Lecture Notes in
Operations Research and
Mathematical Economics

Edited by M. Beckmann and H. P. Künzi

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1968

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J.A. Hanson

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Einführung in die Methode Branch and Bound F. Weinberg,2013-03-13 Es gibt eine grosse Menge von betriebswirtschaftlichen Entscheidungsfragen die sich mit den nunmehr bereits als herk mmlich geltenden Optimierungs methoden des Operations Research nicht behandeln lassen sei es beispiels weise dass die Zielfunktion und auch einzelne Restriktionen nicht konvex sind sei es dass nur ganzzahlige L sungen toleriert werden sei es dass die von einzelnen Variablen angenommenen Zahlenwerte Einfluss auf die G ltigkeit ganzer Restriktionengruppen nehmen So wachsen z B die Kosten der Lagerhaltung als Sprungfunktion mit der Er richtung jedes zus tzlichen Warenhauses und sie nehmen f r jedes bestehende Warenhaus meist konkav mit der Quantit t der gelagerten G ter zu Dieser nicht konvexe Charakter kann sich in einer Zielfunktion Kosten Minimierung oder in einer Restriktion ussern Nicht Ueberschreitung einer Kostenlimite Die Anzahl von Warenh usern ist offenbar eine ganze Zahl deren Optimum unter Angabe der zugeh rigen geographischen Standorte gesucht werden mag Die Notwendigkeit der Ber cksichtigung ortsgebundener Restriktionen f r einzelne Warenh user z B Provenienzvorschriften betreffend deren eigene G terversorgung ist vom Werte der logischen Variablen abh ngig der angibt ob ein bestimmtes Warenhaus errichtet werden soll oder nicht Es w rde nicht schwer fallen eine lange Liste von derartigen Problemen auf zuz hlen die alle sehr erhebliche finanzielle Bedeutung f r eine Unternehmung annehmen Diese Probleme haben schon immer bestanden es ist interessant dass sie in letzter Zeit immer h ufiger genannt werden und der Ruf nach ihrer L sung mit immer gr sserer Dringlichkeit ert nt Development of an Algorithm for the Taktline Layout of Synchronized Job Shop Production Antonia Fels,2019-03-11 In job shop production the change towards synchronized job shop production which is based on the concept of so called taktlines has been shown to enhance efficiency In this dissertation an algorithm for the taktline layout is developed following a multi objective approach The algorithm consists of two sequential discrete optimizations problems namely a modified Substring Cover Problem and a partitioning Cluster Analysis including a Multiple Sequence Alignment For an overall validation real world data from tool manufacturers are subject to the proposed algorithm *Catalog of Copyright Entries. Third Series* Library of Congress. Copyright Office,1971

Mathematical Modeling for Industrial Processes L.P. Hyvärinen,2012-12-06 These notes are based on the material presented in a series of lec tures in the IBM Systems Research Institute ESRI in Geneva durJng 1967 1969 to systems engineers working in the design and programming of computer systems for control and monitoring of i nustrial proc esses The purpose of the lectures and this book is to give a survey of dif ferent approaches in developing models to describe the behavior of the process in terms of controllable variables It does not cover the theory of control stability of control systems nor techniques in data acquisition or problems in instrumentation and sampling But certain aspects in the organization of data collection and design of experiments are obtained as side products notably the concept of orthogonality The reader is assumed to have a working knowledge of elementary prob ability theory and mathematical statistics Therefore the text con

tains no introduction to these concepts The author is aware of some inaccuracies in not making proper dis tinction between population parameters and their sample estimates in the text but this should alw s be evident from the context The same applies to the occasional replacement of number of degrees of freedom by the number of samples in the data In practice computer collected sets of data consist of a high number of samples and the difference between the two is inSignificant

Economic Models, Estimation and Risk Programming: Essays in Honor of Gerhard Tintner K. A. Fox,J. K. Sengupta,G. V. L. Narasimham,2012-12-06 These essays in honor of Professor Gerhard Tintner are substantive contributions to three areas of econometrics 1 economic models and applications 2 estimation and 3 stochastic programming in each of which he has labored with outstanding success His own work has extended into multivariate analysis the pure theory of decision making under un certainty and other fields which are not touched upon here for reasons of space and focus Thus this collection is appropriate to his interests but covers much less than their full range Professor Tintner s contributions to econometrics through teaching writing editing lecturing and consulting have been varied and inter national We have tried to highlight them in The Econometric Work of Gerhard Tintner and to place them in historical perspective in The Invisible Revolution in Economics Emergence of a Mathematical Science Professor Tintner s career to date has spanned the organizational life of the Econometric Society and his contributions have been nearly coextensive with its scope His principal books and articles up to 1968 are listed in the Selected Bibliography Professor Tintner s current research involves the intricate problems of specification and application of stochastic processes to economic systems particularly to growth diffusion of technology and optimal control As always he is moving with the econometric frontier and a portion of the frontier is moving with him IV Two of the editors wrote dissertations under Professor Tintner s sup vision the third knew him as a colleague and friend

Foundations of Non-stationary Dynamic Programming with Discrete Time Parameter K. Hinderer,2012-12-06 The present work is an extended version of a manuscript of a course which the author taught at the University of Hamburg during summer 1969 The main purpose has been to give a rigorous foundation of stochastic dynamic programming in a manner which makes the theory easily applicable to many different practical problems We mention the following features which should serve our purpose a The theory is built up for non stationary models thus making it possible to treat e g dynamic programming under risk dynamic programming under uncertainty Markovian models stationary models and models with finite horizon from a unified point of view b We use that notion of optimality p optimality which seems to be most appropriate for practical purposes c Since we restrict ourselves to the foundations we did not include practical problems and ways to their numerical solution but we give cf section 8 a number of problems which show the diversity of structures accessible to non stationary dynamic programming The main sources were the papers of Blackwell 65 Strauch 66 and Maitra 68 on stationary models with general state and action spaces and the papers of Dynkin 65 Hinderer 67 and Sirjaev 67 on non stationary models A number of results should be new whereas most theorems constitute extensions usually from stationary

models to non stationary models or analogues to known results Statistical Inference in Random Coefficient Regression Models P.A.V.B. Swamy,2012-12-06 This short monograph which presents a unified treatment of the theory of estimating an economic relationship from a time series of cross sections is based on my Ph D dissertation submitted to the University of Wisconsin Madison To the material developed for that purpose I have added the substance of two subsequent papers Efficient methods of estimating a regression equation with equi correlated disturbances and The exact finite sample properties of estimators of coefficients in error components regression models with Arora which form the basis for Chapters 11 and III respectively One way of increasing the amount of statistical information is to assemble the cross sections of successive years To analyze such a body of data the traditional linear regression model is not appropriate and we have to introduce some additional complications and assumptions due to the hetero geneity of behavior among individuals These complications have been discussed in this monograph Limitations of economic data particularly their non experimental nature do not permit us to know a priori the correct specification of a model I have considered several different sets of assumptionR about the stability of coeffi cients and error variances across individuals and developed appropriate inference procedures I have considered only those sets of assumptions which lead to opera tional procedures Following the suggestions of Kuh Klein and Zellner I have adopted the linear regression models with some or all of their coefficients varying randomly across individuals **The Coordinate-Free Approach to Gauss-Markov Estimation** H. Drygas,2012-12-06 These notes originate from a couple of lectures which were given in the Econometric Workshop of the Center for Operations Research and Econometrics CORE at the Catholic University of Louvain The participants of the seminars were recommended to read the first four chapters of Seber s book 40 but the exposition of the material went beyond Seber s exposition if it seemed necessary Coordinate free methods are not new in Gauss Markov estimation besides Seber the work of Kolmogorov 11 SCheffe 36 Kruskal 21 22 and Malinvaud 25 26 should be mentioned Malinvaud s approach however is a little different from that of the other authors because his optimality criterion is based on the ellipsoid of c centration This criterion is however equivalent to the usual c cept of minimal covariance matrix and therefore the result must be the same in both cases While the usual theory gives no indication how small the covariance matrix can be made before the optimal es timator is computed Malinvaud can show how small the ellipsoid of concentration can be made it is at most equal to the intersection of the ellipssoid of concentration of the observed random vector and the linear space in which the unknown expectation value of the observed random vector is lying This exposition is based on the observation that in regression nalysis and related fields two conclusions are or should preferably be applied repeatedly Steady State Capital Theory C.C. v. Weizsäcker,2012-12-06 The following lecture notes were written shortly after I gave a course on capital theory in the winter semester 1970 71 at the Univer sity of Heidelberg While the general line of the argument is similar to the one in the course I have modified and added a large number of specific points in the process of writing the English version I should like to emphasize the narrow

limitations of the material covered in these notes I have completely concentrated on steady states of stationary and exponentially growing economies even up to the point where there is the danger of misleading the reader1 I have done this for several reasons Other activities have not left me with a sufficient amount of time to be able to find the unifying principle of analysis and mode of presentation for the dynamic aspects of capi tal theory which would have made it worthwhile to add a sizeable book to the large body of literature in this field On the other hand over the last couple of years I have become increasingly aware that some of the results in steady state capital theory which could be derived without too much mathematical effort are of relevance in present day dis cussions about the political role of economic theory and the relative merits of orthodox and radical economics Also these results seemed not to be known by mO of the participants in these discussions **Some Network Models in Management Science** S. E. Elmaghraby,2012-12-06 **On Round-Off Errors in Linear Programming** H. Müller-Merbach,2012-12-06 Due to the limited number of digits or bits per storage location in electronic computers round off errors arise during arithmetic operations Depending upon the kind of operation the structure of the data and the skillfulness of the program these errors increase and spread out more or less quickly during a continued computation process in which the computed data affected by errors are themselves used for generating new data The purpose of this investigation was to learn about the increase of round off errors in linear programming procedures Less attention was paid to the theory of round off errors or to the effectiveness of error elimination procedures In regard to these questions the results of in vestigations which have been made on round off errors in a more general context dealing with matrix inversion and eigenvalue problems could be used for the purposes of this paper The emphasis of this investigation lay rather on studying the behavior of typical linear programming problems from the pOint of view of error cumulation

Introduction to Optimization Theory in a Hilbert Space A.V. Balakrishnan,2012-12-06 This book is based on lectures given in a one quarter course at UCLA The aim is to present som e of the basic concepts and techniques of Functional Analys is of relevance to optim ization problem s in Control Com m unication and other areas in System Science The students are expected to have had an introductory course in Hilbert Space theory Som e effort has been m ade to be self contained m ainly in order that the vocabularly used can be clarified A m inim al bibliography is appended The author is indebted to Jiri Ruzicka and Jerom e Mersky for help with proof reading Profes sor L Berkovitz looked over and m ade m any helpful corn rn ents on parts of an early version Thanks are also due to Trudy Cook for typing the m anuscript Grateful acknowledgem ent is also m ade of partial support under AFOSR Grant No 68 1408 Applied Mathem atics Division United Stat s Air Force

Computational Methods in Optimal Control Problems I.H. Mufti,2012-12-06 The purpose of this modest report is to present in a simplified manner some of the computational methods that have been developed in the last ten years for the solution of optimal control problems Only those methods that are based on the minimum maximum principle of Pontriagin are discussed here The autline of the report is as follows In the first two sections a control problem of Bolza is formulated and

the necessary conditions in the form of the minimum principle are given The method of steepest descent and a conjugate gradient method are dis cussed in Section 3 In the remaining sections the successive sweep method the Newton Raphson method and the generalized Newton Raphson method also called quasilinearization method ar presented from a unified approach which is based on the application of Newton Raphson approximation to the necessary conditions of optimality The second variation method and other shooting methods based on minimizing an error function are also considered TABLE OF CONTENTS 1 0 INTRODUCTION 1 2 0 NECESSARY CONDITIONS FOR OPTIMALITY 2 3 0 THE GRADIENT METHOD 4 3 1 Min H Method and Conjugate Gradient Method 8 3 2 Boundary Constraints 9 3 3 Problems with Control Constraints 15 4 0 SUCCESSIVE SWEEP METHOD 18 4 1 Final Time Given Implicitly 22 5 0 SECOND VARIATION METHOD 23 6 0 SHOOTING METHODS 27 6 1 Newton RaphsonMethod 27 6 **Bayesian Full Information Structrual Analysis** J.A. Morales,2012-12-06 **Growth in Open Economies** J.A. Hanson,2012-12-06 The years following World War II have witnessed an increasing interest in the effects of growth on trade the patterns of international specialization and the terms of trade On the one hand some English economists have maintained the Ricardian tradition of diminishing returns rising food prices and therefore declining British terms of trade while on the other hand Prebisch Singer and other critics have attempted to document and explain a long run decline in the terms of trade of the underdeveloped countries Finally in a reaction to this concentration on a single factor as the determinant of international price movements a group of economists began a systematic investigation of the role of growth in trade and the terms of trade using neoclassical assumption This study particularly in its assumptions regarding demand falls into the tradition of the last group However it extends the tradition by treating growth as a continuous process dependent on saving out of produced income and the growth rate of population in two trading economies Therefore in addition to answering the comparative statics questions regarding the trends in the terms of trade it develops the conditions which guarantee that the two economies will approach a state of unique long run balanced growth in which all per capita variables as well as the terms of trade stabilize Moreover these methods permit some discussion of changes in the patterns of specialization **On a General Economic Theory of Motion** M.J.P. Magill,2012-12-06 *Constrained Extrema Introduction to the Differentiable Case with Economic Applications* M.A. El-Hodiri,2012-12-06 These notes are the result of an interrupted sequence of seminars on optimiza tion theory with economic applications starting in 1964 1965 This is mentioned by way of explaining the uneven style that pervades them Lately I have been using the notes for a two semester course on the subject for graduate students in economics Except for the introductory survey the notes are intended to provide an appetizer to more sophisticated aspects of optimization theory and economic theory The notes are divided into three parts Part I collects most of the results on constrained extremf of differentiable functionals on finite and not so finite dimensional spaces It is to be used as a reference and as a place to find credits to various authors whose ideas we report Part II is concerned with finite dimensional problems

and is written in detail Needless to say my contributions are marginal The economic examples are well known and are presented by way of illustrating the theory Part III is devoted to variational problems leading to a discussion of some optimal control problems There is a vast amount of literature on these problems and I tried to limit my intrusions to explaining some of the obvious steps that are usually left out I have borrowed heavily from Akhiezer 1 Berkovitz 7 Bliss lOJ and Pars 40J The economic applications represent some of my work and are presented in the spirit of illustration *A Theory of Supercritical Wing Sections, with Computer Programs and Examples* F. Bauer,P. Garabedian,D. Korn,2012-12-06 At present there is considerable interest in supercritical wing technology for the development of aircraft designed to fly near the speed of sound The basic principle is the suppression of boundary layer separation by shifting the shock waves that occur on the wing toward the trailing edge and making them as weak as possible The purpose of this report is to make available to the engineering public mathematical methods for the design of supercritical wings These methods depend on the numerical solution of the partial differential equations of two dimensional gas dynamics The main contribution is a computer program for the design of shockless transonic airfoils using the hodograph transformation and analytic continuation into the complex domain Another contribution is a program for the analysis of transonic flow with shocks past an airfoil at off design conditions In our design work we include a turbulent boundary layer correction Part I of the paper is devoted to a description of the mathemati cal theory and need not be studied by those primarily concerned with running the programs Part II is a manual for users of our programs which is independent of the theoretical part In Part III and in Appendices II and III we give numerical examples and discuss computa tional results The main substance of the report however is contained in the listing of the computer programs themselves in Appendix IV We have used the Fortran language throughout and we have included numerous comment cards in the listing *Lectures on Mathematical Theory of Extremum Problems* I. V. Girsanov,2012-12-06 The author of this book Igor Vladimirovich Girsanov was one of the first mathematicians to study general extremum problems and to realize the feasibility and desirability of a unified theory of extremal problems based on a functional analytic approach He actively advocated this view and his special course given at the Faculty of Mechanics and Mathematics of the Moscow State University in 1963 and 1964 was apparently the first systematic exposition of a unified approach to the theory of extremal problems This approach was based on the ideas of Dubovitskii and Milyutin 1 The general theory of extremal problems has developed so intensely during the past few years that its basic concepts may now be considered finalized Nevertheless as yet the basic results of this new field of mathematics have not been presented in a form accessible to a wide range of readers The profound paper of Dubovitskii and Milyutin 2 can hardly be recommended for a first study of the theory since in particular it does not contain proofs of the fundamental theorems Girsanov s book fills this gap It contains a systematic exposition of the general principles underlying the derivation of necessary and sufficient conditions for an extremum in a wide variety of problems Numerous applications are given to specific extremal problems The

main material is preceded by an introductory section in which all prerequisites from functional analysis are presented

Computability and Decidability J. Loeckx,2012-12-06 The present Lecture Notes evolved from a course given at the Technische Hogeschool Eindhoven and later at the Technische Hogeschool Twente They are intended for computer science students more specifically their goal is to introduce the notions of computability and decidability and to prepare for the study of automata theory formal language theory and the theory of computing Except for a general mathematical background no preliminary knowledge is presupposed but some experience in programming may be helpful While classical treatises on computability and decidability are oriented towards the foundation of mathematics or mathematical logic the present notes try to relate the subject to computer science Therefore the expose is based on the use of strings rather than on that of natural numbers the notations are similar to those in use in automata theory in addition according to a common usage in formal language theory most of the proofs of computability are reduced to the semi formal description of a procedure the constructivity of which is apparent to anybody having some programming experience Notwithstanding these facts the subject is treated with mathematical rigor a great number of informal comments are inserted in order to allow a good intuitive understanding I am indebted to all those who drew my attention to some errors and ambiguities in a preliminary version of these Notes I want also to thank Miss L A Krukerink for her diligence in typing the manuscript

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