

Programing and numerical analysis

AN INTRODUCTION TO COMPUTER PROGRAMING. By Henry Mullish. 253 pp. Gordon and Breach, New York, 1966. Cloth \$14.50, paper \$5.00

NUMERICAL ANALYSIS FOR COMPUTERS. By John A. N. Lee. 284 pp. Reinhold, New York, 1966. \$10.00

by Joseph Gillis

Books on programing are not rare and it is rather difficult to determine their relative merits. One method that the reviewer sometimes uses is to put a book in the hands of a beginner and see whether he can write a program at the end. It is about as fair as giving somebody a book on swimming and testing him in the water when he has finished it.

However, whatever the merits of the criterion, *An Introduction to Computer Programing* passed it well. This

text contains all the basic elements of Fortran programing very simply explained—and nothing else. The intricacies of numerical analysis are ignored and the illustrative problems are all of the kind best dealt with by Fortran-like languages.

Up to a year or two ago books on computers suffered from the trouble that the machines described were obsolete before the books were off the press. We seem to have passed that stage, but something like it is beginning to be true of programing languages. The present text describes Fortran II and a great deal has happened since that was developed, even in the area of Fortran itself. However, anybody competent in Fortran II would still have no difficulty in absorbing the subsequent refinements and this book can be a useful means of introducing the subject to a beginner.

The material presented in *Numerical Analysis for Computers* was given in a course on numerical methods for advanced undergraduates at Kingston,

Ontario. It is admirably suited for such a purpose and could very usefully be put into the hands of similar students anywhere in the world.

The book begins with an introduction to Fortran programing and this is followed by chapters on most of the basic topics of numerical analysis. The amount of information under each heading is limited by the size and intention of the book, but the author's own practical interest and experience in computing show up both in the clear way in which snags are pointed out and in the variety of devices suggested for overcoming them.

One can safely recommend this text for the sort of course for which it was originally designed.

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The reviewer is professor of applied mathematics and former dean of the graduate school at the Weizmann Institute of Science, Rehovoth, Israel.

Modern position finding

SPHERICAL ASTRONOMY. By Edgar W. Woolard, Gerald M. Clemence. 453 pp. Academic Press, New York, 1966. \$18.00

by Ernst J. Opik

Written by the retired director of the Nautical Almanac Office, US Naval Observatory, and the retired scientific director of the US Naval Observatory (respectively), this is an authoritative treatment of the principles of positional astronomy. It is intended to replace the old classical treatises such as those of Chauvenet and Newcomb, which included methods and techniques no longer used, and it replaces these methods by more modern methods that until now have been somewhat widely scattered in the astronomical literature. Some of the topics that played a prominent part in the classical treatises are omitted since they are treated in other publications. These are the theories of special phenomena such as eclipses, transits and

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occultations; the theory of least squares and other methods for adjustment of observations; methods in numerical mathematics and techniques of numerical calculations.

The topics left, which are covered in one or more chapters of the present treatment, are the celestial coordinate systems, parallax, refraction, aberration, precession and nutation, variations of the local reference system, the dynamical basis, ephemerides, measurement of time, construction of observational star catalogs and a final chapter on the inertial reference system. Because of increasing precision of observations and the higher accuracy of astronomical data needed for applications such as space flight, the authors have taken care to derive exact mathematical relations before making

the approximations needed for practical purposes. Where in the older treatises the first-order approximation was all that was considered, it is now necessary in many cases to go to second- and third-order terms. Thus the book has a dryness inherent in this type of mathematics. Needless to say, the reader must be very proficient in the use of the formulas of spherical trigonometry as well as the technique of taking approximations. However, the principles and results are discussed in considerable detail. In connection with this discussion I found it sometimes hard to follow because of a paucity of diagrams which the reader will have to construct himself.

Because the book concentrates upon the basic principles and theory there are few worked examples although the

discussion of numerical values of the empirical constants is fairly complete. Thus it supplements the *Explanatory Supplement* to the *Ephemeris* published by Her Majesty's Stationery Office in 1961 where many more tables and worked examples are to be found but the basic theory is glossed over. Since one of the authors of the present treatise was also an author of the *Explanatory Supplement*, it is not surprising that both books are necessary to a complete understanding of the *American Ephemeris and Nautical Almanac*.

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The reviewer, professor of aeronautics and astronautics at the University of Washington, teaches the course in navigation for the Seattle Power Squadron.

Is anybody out there?

INTELLIGENT LIFE IN THE UNIVERSE. By I. S. Shklovskii, Carl Sagan. Russian portion trans. by Paula Fern. 493 pp. Holden-Day, San Francisco, 1966. \$8.95

INTELLIGENCE IN THE UNIVERSE. By Roger A. MacGowan, Frederick I. Ordway III. 416 pp. Prentice-Hall, Englewood Cliffs, N. J., 1966. \$13.50

by Herbert Malamud

The question of the existence of intelligent life in the universe (other than that on earth) has concerned philosophers of religion and science fiction for many years. Since the sudden birth of space travel and the resulting imminence of man's visits to other planetary bodies, the question has become of interest to other, more pragmatic personalities—hence the general popularity of flying-saucer speculations.

It is no accident that the subject has engaged the attention of Iosef Shklovskii, the imaginative Soviet astronomer who first explained the synchrotron-radiation source in the Crab nebula. A result of this attention was the appearance in 1963 of his *Universe, Life, Mind*.

Carl Sagan, presently assistant professor of astronomy at Harvard and a staff member of the Smithsonian Observatory is another who has studied

and written on the subject of possible extraterrestrial life forms. It was not a coincidence that he was struck by the book and offered to supervise its translation (by Paula Fern). Shklovskii was pleased, and the supervision became explanations and then additions and commentaries. *Intelligent Life in the Universe*, the final book, is about twice the length of the Russian original, Sagan's contributions being set off by deltas everywhere. While most books written by multiple authors have been carefully edited to hide this from the reader (except on the title page), this volume is an exception, the authors going so far as to include discussions of a few minor disagreements, leaving the reader to decide himself as to which is more likely correct.

All in all, this is an eminently successful collaboration by two authors who had, at least until the time of publication of their book, never met.

Roger MacGowan, of the Army Missile Command in Huntsville, Alabama, and Frederick Ordway of the General Astronautics Research Corporation of London have given us a more conventional collaboration in *Intelligence in the Universe*. Both, like the authors previously mentioned, have given professional attention to the problem, and have widely published in the field.

The two books are more alike than different, in many respects. Both may be described by the same outline, for example. They begin with a description of the universe, followed by an outline of stellar evolution. A description of and theories of development of planets follows this, with reasons for believing that planetary systems are more likely to be the rule rather than the exception. Shklovskii and Sagan accentuate this section more than MacGowan and Ordway do.

After this beginning comes a description of the development of life from inorganic systems and of the evolution from simple to complex and finally to thinking (presumably intelligent) life forms. A detailed description of the thinking process accompanies this section, much more detailed in the MacGowan-Ordway book. The possibilities inherent in thinking automata are also considered here.

Estimates based on reasonable extrapolations from data and on reasonable assumptions are derived for the possible prevalence of thinking forms, both biological and automatic, and an examination is made of possible empirical evidence of extraterrestrial intelligence, including possible historic or prehistoric visits to earth.

The authors then examine the question of possible communication with