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Linear orderings, by Joseph G. Rosenstein, Academic Press, New York, 1982, xvii + 487 pp., $64.00. ISBN 0-1259-7680-1

The study of linear (total) orderings requires no justification. The concept is one of the earliest and most fundamental in mathematics—its key importance was established by such giants as Cantor, Gödel and von Neumann who pinpointed the central role of the ordinal numbers. The complexity of more general linear orderings was shown by Hausdorff in "Grundzüge einer Theorie der geordneten Mengen" which laid the foundations of the subject. More recently, developments in universal algebra and model theory have led to renewed interest in linear orderings. In 1977, Graham Higman proved that any homogeneous relation is essentially a linear ordering. In model theory, Ehrenfeucht and Mostowski (1956) showed that if a first order theory T has an infinite model and $\langle X, \leqslant \rangle$ is any linearly ordered set, then T has a model whose automorphism group has $\mathrm{Aut}(\langle X, \leqslant \rangle)$ as a subgroup. In the 1970s, Shelah developed a technique (forking) for analysing first order theories in which no infinite linear ordering is implicitly defined (stable theories); no such general technique is known for handling theories in which an infinite linear ordering is present.

In the absence of algebraic operations and any other relations, theories of linear orderings are quite well understood, mainly as a result of Laüchli and Leonard, Rosenstein, Rubin, Gurevich and Shelah, and Fraïssé and his school. For example, Rubin proved that any complete theory of linear orderings which has an uncountable number of countable models has continuum many—a very deep theorem. Some of the work has been generalised to partial orderings, but the absence of any overall picture when algebraic operations interplay with the ordering remains acute. Isolated examples have been extensively studied: