Fulkerson. The second algorithm is also applicable to quadratic problems.

The last chapter describes a method of steepest descent for general programming problems. This method is an extension of gradient methods used for finding the unconstrained minimum of a function of several variables.

There are eight valuable appendices devoted to a variety of topics from programming theory.

H. Kaufman, McGill University

A Short Course in Differential Equations, by Earl D. Rainville. Macmillan, New York; Brett-Macmillan, Galt, Ont., second edition, 1958. 255 pages. $4.50.

This is the second, enlarged edition of a book which deals with ordinary differential equations in real variables for beginners. It contains the elementary facts and procedures in readable form. Applications to physics and mechanics are given in brief special chapters following the exposition of theory. Various methods, including the operational method, are discussed for the integration of linear differential equations with constant coefficients. The general existence theorem for equations of the first order is stated and the reader is invited to apply the iterative process, as given without convergence proof, to an elementary example. The book contains about 1250 exercise examples with answers. It should appeal to Science and Engineering students with a modest knowledge of the calculus.

Hanna Schwerdtfeger, McGill University

Applications of Finite Groups, by J.S. Lomont. Academic Press, New York and London. 346 pages. $11.

The classical works of Weyl, Van der Waerden and Wigner dealing with the applications of group theory to physics were written with a zeal to convert their reluctant fellow physicists to the powerful global tools of this branch of mathematics. They succeeded so well in their task that now, after nearly three decades, there is a growing need for a new and comprehensive book devoted to the impressive accumulation of group theoretical methods in quantum mechanics, field theory and elementary particle physics which has taken place meanwhile. While the new developments connected with the rotation group are well covered by recent books on angular momentum, it is still extremely difficult to find a good text book account of the representations of the proper and improper Lorentz groups or the various gauge groups and symmetry properties peculiar to relativistic quantized field theories.

One cannot say that the book under review fulfils this need. Firstly, it is restricted in scope to finite groups. Secondly, field theory (with the exception of fermian creation operators) and elementary particles are not included among the subjects discussed, the applications dealing mainly with atomic, molecular and solid state physics. However, being partly aware of the existing gap in the literature, the author has inserted a section on the rotation group in the text and added a long appendix on the Lorentz group. Unfortunately neither of these additions does justice to its subject and their sketchy and undidactical treatment makes them unsatisfactory for the student who is approaching these topics for the first time.

Turning now to the main body of the text one is impressed by the table of contents which covers a fair amount of important results pertaining to abstract groups with special emphasis on the theory of group characters and lists a wide range of applications. These include classical applications like the derivation and classification of crystallographic groups, the discussion of molecular vibrations and molecular structure or the rich subject of wave functions in crystals with a discussion of Brillouin zones. Less familiar topics like wave guide junctions and the structure of thermodynamical functions are also treated.

Unfortunately the reading of the book itself is less rewarding. The author's idea of a book useful to physicists appears to be that it should be written in a Handbook style, stuffed with a monotonous collection of (sometimes numbered) formulae and results, some proven, others merely stated, the material being made digestible not by order and clarity, but instead by an unnecessary familiarity of expression, the whole thing being seasoned with rather random examples and illustrations. Why a careful explanation of mathematical methods and concepts involved should be abandoned in favour of the bombardment of the reader by recipes, just because the reader happens to be a physicist, is not easy to understand.

To pick up a few examples, a concept like "endomorphism" is defined by means of the notion of subgroup, prior to the definition of the latter concept. The important Lagrange theorem is then mentioned as if it were self evident while half a page is devoted to trivial examples illustrating what is meant by a function on a group. A lack of perspective dominates the mathematical chapters and the unwarned reader may unjustly blame himself for failing to understand such assertions as the one (on page 26) about every group of order < 60 being solvable, after he has vainly tried to absorb a half page treatment of the Galois theory of composition quotient groups.

If the reader can surmount these barriers and wade his way through the applications, he will enjoy some well written chapters like the ones dealing with molecular vibrations and molecular orbitals. It is to be regretted that the chapters on symmetric groups and their applications cannot be included in this class since the important technique of Young symmetrizers is not given an adequate treatment in existing books on the applications of group theory.

Long and fairly complete lists of references are given at the end of each chapter, but the papers and books listed (with titles translated into English!) are never referred to in the text.

It seems rather ironical that a book dealing with symmetry and structure should have so little use for either in its conception and execution.

Feza Gürsey, Princeton, N. J.

Studies in linear and non-linear programming, by K.J. Arrow, L. Hurwicz and H. Uzawa. Stanford University Press, 1958. 229 pages. $7.50.

The three main themes in this collection of papers are existence theorems (part I), the gradient method (part II) and the construction of special algorithms for specific programming problems (part III). The first chapter provides detailed summaries of the papers and connecting links between them.

In chapter 2 an explicit formula is obtained for a set of vectors spanning a convex polyhedral cone given as the intersection of half-spaces. This result is then used to prove the fundamental theorems on convex polyhedral cones. In a later chapter an elementary method for solving linear programming problems is based on this formula. As the method calculates all the extreme points of the feasible set, it is not as efficient as the simplex method.

Consider the problem: Find an n-vector x that maximizes f(x) subject to the restriction that $x \geq 0$ and $g(x) \geq 0$, where f(x) and $g(x) = \langle g_1(x), \ldots, g_m(x) \rangle$ are functions defined on the n-vector $x \geq 0$. The Lagrangian associated with this problem is

$$\phi(x,u) = f(x) + u \cdot g(x),$$

where $x = \langle x_1, \ldots, x_n \rangle$ and $u = \langle u_1, \ldots, u_m \rangle$. The case when f(x) and g(x) are concave functions in $x \geq 0$ (concave programming) is considered in chapter 3, and a new condition is given under which $\bar{x}$ is a solution of the maximizing problem if and only if there is a vector $\bar{u}$ such that $(\bar{x}, \bar{u})$ is a non-negative