is one-dimensional. The only Lie tl-groups are the powers R^n of the additive group of real numbers; hence they are all commutative. (Received January 3, 1945.)

53. A. L. Foster: *Boolean-like rings, a generalization of Boolean rings. The logical algebra of general commutative rings.*

This paper is mainly concerned with the study of a generalization (first touched on in: A. L. Foster, *The idempotent elements of a commutative ring form a Boolean algebra* · · · . *Ring duality and transformation theory*, to appear in Duke Math. J., March 1945) of the concept Boolean ring, a generalization in which many of the formal properties, both ring and "logical," of the latter are preserved, and one which arises naturally from the basic duality theory of rings previously introduced. The class of Boolean-like rings is discussed within the framework of a certain logical algebra of (general) rings. (Received January 8, 1945.)

54. G. N. Garrison: *Note on invariant complexes of a quasigroup.*

In an earlier paper (*Quasi-groups*, Ann. of Math. vol. 41 (1940) pp. 474–487) the writer discussed (§4.4) relations between two invariant complexes, H and K, of a