$w=(N-1)^{1/2}s/\chi_{1-\alpha}$. It is shown that if D be defined as follows: (1) if $L_1 \leqq \bar{x} \leqq L_2$, $D=(2\pi)^{-1/2}\int_{(L_1-\bar{x})/w}^{(L_2-\bar{x})/w} \exp\{-y^2/2\}dy$, (2) $D=G$ otherwise, then $|P\{D\leqq\gamma\}-\alpha|$ approaches zero as $N\rightarrow\infty$. Thus D is a large sample lower confidence limit. The extension to upper and two-sided limits presents no difficulty. (Received July 8, 1946.)

Topology

336. R. F. Arens: *Convex topological algebras.* Preliminary report.

A convex topological algebra A is a convex topological linear space in which a multiplication of elements is defined, which is, as is addition and scalar multiplication (for definiteness, take the case of real scalars), continuous simultaneously in both factors. This is a generalization of the concept of normed rings. However, the elements with inverses do not form an open set, nor is inversion continuous when possible. The author proves that if A is a division algebra, and is complete in some metric, then A is finite-dimensional, and hence its structure follows from Frobenius' theorem. This result is fundamental for the representation theory of convex topological algebras. (Received June 7, 1946.)

337. R. F. Arens: *Duality in topological linear spaces.*

Let L be any topological linear space with elements x. Let L^* be the set of continuous linear functionals f defined on L, and use in L^* the topology in which convergence of directed sets means uniform convergence on each compact subset of L (the k-topology). Let this construction be repeated, using L^* instead of L, and giving rise to L^{**}, with elements X. Then for each X there is an $x\in L$ such that $X(f)=f(x)$ for each $f\in L^*$. This natural mapping from L^{**} back into L is 1-1 and continuous if L is convex; if furthermore L is complete in some invariant metric (in particular, if L is a Banach space) then the natural mapping is bicontinuous. (Received July 10, 1946.)

338. R. H. Bing: *Skew sets.*

No plane set G contains a collection of five mutually separated sets such that the closure of the sum of any pair of these five sets is the closure of a connected subset of G which is open in G. (Received July 10, 1946.)

339. G. D. Birkhoff and D. C. Lewis: *Chromatic polynomials.*

The number of ways a map P_{n+3} of $n+3$ regions can be colored with λ colors is given by a polynomial $P_{n+3}(\lambda)$ of degree $n+3$. Certain new properties of these chromatic polynomials are established. For instance, if P_{n+3} is regular and if $(-1)^h a_h$ is the coefficient of $(\lambda-2)^{n-h}$ in the expansion of $P_{n+3}(\lambda)/\lambda(\lambda-1)(\lambda-2)$ in powers of $\lambda-2$, it is shown that binomial coefficient $C_h^n \leqq a_h \leqq C_h^{n+h-1}$. Similar results are obtained for expansions in powers of $\lambda-5$. Moreover, extensive numerical calculations indicate that both $P_{n+3}(\lambda)/\lambda(\lambda-1)(\lambda-2)-(\lambda-3)^n$ and $(\lambda-2)^n-P_{n+3}(\lambda)/\lambda(\lambda-1)(\lambda-2)$ are positively completely monotonic for $\lambda\geqq 4$. This conjecture is a very strong form of the usual four-color proposition that $P_n(4)>0$. In connection with reducibility, reduction formulas, and the analysis of rings, the theory of Kempe chains, which has been applied qualitatively with considerable success to the case $\lambda=4$, is generalized so as to yield quantitative results on chromatic polynomials for all values of λ. Typical results on reducible configurations, previously obtained only by use of Kempe chains, are also obtained inductively. The present paper therefore to some extent attempts to