solution exist, is illustrated by example. Here the author has led the reader in a very natural way to the basis of the deep existence theorems of control theory.

The mathematical theory begins in Chapter 4. The approach taken is to show that the payoff, or value $V(x)$, of a game starting at the arbitrary initial state x, satisfies what has become known as the "Bellman equation" which somewhat resembles a partial differential equation of Hamilton-Jacobi type. The solutions of such equations often exhibit extreme changes in neighborhoods of certain surfaces in state space called singular surfaces by the author, or switching surfaces in control theory. The majority of the remainder of the book is concerned with showing, mainly by example, the types of behavior which solutions may exhibit near these surfaces, in classifying the surfaces and in solving problems using the concepts introduced.

On the whole, the printing of the book is very good. There are only occasional minor errors, e.g., the rightmost vectogram for the player P in Figure 3.3.1, page 51, is in error and will not yield the shown solution.

The wide range of possible applications of differential games is exemplified in the many examples discussed and solved throughout the text. While obtaining solutions to these intriguing problems, the author has done an excellent job in providing insight into the deep mathematical theories which exist and the difficulties which must still be overcome.

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136[X].—BEN NOBLE, *Numerical Methods*, Oliver & Boyd Ltd., Edinburgh, Scotland, 1964. Volume 1, *Iteration, Programming and Algebraic Equations*, xii + 156 pp., 19 cm. Price \$2.75. Volume 2, *Differences, Integration and Differential Equations*, viii + 372 pp., 19 cm. Price \$3.00.

A reasonable knowledge of numerical analysis should be possessed by every engineer, scientist or applied mathematician. A great many books have been recently published in an attempt to fill the demand for this knowledge, particularly at an elementary level. Many of these books combine numerical analysis and computer programming, using a problem-oriented language like FORTRAN. These books are frequently disappointing, particularly if you have read the publisher's claims on the dust jacket before you read the author's preface.

It is a pleasure to report that these two volumes under review have accomplished their stated purpose and constitute an excellent elementary introduction to the most commonly used numerical methods. The first chapter of Vol. I sets the general level of the work by presenting a clear concise account of several topics such as round off, absolute and relative errors, error analysis and control, etc. The treatment is both practical and elementary. This is followed with chapters on iteration methods, elementary programming, linear equations, and matrix methods. The emphasis is placed on presenting a few methods in some detail. The chapter on programming uses a problem-oriented language, but does not try to teach FORTRAN or ALGOL. The language is used to illustrate how a source language is used without going into the vast amount of detail necessary to present an existing source language.

Volume II covers topics in finite differences and approximate representation of functions, polynomial interpolation, numerical integration and differentiation, ordinary differential equations and partial differential equations. As in Vol. I the work is illustrated by well chosen examples. The methods presented are standard ones, but the author gives many hints and much practical advice on using the various numerical procedures. The weakest chapter in the book is one on partial differential equations. Only the heat equation and Laplace's equation are actually considered. Even here the author manages to say a lot in a very small space.

These volumes are part of the University Mathematical Text series. The price of each volume is quite modest. In fact, the two volumes can be obtained for considerably less than many single volume treatments of numerical analysis.

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137[X, Z].—LADIS D. KOVACH, *Computer-Oriented Mathematics*, Holden-Day, Inc., San Francisco, Calif., 1964, vii + 98 pp., 23 cm. Price $3.95.

The purpose of this small volume is to acquaint the interested reader with the ideas behind some of the algorithms which are commonplace in computer programs. It is designed for use in lower-level college programming courses and for advanced high school students. The only concept from elementary calculus which appears is the derivative, and this occurs but once.

Topics included are: characteristics of computers, number bases, initial guesses, interpolation, approximation methods, iteration, relaxation, and Monte Carlo methods.

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138[X, Z].—WILLIAM PRAGER, *Introduction to Basic FORTRAN Programming and Numerical Methods*, Blaisdell Publishing Company, New York, 1965, ix + 203 pp., 28 cm. Price $6.00.

This book, written by one of the most distinguished applied mathematicians of the present time, admirably illustrates that trend in the writing of textbooks on numerical analysis (visible in a number of recent works) in which the author seeks to impart to the student practical experience in the use of a digital computer, to acquaint him with the theory of computation, and to do so within the framework of a balanced and integrated course of study.

With regard to the specific scope and intention of the book it would seem impossible to do better than quote from the publisher's advertisement.

"This text corresponds to a sophomore course, which the author has been teaching for several years. The timing of this course and the choice of its contents was motivated by the desire to introduce students in engineering and the sciences to automatic computation as early as is possible without inviting uncritical use of the new tool.

"An introductory chapter, in which the program for a simple computation (selected partial sums of a series) is presented first in English and then in FOR-