countable type" is used in place of the more usual "countably decomposable" or "σ-finite". Notwithstanding these reservations, I consider this book valuable both as a reference source and, in conjunction with examples of the sort given by Dixmier and Sakai, as a clear and readable introduction to von Neumann algebras and Tomita-Takesaki theory.

A. S. WASSERMANN

KOSTRIKIN, A. I., *Introduction to algebra,* translated by N. Koblitz (Universitext, Springer-Verlag, Berlin-Heidelberg-New York, 1982), 575 pp., £16·50.

This book is far too expensive to be realistically recommended for purchase to today's overdrawn undergraduates, but should certainly be acquired by university libraries. Like many books for undergraduates it has grown out of a course of lectures, or rather in this case, out of two courses of lectures, for the book is formally divided into two roughly equal parts corresponding respectively to a first and a third semester course at Moscow University. This is a source of strength, in that the material is thoroughly class tested and the associated exercises are interesting, varied and apposite; but it gives rise to a weakness in that the elementary real vector space theory of Part 1 is an inadequate preparation for the material on group representations and modules in Part 2. The Moscow students are well catered for, since they receive a second semester course on linear algebra and geometry, but the reader of this book enjoys no such advantage and the attempts that are made to plug the gap are not entirely successful.

It is certainly interesting to see what is taught in an important (and presumably not too unrepresentative) Soviet institution and to realise that their traditions in algebra teaching are not very different from our own. Part 1 begins with "concrete" linear algebra (with vectors as n-tuples of real numbers) and includes an unusually thorough chapter on determinants. From there it proceeds to a fairly typical first course on groups, polynomials, rings and fields, with perhaps a greater emphasis than usual on polynomials as such. Part 2 begins with a long chapter (64 pages) of graphs followed by an even longer chapter (86 pages) on representations going as far as character theory and tensor products. This leaves relatively little space for further developments in rings and fields, and so although many interesting aspects (such as finite fields and ruler and compass construction) are discussed in the final chapter there is no systematic exposition of the Galois group, and the insolubility by radicals of the quintic, heralded in the introduction as one of the motivating problems of abstract algebra, is not in fact discussed in detail.

The exposition is precise, careful and thorough and the translation reads so smoothly that it is hardly ever noticeable that English was not the original language. The photographically reduced typescript has been produced very skilfully and deserves to be supplemented by less amateurish diagrams.

In summary, this book will be a useful source for both teacher and student and should be valued by both, not least for its wide-ranging and striking examples of the application of algebraic ideas.

J. M. HOWIE

ROBINSON, D. J. S., *A course in the theory of groups* (Graduate Texts in Mathematics Vol. 80, Springer-Verlag, Berlin-Heidelberg-New York, 1982) xvii+481 pp., DM 98.

This is a lovely book, whose stated aim and intention (successfully accomplished) is to give an introduction to the general theory of groups. The reader is expected to have the maturity of a year's graduate study in a British or American university, with a good basic knowledge of rings, fields, modules and the like. The writing is meticuously clear and concise. While not leisurely, it is not terse and indeed it is done with such enthusiasm and erudition as to carry the reader happily along. Many examples of groups are given, the life-blood of the subject, of course; in addition there is a truly vast set of exercises (some 650 in all!), varying from the elementary to the really quite challenging. Some of them are required for the subsequent development, and are noted as such. Any aspiring group theorist—as well as some of us older ones—would be well advised to read the book in detail and *do the exercises*. A book like this would also make a fine basis for a research student seminar, that is, with the students doing all the work.

The material covered is impressively wide, nicely balancing the theories of infinite groups, finite groups and abelian groups. Although the "abelian" section is quite short, it does contain quite a lot of what a general group-theorist would need in his work. The Chapter headings and sub-headings give some idea of the width:

Chapter 1: FUNDAMENTAL CONCEPTS OF GROUP THEORY. Binary Operations, Semigroups, and Groups; Examples of Groups; Subgroups and Cosets; Homomorphisms and Quotient Groups; Endomorphisms and Automorphisms; Permutation Groups and Group Actions.

Chapter 2: FREE GROUPS AND PRESENTATIONS. Free Groups; Presentations of Groups; Varieties of Groups.

Chapter 3: DECOMPOSITIONS OF A GROUP. Series and Composition Series; Some Simple Groups; Direct Decompositions.

Chapter 4: ABELIAN GROUPS. Torsion Groups and Divisible Groups; Direct Sums of Cyclic and Quasicyclic Groups; Pure Subgroups and p-groups; Torsion-free Groups.

Chapter 5: SOLUBLE AND NILPOTENT GROUPS. Abelian and Central Series; Nilpotent Groups; Groups of Prime-Power Order; Soluble Groups.

Chapter 6: FREE GROUPS AND FREE PRODUCTS. Further Properties of Free Groups; Free Products of Groups; Subgroups of Free Products; Generalized Free Products.

Chapter 7: FINITE PERMUTATION GROUPS. Multiple Transitivity; Primitive Permutation Groups; Classification of Sharply k-transitive Permutation Groups; The Mathieu Groups.

Chapter 8: REPRESENTATIONS OF GROUPS. Representations and Modules; Structure of the Group Algebra; Characters; Tensor Products and Representations; Applications to Finite Groups.

Chapter 9: FINITE SOLUBLE GROUPS. Hall π-subgroups; Sylow Systems and System Normalizers; p-soluble Groups; Supersoluble Groups; Formations.

Chapter 10: THE TRANSFER AND ITS APPLICATIONS. The Transfer Homomorphism; Grün's Theorems; Frobenius' Criterion for p-nilpotence; Thompson's Criterion for p-nilpotence; Fixed-point-free Automorphisms.

Chapter 11: THE THEORY OF GROUP EXTENSIONS. Group Extensions and Covering Groups; Homology Groups and Cohomology Groups; The Gruenberg Resolution; Group-theoretic Interpretations of the (Co)homology Groups.

Chapter 12: GENERALIZATIONS OF NILPOTENT AND SOLUBLE GROUPS. Locally Nilpotent Groups; Some Special Types of Locally Nilpotent Groups; Engel Elements and Engel Groups; Classes of Groups Defined by General Series; Locally Soluble Groups.

Chapter 13: SUBNORMAL SUBGROUPS. Joins and Intersections of Subnormal Subgroups; Permutability and Subnormality; The Minimal Condition on Subnormal Subgroups; Groups in Which Normality Is a Transitive Relation; Automorphism Towers and Complete Groups.

Chapter 14: FINITENESS PROPERTIES. Finitely Generated Groups and Finitely Presented Groups; Torsion Groups and the Burnside Problems; Locally Finite Groups; 2-groups with the Maximal or Minimal Condition; Finiteness Properties of Conjugates and Commutators.

Chapter 15: INFINITE SOLUBLE GROUPS. Soluble Linear Groups; Soluble Groups with Finiteness Conditions on Abelian Subgroups; Finitely Generated Soluble Groups and the Maximal Condition on Normal Subgroups; Finitely Generated Soluble Groups and Residual Finiteness; Finitely Generated Soluble Groups and Their Frattini Subgroups.

Riches indeed. The author modestly states: "No book of this type can be comprehensive, but I hope it will serve as an introduction to the several excellent research level texts now in print." It seems to me that it does this latter as well as could ever be expected. Where he could not possibly go into detail, as for example the state of the art in finite simple group theory, he points to references where the interested reader can follow methods up. The group-theoretical community will be grateful to the author for bringing together such a wide collection of topics; it must have been gruelling work. Reference is made to 230 research articles, and a staggering 67 books, all but 9 of them on group theory. The old order has certainly changed, giving place to new!

I do not doubt that this book will go into the annals of group theory as a classic of its type: if you have not done so already, get a copy.

JAMES WIEGOLD

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