

ABSTRACTS OF PAPERS

The abstracts below are abstracts of papers presented by title at the October Meeting in New York and the November meeting in Evanston. Abstracts of papers presented in person at these meetings will be included in the reports of the meetings which will be published in the January issue of this BULLETIN.

Abstracts are numbered serially throughout this volume.

ALGEBRA AND THEORY OF NUMBERS

453*t.* R. H. Bruck and Erwin Kleinfeld: *The structure of alternative division rings.*

The following theorem is proved: (A) Every alternative division ring R of characteristic other than two is either (i) a field or skew-field or (ii) a Cayley-Dickson division algebra (of order eight over its centre). The essence of the proof is to show that if R , with centre F , is not associative, then every element of R satisfies a quadratic equation over F . This reduces (A) to a theorem of A. A. Albert (*Absolute-valued algebraic algebras*, Bull. Amer. Math. Soc. vol. 55 (1949) pp. 763-768). Call a projective plane alternative if Ruth Moufang's law of the complete quadrangle or Marshall Hall's Theorem L holds universally, but no complete quadrangle has collinear diagonal points. Then (A), together with published work of Moufang, Hall, R. D. Schafer, and others, implies the following theorems: (B) Every alternative plane characterizes a coordinate (alternative division) ring uniquely in the sense of isomorphism. (C) If an ordered plane is alternative it is Desarguesian. That (A) implies (B) was previously pointed out by M. F. Smiley, and (C) answers a question originally posed by Max Dehn to Ruth Moufang some years ago. (This abstract was originally submitted July 27, 1950 to the International Congress, too late for acceptance.) (Received September 15, 1950.)

454*t.* Trevor Evans: *On multiplicative systems defined by generators and relations. I. General theory.*

Using the characterization of a loop as a system with three binary operations, a study is made of the properties of loops defined in terms of generators and relations. A normal form theorem is obtained for loops defined by a certain type of relation and it is shown that every finitely related loop can be put in this form. The structure of subloops of loops defined by generators and relations is completely determined and results obtained analogous to those of Grace E. Bates, *The theory of free loops and nets and their generalizations*, Amer. J. Math. vol. 69 (1947) pp. 449-550. Corresponding results hold also for other nonassociative multiplicative systems such as quasigroups, groupoids, and groupoids with unique division on one side. The word problem is solved for loops and the cancellation and division problems for groupoids. (Received August 14, 1950.)

455*t.* Trevor Evans: *On multiplicative systems defined by generators and relations. II. Monogenic loops.*

The methods developed in a previous paper by the author *On the theory of multiplicative systems defined by generators and relations. I. General theory*, are used to study some properties of monogenic loops (loops generated by one element). The following