Mathematical Optimization Models And Methods Diva Portal

In the modern world, most gross product is created within Enterprise firms, project programs, state agencies, transnational corporations and their divisions, as well as various associations and compositions of the above entities. Enterprises, being, on the one hand, complex, and, on the other hand, widespread systems, are the subject matter of cybernetics, system theory, operations research, management sciences and many other fields of knowledge. However, the complexity of the system obstructs the development of mathematically rigorous foundations for Enterprise control. Moreover, methods of operations research and related sciences, which are widely used in practice, provide optimization of the constituents of an Enterprise, without modeling it as a whole system. But the optimization of parts does not lead to the optimality of the whole, and, also, the absence of top-down and holistic mathematical models of Enterprise contradicts the principle of holism and the system approach. The approach in this book looks first at Enterprise Systems and their essential aspects as complex sociotechnical systems composed of integrated sets of

structural and process models (Chapters 1 and 2). A uniform description of all the heterogeneous fields of the modern Enterprise (marketing, sales, manufacturing, HR, finance, etc.) is then made, and the Enterprise Control Problem is posed as a top-down and holistic mathematical optimization problem (Chapter 3). Original models and methods of contract theory (Chapter 4), technology management (Chapter 5), human behavior and human capital (Chapter 6) and complex activity and resource planning (Chapter 7) are developed to solve the problem. Structural processes and mathematical models constitute an Optimal Enterprise Control Framework (Chapter 8) that provides a practical solution to the Enterprise Control Problem. This book is a resource for postgraduate and doctoral students, postdoctoral researchers and professors with research interests in the following fields of science: Fundamental Complex Systems study, Complex Systems Engineering, Enterprise Systems Engineering Applications of Operations Research, Optimization, Probability and Stochastic processes to Management Science, Economics and Business Theory of the Firm Business and Management – general, strategy/leadership, organization management, operations management and management information systems Theory of Business Processes, Business Processes Improvement and Reengineering This book contains the written versions of main lectures presented at the

Advanced Study Institute (ASI) on Computational Mathematical Programming, which was held in Bad Windsheim, Germany F. R., from July 23 to August 2, 1984, under the sponsorship of NATO. The ASI was organized by the Committee on Algorithms (COAL) of the Mathematical Programming Society. Co-directors were Karla Hoffmann (National Bureau of Standards, Washington, U.S.A.) and Jan Teigen (Rabobank Nederland, Zeist, The Netherlands). Ninety participants coming from about 20 different countries attended the ASI and contributed their efforts to achieve a highly interesting and stimulating meeting. Since 1947 when the first linear programming technique was developed, the importance of optimization models and their mathematical solution methods has steadily increased, and now plays a leading role in applied research areas. The basic idea of optimization theory is to minimize (or maximize) a function of several variables subject to certain restrictions. This general mathematical concept covers a broad class of possible practical applications arising in mechanical, electrical, or chemical engineering, physics, economics, medicine, biology, etc. There are both industrial applications (e.g. design of mechanical structures, production plans) and applications in the natural, engineering, and social sciences (e.g. chemical equilibrium problems, christollography problems). Decomposition methods aim to reduce large-scale problems to simpler problems.

This monograph presents selected aspects of the dimension-reduction problem. Exact and approximate aggregations of multidimensional systems are developed and from a known model of input-output balance, aggregation methods are categorized. The issues of loss of accuracy, recovery of original variables (disaggregation), and compatibility conditions are analyzed in detail. The method of iterative aggregation in large-scale problems is studied. For fixed weights, successively simpler aggregated problems are solved and the convergence of their solution to that of the original problem is analyzed. An introduction to block integer programming is considered. Duality theory, which is widely used in continuous block programming, does not work for the integer problem. A survey of alternative methods is presented and special attention is given to combined methods of decomposition. Block problems in which the coupling variables do not enter the binding constraints are studied. These models are worthwhile because they permit a decomposition with respect to primal and dual variables by two-level algorithms instead of three-level algorithms. Audience: This book is addressed to specialists in operations research, optimization, and optimal control. Optimization Models for Rail Car Fleet Management represents the result of multi-year efforts to provide readers with insights into one of the most important areas of railway transport management. The book covers mathematical procedures for

the effective and efficient utilization of railway freight cars, developed models for optimization methods, heterogeneity and partial substitutability of freight cars, research and development in rail freight car fleet management models, and the stochastic and dynamic nature of the supply, demand and traveling time of freight cars, among other topics. Summarizes the authors past research efforts in the field of rail freight car fleet management Presents various approaches that include the application of a variety of optimization techniques Contains centralized, decentralized, distributed perspectives considered under the assumption of deterministic, stochastic, fuzzy and fuzzy stochastic parameters This book is focused on the discussion of the traffic assignment problem, the mathematical and practical meaning of variables, functions and basic principles. This work gives information about new approaches, methods and algorithms based on original methodological technique, developed by authors in their publications for the past several years, as well as corresponding prospective implementations. The book may be of interest to a wide range of readers, such as civil engineering students, traffic engineers, developers of traffic assignment algorithms etc. The obtained results here are to be used in both practice and theory. This book is devoted to the traffic assignment problem, formulated in a form of nonlinear optimization program. The most efficient solution algorithms

related to the problem are based on its structural features and practical meaning rather than on standard nonlinear optimization techniques or approaches. The authors have carefully considered the meaning of the traffic assignment problem for efficient algorithms development.

Mathematical Optimization Terminology: A Comprehensive Glossary of Terms is a practical book with the essential formulations, illustrative examples, real-world applications and main references on the topic. This book helps readers gain a more practical understanding of optimization, enabling them to apply it to their algorithms. This book also addresses the need for a practical publication that introduces these concepts and techniques. Discusses real-world applications of optimization and how it can be used in algorithms Explains the essential formulations of optimization in mathematics Covers a more practical approach to optimization

Scheduled transportation networks give rise to very complex and large-scale networkoptimization problems requiring innovative solution techniques and ideas from mathematical optimization and theoretical computer science. Examples of scheduled transportation include bus, ferry, airline, and railway networks, with the latter being a prime application domain that provides a fair amount of the most complex and largest instances of such optimization problems. Scheduled

transport optimization deals with planning and scheduling problems over several time horizons, and substantial progress has been made for strategic planning and scheduling problems in all transportation domains. This state-of-the-art survey presents the outcome of an open call for contributions asking for either research papers or state-of-the-art survey articles. We received 24 submissions that underwent two rounds of the standard peer-review process, out of which 18 were finally accepted for publication. The volume is organized in four parts: Robustness and Recoverability, Robust Timetabling and Route Planning, Robust Planning Under Scarce Resources, and Online Planning: Delay and Disruption Management.

Optimization problems arising in practice usually contain several random parameters. Hence, in order to obtain optimal solutions being robust with respect to random parameter variations, the mostly available statistical information about the random parameters should be considered already at the planning phase. The original problem with random parameters must be replaced by an appropriate deterministic substitute problem, and efficient numerical solution or approximation techniques have to be developed for those problems. This proceedings volume contains a selection of papers on modelling techniques, approximation methods, numerical solution procedures for stochastic

optimization problems and applications to the reliability-based optimization of concrete technical or economic systems.

This book presents the theoretical details and computational performances of algorithms used for solving continuous nonlinear optimization applications imbedded in GAMS. Aimed toward scientists and graduate students who utilize optimization methods to model and solve problems in mathematical programming, operations research, business, engineering, and industry, this book enables readers with a background in nonlinear optimization and linear algebra to use GAMS technology to understand and utilize its important capabilities to optimize algorithms for modeling and solving complex, large-scale, continuous nonlinear optimization problems or applications. Beginning with an overview of constrained nonlinear optimization methods, this book moves on to illustrate key aspects of mathematical modeling through modeling technologies based on algebraically oriented modeling languages. Next, the main feature of GAMS, an algebraically oriented language that allows for high-level algebraic representation of mathematical optimization models, is introduced to model and solve continuous nonlinear optimization applications. More than 15 real nonlinear optimization applications in algebraic and GAMS representation are presented which are used to illustrate the performances of the algorithms described in this book. Theoretical and computational results, methods, and techniques effective for solving nonlinear optimization problems, are detailed through the algorithms MINOS, KNITRO, CONOPT, SNOPT and IPOPT which work in GAMS technology.

Here is a collection of nonlinear optimization applications from the real world, expressed in the

General Algebraic Modeling System (GAMS). The concepts are presented so that the reader can quickly modify and update them to represent real-world situations.

"This book focuses on the mathematical models and methods that support most data mining applications and solution techniques, covering such topics as association rules; Bayesian methods; data visualization; kernel methods; neural networks; text, speech, and image recognition; an invaluable resource for scholars and practitioners in the fields of biomedicine, engineering, finance, manufacturing, marketing, performance measurement, and telecommunications"--Provided by publisher.

This book presents mathematical models of demand-side management programs, together with operational and control problems for power and renewable energy systems. It reflects the need for optimal operation and control of today’s electricity grid at both the supply and demand spectrum of the grid. This need is further compounded by the advent of smart grids, which has led to increased customer/consumer participation in power and renewable energy system operations. The book begins by giving an overview of power and renewable energy systems, demand-side management programs and algebraic modeling languages. The overview includes detailed consideration of appliance scheduling algorithms, price elasticity matrices and demand response incentives. Furthermore, the book presents various power system operational and control mathematical formulations, incorporating demand-side management programs. The mathematical formulations developed are modeled and solved using the Advanced Interactive Multidimensional Modeling System (AIMMS) software, which offers a powerful yet simple algebraic modeling language for solving optimization problems. The book is extremely useful for all power system operators and planners who are concerned

with optimal operational procedures for managing today's complex grids, a context in which customers are active participants and can curb/control their demand. The book details how AIMMS can be a useful tool in optimizing power grids and also offers a valuable research aid for students and academics alike.

This book opens new avenues in understanding mathematical models within the context of a transition economy. The exposition lays out the methods for combining different mathematical structures and tools to effectively build the next model that will accurately reflect real world economic processes. Mathematical modeling of weather phenomena allows us to forecast certain essential weather parameters without any possibility of changing them. By contrast, modeling of transition economies gives us the freedom to not only predict changes in important indexes of all types of economies, but also to influence them more effectively in the desired direction. Simply put: any economy, including a transitional one, can be controlled. This book is useful to anyone who wants to increase profits within their business, or improve the quality of their family life and the economic area they live in. It is beneficial for undergraduate and graduate students specializing in the fields of Economic Informatics, Economic Cybernetics, Applied Mathematics and Large Information Systems, as well as for professional economists, and employees of state planning and statistical organizations.

Appendices A Rotastore A. l Tabular Results for Different Models A. 2 Tabular Results for Different Algorithms B OptiTrans B. l Input Data B. l. l Input Data Common to all Solution Approaches B. 1. 2 Specific Input Data for the MILP Model and the Column Enumeration Approach B. 1. 3 Specific Input Data for the Heuristic Methods B. 1. 3. 1 Penalty Criteria B. 1. 3. 2 Control Parameters of the OptiTrans Software B. 2 Tabular Results B. 2. 1 Tabular

Results for the MILP Model B. 2. 2 Tabular Results for the Heuristic Methods B. 2. 2. 1 Input Data for a Whole Day - Offline Analysis B. 2. 2. 2 Results for CIH and SA References Index Preface This book covers the analysis and development of online algorithms involving exact optimization and heuristic techniques, and their appli- tion to solve two real life problems. The first problem is concerned with a complex technical system: a special carousel based high-speed storage system - Rotastore. It is shown that this logistic problem leads to an NP-hard Batch Presorting Pr- lem (BPSP) which is not easy to solve optimally in offline situations. We consider a polynomial case and develope an exact algorithm for offline situations. Competitive analysis showed that the proposed online - gorithm is 312-competitive. Online algorithms with lookahead improve the online solutions in particular cases. If the capacity constraint on additional storage is neglected the problem has a totally unimodular polyhedron.

In this thesis, we study the open-pit design problem, the open-pit mining scheduling problem, and the open-pit design problem with geological and price uncertainty. These problems give rise to (mixed) discrete optimization models that in real-life settings are large scale and computationally challenging.

"This book deals with a simple sounding question whether a certain amount of gas can be transported by a given pipeline network. While well studied for a single pipeline, this question gets extremely difficult if we consider a meshed nation wide gas transportation network, taking into account all the technical details and discrete decisions, as well as regulations, contracts, and varying demand. This book describes several mathematical models to answer these questions, discusses their merits and disadvantages, explains the necessary technical and regulatory background, and shows how to solve this question using sophisticated mathematical

optimization algorithms."--

Optimization is of central concern to a number of discip lines. Operations Research and Decision Theory are often consi dered to be identical with optimizationo But also in other areas such as engineering design, regional policy, logistics and many others, the search for optimal solutions is one of the prime goals. The methods and models which have been used over the last decades in these areas have primarily been "hard" or "crisp", i. e. the solutions were considered to be either fea sible or unfeasible, either above a certain aspiration level or below. This dichotomous structure of methods very often forced the modeller to approximate real problem situations of the more-or-less type by yes-or-no-type models, the solutions of which might turn out not to be the solutions to the real prob lems. This is particularly true if the problem under considera tion includes vaguely defined relationships, human evaluations, uncertainty due to inconsistent or incomplete evidence, if na tural language has to be modelled or if state variables can only be described approximately. Until recently, everything which was not known with cer tainty, i. e. which was not known to be either true or false or which was not known to either happen with certainty or to be impossible to occur, was modelled by means of probabilitieso This holds in particular for uncertainties concerning the oc currence of events.

Peter Kall and János Mayer are distinguished scholars and professors of Operations Research and their research interest is particularly devoted to the area of stochastic

optimization. Stochastic Linear Programming is a definitive presentation and discussion of the theoretical properties of the models, the conceptual algorithmic approaches, and the computational issues relating to the implementation of these methods to solve problems that are stochastic in nature.

This monograph provides both a unified account of the development of models and methods for the problem of estimating equilibrium traffic flows in urban areas and a survey of the scope and limitations of present traffic models. The development is described and analyzed by the use of the powerful instruments of nonlinear optimization and mathematical programming within the field of operations research. The first part is devoted to mathematical models for the analysis of transportation network equilibria; the second deals with methods for traffic equilibrium problems. This title will interest readers wishing to extend their knowledge of equilibrium modeling and analysis and of the foundations of efficient optimization methods adapted for the solution of large-scale models. In addition to its value to researchers, the treatment is suitable for advanced graduate courses in transportation, operations research, and quantitative economics.

Merging logic and mathematics in deductive inference-an innovative,cutting-edge approach. Optimization methods for logical inference? Absolutely, say VijayChandru and John Hooker, two major contributors to this rapidlyexpanding field. And even though "solving logical inferenceproblems with optimization methods may seem a bit

like eatingsauerkraut with chopsticks. . . it is the mathematical structure ofa problem that determines whether an optimization model can helpsolve it, not the context in which the problem occurs." Presenting powerful, proven optimization techniques for logicinference problems, Chandru and Hooker show how optimization modelscan be used not only to solve problems in artificial intelligenceand mathematical programming, but also have tremendous applicationin complex systems in general. They survey most of the recentresearch from the past decade in logic/optimization interfaces,incorporate some of their own results, and emphasize the types oflogic most receptive to optimization methods-propositional logic,first order predicate logic, probabilistic and related logics,logics that combine evidence such as Dempster-Shafer theory, rulesystems with confidence factors, and constraint logic programmingsystems. Requiring no background in logic and clearly explaining all topicsfrom the ground up, Optimization Methods for Logical Inference isan invaluable guide for scientists and students in diverse fields,including operations research, computer science, artificialintelligence, decision support systems, and engineering.

Portfolio categorization, evaluation, and prioritization are essential processes for portfolio management and play important roles in efforts to accomplish organizational strategic goals. This paper explores the implementation of a project selection tool using mathematical programming. Project selection is an essential process for portfolio management and plays an important role in accomplishing organizational goals. This

paper presents a literature review of the techniques used in project selection. Numerical methods include financial models, scoring models, and optimization models. This paper focuses on project selection using optimization models. This method selects a set of projects that deliver the maximum benefit (e.g., net present value [NPV], profit) represented for objective functions subjected to a series of constraints (e.g., budget, manpower). This paper shows simple examples, which includes formulation and solution of the problem using 0-1 integer programming (one objective portfolio) and goal programming (multiple objectives portfolio). Mathematical programming methods can improve the quality of the decision-making process reducing subjectivity and optimizing the resources allocation in the projects that add more value to the organization. This paper shows models for project selection maximizing the benefits of an organization and considering its strategic goals. It includes a literature review of the project selection methodologies used in the industry. Following the theoretical framework, this paper shows the use of mathematical programming for project selection. The paper presents some examples and a discussion of the advantages, potential improvement, and limitations of this methodology.

Light will be thrown on a variety of problems concerned with the construction and analysis of optimization models: equilibrium models of mathematical economy, modern numerical optimization methods and software, methods of convex programming optimal with respect to complexity, polynomial algorithms of linear programming, decomposition

of optimization systems, modern apparatus of nonsmooth optimization, models and methods of discrete programming.

Although a useful and important tool, the potential of mathematical modelling for decision making is often neglected. Considered an art by many and weird science by some, modelling is not as widely appreciated in problem solving and decision making as perhaps it should be. And although many operations research, management science, and optimization books touch on modelling techniques, the short shrift they usually get in coverage is reflected in their minimal application to problems in the real world. Illustrating the important influence of modelling on the decision making process, Optimization Modelling: A Practical Approach helps you come to grips with a wide range of modelling techniques. Highlighting the modelling aspects of optimization problems, the authors present the techniques in a clear and straightforward manner, illustrated by examples. They provide and analyze the formulation and modelling of a number of well-known theoretical and practical problems and touch on solution approaches. The book demonstrates the use of optimization packages through the solution of various mathematical models and provides an interpretation of some of those solutions. It presents the practical aspects and difficulties of problem solving and solution implementation and studies a number of practical problems. The book also discusses the use of available software packages in solving optimization models without going into difficult mathematical details and complex solution methodologies.

The emphasis on modelling techniques rather than solution algorithms sets this book apart. It is a single source for a wide range of methods, classic theoretical and practical problems, data collection and input preparation, the use of different optimization software, and practical issues of modelling, model solving, and implementation. The authors draw directly from their experience to provide lessons learned when applying modelling techniques to practical problem solving and implementation difficulties.

This book unravels the mystery of Big Data computing and its power to transform business operations. The approach it uses will be helpful to any professional who must present a case for realizing Big Data computing solutions or to those who could be involved in a Big Data computing project. It provides a framework that enables business and technical managers to make optimal decisions necessary for the successful migration to Big Data computing environments and applications within their organizations.

This book introduces the reader to the field of multiobjective optimization through problems with simple structures, namely those in which the objective function and constraints are linear. Fundamental notions as well as state-of-the-art advances are presented in a comprehensive way and illustrated with the help of numerous examples. Three of the most popular methods for solving multiobjective linear problems are explained, and exercises are provided at the end of each chapter, helping students to grasp and apply key concepts and methods to more complex problems. The book was

motivated by the fact that the majority of the practical problems we encounter in management science, engineering or operations research involve conflicting criteria and therefore it is more convenient to formulate them as multicriteria optimization models, the solution concepts and methods of which cannot be treated using traditional mathematical programming approaches.

Decision makers in many areas, from industry to engineering and the social sector, face an increasing need to consider multiple, conflicting objectives in their decision processes. In many cases these real world decision problems can be formulated as multicriteria mathematical optimization models. The solution of such models requires appropriate techniques to compute so called efficient, or Pareto optimal, or compromise solutions that - unlike traditional mathematical programming methods - take the contradictory nature of the criteria into account. This book provides the necessary mathematical foundation of multicriteria optimization to solve nonlinear, linear and combinatorial problems with multiple criteria. Motivational examples illustrate the use of multicriteria optimization in practice. Numerous illustrations and exercises as well as an extensive bibliography are provided. In the new edition a chapter on optimality conditions has been added. The linear programming part has been extended and includes new developments. Moreover, motivational examples are now introducing the majority of chapters.

This book systematically discusses nonlinear interval optimization design theory and

methods. Firstly, adopting a mathematical programming theory perspective, it develops an innovative mathematical transformation model to deal with general nonlinear interval uncertain optimization problems, which is able to equivalently convert complex interval uncertain optimization problems to simple deterministic optimization problems. This model is then used as the basis for various interval uncertain optimization algorithms for engineering applications, which address the low efficiency caused by double-layer nested optimization. Further, the book extends the nonlinear interval optimization theory to design problems associated with multiple optimization objectives, multiple disciplines, and parameter dependence, and establishes the corresponding interval optimization models and solution algorithms. Lastly, it uses the proposed interval uncertain optimization models and methods to deal with practical problems in mechanical engineering and related fields, demonstrating the effectiveness of the models and methods.

Fundamental concepts of mathematical modeling Modeling is one of the most effective, commonly used tools inengineering and the applied sciences. In this book, the authorsdeal with mathematical programming models both linear and nonlinearand across a wide range of practical applications. Whereas other books concentrate on standard methods of analysis,the authors focus on the power of modeling methods for solvingpractical problems-clearly showing the connection between physicaland mathematical realities-while also describing and exploring themain concepts and tools

at work. This highly computational coverageincludes: * Discussion and implementation of the GAMS programmingsystem * Unique coverage of compatibility * Illustrative examples that showcase the connection between modeland reality * Practical problems covering a wide range of scientificdisciplines, as well as hundreds of examples and end-of-chapterexercises * Real-world applications to probability and statistics, electricalengineering, transportation systems, and more Building and Solving Mathematical Programming Models in Engineeringand Science is practically suited for use as a professionalreference for mathematicians, engineers, and applied or industrialscientists, while also tutorial and illustrative enough foradvanced students in mathematics or engineering.

In order to simplify the complex calculation and solve the difficult solution problems of neutrosophic number optimization models (NNOMs) in the practical production process, this paper presents two methods to solve NNOMs, where Matlab built-in function “fmincon()” and neutrosophic number operations (NNOs) are used in indeterminate environments. Next, the two methods are applied to linear and nonlinear programming problems with neutrosophic number information to obtain the optimal solution of the maximum/minimum objective function under the constrained conditions of practical productions by neutrosophic number optimization programming (NNOP) examples. Finally, under indeterminate environments, the fit optimal solutions of the examples can also be achieved by using some specified indeterminate scales to fulfill some specified

actual requirements. The NNOP methods can obtain the feasible and flexible optimal solutions and indicate the advantage of simple calculations in practical applications. Entropy optimization is a useful combination of classical engineering theory (entropy) with mathematical optimization. The resulting entropy optimization models have proved their usefulness with successful applications in areas such as image reconstruction, pattern recognition, statistical inference, queuing theory, spectral analysis, statistical mechanics, transportation planning, urban and regional planning, input-output analysis, portfolio investment, information analysis, and linear and nonlinear programming. While entropy optimization has been used in different fields, a good number of applicable solution methods have been loosely constructed without sufficient mathematical treatment. A systematic presentation with proper mathematical treatment of this material is needed by practitioners and researchers alike in all application areas. The purpose of this book is to meet this need. Entropy Optimization and Mathematical Programming offers perspectives that meet the needs of diverse user communities so that the users can apply entropy optimization techniques with complete comfort and ease. With this consideration, the authors focus on the entropy optimization problems in finite dimensional Euclidean space such that only some basic familiarity with optimization is required of the reader.

This book constitutes the refereed proceedings of the 10th Pacific-Asia Conference on Knowledge Discovery and Data Mining, PAKDD 2006, held in Singapore in April 2006.

The 67 revised full papers and 33 revised short papers presented together with 3 invited talks were carefully reviewed and selected from 501 submissions. The papers are organized in topical sections on Classification, Ensemble Learning, Clustering, Support Vector Machines, Text and Document Mining, Web Mining, Bio-Data Mining, and more.

This book presents a structured approach to formulate, model, and solve mathematical optimization problems for a wide range of real world situations. Among the problems covered are production, distribution and supply chain planning, scheduling, vehicle routing, as well as cutting stock, packing, and nesting. The optimization techniques used to solve the problems are primarily linear, mixed-integer linear, nonlinear, and mixed integer nonlinear programming. The book also covers important considerations for solving real-world optimization problems, such as dealing with valid inequalities and symmetry during the modeling phase, but also data interfacing and visualization of results in a more and more digitized world. The broad range of ideas and approaches presented helps the reader to learn how to model a variety of problems from process industry, paper and metals industry, the energy sector, and logistics using mathematical optimization techniques.

Mathematical modeling is an essential part of most optimization problem-solving processes. To reduce the gap between the solutions obtained from mathematical models and the real-world solutions to practical problems, appropriate modeling techniques must be applied along with

efficient solution approaches. "Optimization Modelling" presents different modeling techniques, illustrated by various examples. A range of well-known theoretical and practical problems are analyzed, and the use of optimization packages is demonstrated for mathematical models. Including numerous case studies, the book also addresses practical aspects and challenges of problem solving and solution implementation.

Optimization is the act of obtaining the "best" result under given circumstances. In design, construction, and maintenance of any engineering system, engineers must make technological and managerial decisions to minimize either the effort or cost required or to maximize benefits. There is no single method available for solving all optimization problems efficiently. Several optimization methods have been developed for different types of problems. The optimum-seeking methods are mathematical programming techniques (specifically, nonlinear programming techniques). Nonlinear Optimization: Models and Applications presents the concepts in several ways to foster understanding. Geometric interpretation: is used to re-enforce the concepts and to foster understanding of the mathematical procedures. The student sees that many problems can be analyzed, and approximate solutions found before analytical solutions techniques are applied. Numerical approximations: early on, the student is exposed to numerical techniques. These numerical procedures are algorithmic and iterative. Worksheets are provided in Excel, MATLAB®, and MapleTM to facilitate the procedure. Algorithms: all algorithms are provided with a step-by-step format. Examples follow the summary to illustrate its use and application. Nonlinear Optimization: Models and Applications: Emphasizes process and interpretation throughout Presents a general classification of optimization problems Addresses situations that lead to models illustrating many types of

optimization problems Emphasizes model formulations Addresses a special class of problems that can be solved using only elementary calculus Emphasizes model solution and model sensitivity analysis About the author: William P. Fox is an emeritus professor in the Department of Defense Analysis at the Naval Postgraduate School. He received his Ph.D. at Clemson University and has taught at the United States Military Academy and at Francis Marion University where he was the chair of mathematics. He has written many publications, including over 20 books and over 150 journal articles. Currently, he is an adjunct professor in the Department of Mathematics at the College of William and Mary. He is the emeritus director of both the High School Mathematical Contest in Modeling and the Mathematical Contest in Modeling.

Discover the art and science of solving artificial intelligence problems with Python using optimization modeling. This book covers the practical creation and analysis of mathematical algebraic models such as linear continuous models, non-obviously linear continuous models,and pure linear integer models. Rather than focus on theory, Practical Python AI Projects, the product of the author's decades of industry teaching and consulting, stresses the model creation aspect; contrasting alternate approaches and practical variations. Each model is explained thoroughly and written to be executed. The source code from all examples in the book is available, written in Python using Google OR-Tools. It also includes a random problem generator, useful for industry application or study. What You Will Learn Build basic Python-based artificial intelligence (AI) applications Work with mathematical optimization methods and the Google OR-Tools (Optimization Tools) suite Create several types of projects using Python and Google OR-Tools Who This Book Is For Developers and students who already have prior

experience in Python coding. Some prior mathematical experience or comfort level may be helpful as well.

This book presents the mathematical models applicable to manufacturing systems management, covering problems from production to real time control. It explores manufacturing systems from the viewpoints of both physical structure and performance measures. Two broad classes of mathematical models are covered in detail: Generative models, which yield a set of decision variables optimizing a performance measure, based on mathematical optimization Evaluative models, which evaluate some performance measures as a function of some predefined decision strategy. Within this class Petri Nets and Queueing Networks are discussed. Advanced Models for Manufacturing Systems Management describes dynamic systems modeling by state equations, a unifying framework for a wide variety of models. The text/reference stresses model building, but it examines model solving as well. Computational techniques are illustrated, such as linear programming, branch and bound methods, and dynamic programming. Particular emphasis is given to the development of heuristic methods from mathematical models. The book provides readers with valuable tools for management and design. The use of descriptive models within an optimization algorithm is considered. Numerous examples illustrate theoretical concepts throughout text. Appendices are given at the end of the book in order to recall fundamentals, such as linear programming and graph theory. Appendices also appear within each chapter. In this way, readers can follow the main reading path without getting involved with details; these appendices can be read at a later time. This textual structure makes this book particularly well suited for self-study. Advanced Models for Manufacturing Systems Management is beneficial reading for both

students and practitioners.
Researchers and practitioners in computer science, optimization, operations research and mathematics will find this book useful as it illustrates optimization models and solution methods in discrete, non-differentiable, stochastic, and nonlinear optimization. Contributions from experts in optimization are showcased in this book showcase a broad range of applications and topics detailed in this volume, including pattern and image recognition, computer vision, robust network design, and process control in nonlinear distributed systems. This book is dedicated to the 80th birthday of Ivan V. Sergienko, who is a member of the National Academy of Sciences (NAS) of Ukraine and the director of the V.M. Glushkov Institute of Cybernetics. His work has had a significant impact on several theoretical and applied aspects of discrete optimization, computational mathematics, systems analysis and mathematical modeling.