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Book Review

Computational Problems in Abstract Algebra, Edited by John Leech, 1970; 401 pages. (*Pergamon Press Ltd.*, £7 $18.50.)

This work is the proceedings of a conference at Oxford in 1967, to study the uses of computers in algebra. It is a well-known paradox that one of the fields where computers have had the least impact is pure mathematics, but there are signs that this situation is slowly changing, partly no doubt due to conferences such as this one. The main problem is to sort out the questions that are both manageable by computers *and* useful to the mathematician. This volume contains 35 articles ranging from research papers with faintly computational flavour to detailed programmes for answering specific questions using computers.

One of the crucial ways in which computers help the algebraist is in the study of finite simple groups. It so happens that the simple groups that were being found then were just of the right size to make this possible. An article by Marshall Hall, Jr. describes the search for simple groups of order less than 10^6, and actually constructs Janko's group of order 604,800 for the first time. There are several papers on the problem of constructing character tables, enumerating cosets and computing other data for groups, with varying amounts of stress on the computational side. Some authors, e.g. H. Jürgensen, describing multiplication in groups with given presentations, give detailed programmes illustrated by flow charts, but most authors are content to leave the problem in a form in which it can be passed on to the programmer and then report the outcome of the calculation.

There are several articles on other algebraic systems such as semigroups and projective configurations. The most striking are the papers on Jordan algebras by J. L. Paige and C. M. Glennie, which describe the search for identities in special Jordan algebras. Earlier work by Glennie has shown that 'special' identities of degree 8 exist, and he describes here how the computer was used to show that 8 is the least such degree; perhaps such methods can be used to help one get a basis for all the identities.

An interesting feature are the examples of what N. S. Mendelsohn calls 'man-machine interaction'. When a routine computation, e.g. deriving the consequences of a set of defining relations, is put on a computer, a pattern may emerge that was not apparent before. Some pertinent cases are discussed by D. E. Knuth and P. B. Bendix in their article on word problems and universal algebra.

Finally there are articles that do not specifically invoke computers. In particular there is J. H. Conway's splendid piece on enumerating knots, describing a notation which compresses six years work (in the 1890's) into one afternoon. This paper, and the one by H. F. Trotter make it clear that the use of computers can greatly increase the scope of these methods.

To sum up, here is a varied collection of papers showing both the scope and limitations of computers in algebra; they will clearly help the algebraist to decide when to call in a programmer, what he will have to tell him and what answer he can expect.

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