Characters of finite groups, by W. Feit. W.A. Benjamin Inc., New York, 1967. viii + 186 pages. $9.50 hardcover, $4.95 paperback.

Most books on group theory contain a section on characters, but the applications usually do not go much beyond the $p^{\alpha}q^{\beta}$-theorem. In the present book the author develops some of the recent applications of character theory, due to Brauer, Suzuki, Thompson and the author himself.

Chapter 1 brings the basic properties of representations and characters following Schur's method, this being the most direct route. Much of the material in this chapter would figure in the canonical account of the subject, but by no means everything. Among the sidelights is the following remarkable relation ascribed to Frobenius and Schur: the number of solutions of $x^2 = 1$ in a finite group G is less than or equal to the sum of the degrees of the irreducible characters, with equality if and only if the real numbers form a splitting field for G. Integral representations are briefly discussed, but no modular characters. In fact, at several points in the book results first proved by modular characters are obtained within the characteristic 0 theory.

Chapter 2 centres on Brauer's characterization of characters, which is derived here for any field of characteristic 0. The applications include estimates of the Schur index, and results on $A_n = \{x \varepsilon G \mid x^n = 1\}$. It is shown that card (A_n) is divisible by (card (G), n); in case of equality Frobenius conjectured A_n to be a subgroup. Only special cases of this conjecture have been confirmed; some are treated in Chapter 3, which is concerned with criteria for non-simplicity. The first of these is P. Hall's criterion for solubility. Next, the existence and uniqueness of relative normal complements is studied; many of the results of Grün and P. Hall, originally proved by transfer, are rederived here, and results of Brauer and Suzuki on the existence of π-complements are proved. The chapter ends with Thompson's criterion for a group to have a normal p-complement for an odd prime p.

The final chapter discusses a number of topics related more by the methods used than by the results. They are meant "to provide a random sample of some of the work that has recently been done in this area". Of course it would be unreasonable to look for a proof that groups of odd order are soluble, in a book less than three-quarters the length of the classical Feit-Thompson paper, but the book does include the earlier result of Feit, M. Hall and Thompson, that a group of odd order is soluble if the centralizer of any element $\neq 1$

https://doi.org/10.1017/S0008439500028794 Published online by Cambridge University Press

is nilpotent. The non-simplicity of groups with generalized quaternion Sylow 2-subgroup is proved (the case of a quaternion Sylow 2-subgroup still needs modular characters and so is omitted). Other topics include some technical notions such as trivial intersection sets and the construction of irreducible characters by "coherence" which are developed for the sake of applications, in the book and elsewhere.

As this mere enumeration shows, the book contains a great deal in 180 pages. This is achieved by a style which is always very much to the point, and generally terse without sacrificing clarity. In fact, the usefulness of the book lies in the fact that in relatively few pages, assuming only a little elementary group theory (as well as some Galois theory), the author is able to include so many of the vital results of current finite group theory. There is a brief index and a list of notations; the latter should really come at the beginning, since it contains conventions used in the text without further explanation. On occasion one might wish for a little more motivating discussion, or some examples (of which there are hardly any), but these are points the interested reader can often supply for himself. The reviewer noticed no significant misprints (on p. 98, line 2, a "normal" is missing and on p. 181, the sign for normal subgroup is printed back to front). Clearly this is a book that will be welcomed by all serious students of the subject.

P.M. Cohn

Elements of Nonparametric Statistics, by G.E. Noether. John Wiley and Sons, New York, 1967. ix + 104 pages. $7.95.

A glance at the Bibliography of Nonparametric Statistics by Savage or at the two volumes of Handbook of Nonparametric Statistics by Walsh shows that a vast amount of material is available on Nonparametric Statistics in scattered form in research Journals. However, surprisingly little effort has so far been made to make even a part of this material available in a coordinated and systematic manner for the use of students of Nonparametric Statistics. The book Nonparametric Methods in Statistics by Fraser seems to be the only book available that may be used for an introductory course at advanced undergraduate or beginning graduate level. There is clearly a need for more texts at this level specially since Fraser's book is now 10 years old.

Professor Noether's book, as he so clearly points out in his Preface, is intended primarily for the Statistician who is not too familiar with the literature but is interested in finding out more about the procedures he has already learned from some user's manual. It is not therefore surprising that the book lacks in mathematical rigor and detail. The author's style is very economical. In fact eleven chapters have been condensed into 104 pages.