is entitled " Girth ", the *girth* of a graph being the minimum of the lengths of all circuits in the graph. There is some interest amongst a number of graph-theorists in finding graphs, with given girth γ and with all vertices of given degree k, in which the number of vertices is minimal: detailed solutions are here discussed for $k=3$, $\gamma \leqq 8$. It is perhaps doubtful whether the title of the book is quite appropriate to Chapters 5, 7 and 8, but connectivity is certainly the theme of the subsequent chapters. The *connectivity* $\lambda(G)$ of a graph G is defined as the least integer k for which G is expressible as $H \cup K$, where H, K are subgraphs of G with at least k edges each (to exclude trivial partitioning of G) and with exactly k common vertices and no common edges. Thus G is separable, in the usual sense, if and only if $\lambda(G) \leqq 1$. Chapter 9 deals with separability and non-separability and with the tree-like decomposition of a separable (connected) graph into its cut-components, blocks or cyclic elements (depending on the terminological school to which one belongs). Thus one might say that Chapter 9 focuses attention on the distinction between graphs with connectivity $\leqq 1$ and those with connectivity $\geqq 2$. The contents of Chapters 10-12 might be roughly described by saying that they present a somewhat analogous theory in which the important distinction is between graphs with connectivity $\leqq 2$ and those with connectivity $\geqq 3$.

Much of the material included seems to be the product of the author's own research, which the book will help to make more accessible. The book is to be commended for its precision: concepts are exactly defined and theorems are stated exactly and proved exactly, and Professor Tutte thus avoids the sort of intuitive woolliness to which some graph-theorists are too prone. If two further volumes are in fact planned, these, like the present one, will indeed be valuable additions to the literature.

C. ST. J. A. NASH-WILLIAMS

PALEY, HIRAM AND WEICHSEL, PAUL M., *A First Course in Abstract Algebra* (Holt, Rinehart and Winston, 1966), xiii+334 pp., \$8.95.

The authors give a lucid account of the topics in abstract algebra normally included in an honours course. Chapters 1 and 3 deal with the basic properties of sets, relations, functions and permutations, while Chapter 2 is devoted to number theory. Chapters 4 and 5 cover the elementary theory of groups and rings. Some more advanced topics in group theory, including the basis theorem for finitely generated abelian groups, the Sylow theory, the elementary theory of soluble groups, and free groups, are treated in Chapter 6, while Chapter 7 is devoted to a similar treatment of ring theory, among the topics covered being field extensions, finite fields, and projective and injective modules.

The first five chapters, together with a selection of topics from Chapters 6 and 7, would make an excellent honours course in abstract algebra.

J. M. HOWIE

CHIH-HAN SAH, *Abstract Algebra* (Academic Press, Inc., New York, 1966), xiii+342 pp., 78s.

As a potential text for a course in a British university, this book falls rather uncomfortably between two stools, containing as it does rather too much advanced material for undergraduates and rather too much elementary material for postgraduates.

The book would, however, make an excellent supplementary reference for a good honours student: it contains a development of elementary number theory from Peano's axioms and a nearly completely algebraic proof of the fundamental theorem of algebra, as well as many other topics of interest to undergraduates and for which there rarely seems to be time.

The scope of the book is enormous. It seems nearly incredible that so much could be packed into 342 pages, and while the style is certainly concise, it does not seem

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