

tables for each species of *Lithobius* gathered together in an appendix, but they would be better with species headings instead of just numbers.

The immature stadia of one species of *Lithobius* are described in detail from the author's own work and more general remarks on the stadia in other groups are included. Although references are given for other life-history investigations, the author does not include much detail from these. Since he mentions that such authorities as the late K. W. Verhoeff have been misled by sub-adult specimens, he might have used a little more space to help others not to make the same mistakes. For example, the post-larval *Lithobius forficatus* with four teeth on the coxosternum of each maxilliped might be mistaken for a smaller species which does not run down in the key.

Our knowledge of the distribution of centipedes in Britain is still sadly incomplete—witness the lists of county records at the end of each species description. This will give much encouragement to those for whom the prospect of a new county record is exciting. In a general chapter on distribution, the paucity of the Scottish and Irish faunas is noted and species with restricted distributions are mentioned. It would have been helpful had the species concerned been listed; for example, one cannot discover at a glance which are the three littoral species without glancing through the notes on all forty-four. A foretaste of the interest which will accrue from detailed mapping of distribution is available for *Lithobius variegatus*. This must be our most interesting centipede and appears to be endemic to Britain. Dr. Eason noticed that the existing records were all from the west side of the 38° F January isotherm, and his collecting in some critical localities confirmed this pattern of distribution.

One cannot expect clear statements of habitat preferences when such a small number of people have been able to recognize species. As a consequence most of the habitat notes are disappointingly vague. Two of the more explicit notes refer to *Lithobius calcaratus* and *L. crassipes*—"the majority of records . . . are from woodland" and "common in moorland and mountainous country as well as in grassland and woodland". I think I detect here a bias towards woodland for *calcaratus* and open land for *crassipes* which is the very reverse of some published habitat notes. However, such impressions concerning distribution are necessarily very subjective. By providing the ecologist and naturalist with reliable means for diagnosis, Dr. Eason has ensured that more objective descriptions of ecological distribution will be possible in the near future.

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## USER—COMPUTER LANGUAGE

Numerical Methods and Fortran Programming with Applications in Engineering and Science

By Daniel D. McCracken and Dr. William S. Dorn. Pp. xii + 458. (New York and London: John Wiley and Sons, Inc., 1964.) 57s.

TO quote Sir Edward Bullard on the subject of the language of machines: "Most machines do only a few things, and the problem of telling them what to do is not difficult. An electronic computer is an unusual machine in that it can undertake a very wide range of operations. This variety of possible behaviour raises very severe problems of communication between the user and his machine and has led to the development of the art and profession of computer programming . . .". *Numerical Methods and Fortran Programming* deals with two associated topics—the problem of communication between the user and the computer mentioned by Sir Edward Bullard and the prior business of converting mathematical

models into a step-by-step form ready for communication.

In fact, three main tasks must be undertaken when solving a physical problem using a computer. The problem must first be given a mathematical model which illustrates the crux of the matter to be solved. Secondly, having decided on the model, a method of numerical investigation is chosen and the problem is coded, that is to say, a list of instructions in some language is prepared, which will eventually uniquely direct the computer to perform what calculation is required. Thirdly, the programme is fed into the computer and 'de-bugged', and eventually the required results are obtained. Put in this way, the book covers the second task outlined here adequately and very well.

An important point which is sometimes missed, and which is scarcely mentioned in the book (perhaps because it is an introductory work), is that when one approaches the computer with a programme, the computer is already armed with a very large programme, the compiler, which is waiting to deal with coding work. The compiler translates the programme as language into a form which the computer can deal with, and it is only when the whole programme has been translated in this way that the real business of computation can proceed.

Some of the art and profession of computer programming mentioned by Sir Edward Bullard is to do with spelling and the grammar of the language, but some of it is concerned with getting to know what the compiler will make of a particular piece of coding.

In these days of ever increasing use of electronic digital computation, the book will satisfy two main requirements. For mathematicians, physicists and engineers, not in any way familiar with a computer language, four chapters and an appendix take the subject of a particular language, Fortran II, from the fundamentals, through the basics of programme design to the use of sub-routines and format procedure for input and output. Interleaved between these chapters are six other chapters dealing with the numerical analytical detail which one must tackle sooner or later if one is serious about using computers to solve serious problems. The numerical analysis topics range from power series, iteration for the roots of algebraic equations, numerical integration, simultaneous linear equations, to the integration of sets of ordinary and partial differential equations. The material of the two main topics is matched, so that the reader has usually seen enough of the particular language to cast his numerical analysis into language, and has usually seen enough numerical analysis to put his equations into a language that can be solved by a computer. Each chapter is followed by a good number of well-chosen exercises, answers to which are provided; but more important is the use made of 'case studies' which occur at the close of each chapter. The case study poses a practical problem on the material so far introduced and then carefully goes through the detail of its solution. While being useful to the extent that the reader is made to appreciate the necessity for intense attention to accuracy in detail, which is vital for successful computer work, the case studies may be too discursive for some readers and might well be missed on a first reading. Readers who begin to programme some examples, however, will find themselves going back to the detail for vital information.

For advanced undergraduates and for research workers in almost any field of science who intend using computers, this book will be welcome, particularly if they are aimed at an I.B.M. machine or at least a computer with a Fortran compiler; it must be said, however, that not all computers have one, and that some computers have rather poor ones. The book is well produced and makes an excellent general purpose introduction to the whole business of getting answers from digital computers.

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