First stage

500 (0.6) Second stage 700 (0.4)

600 (0.3) 700 (0.7) Third stage 900 (0.2) 800 (0.8)

Scenario 1 Scenario 2 Scenario 3 Scenario 4

A two-level (three-stage) binary scenario tree

Numbers are demand(probability)

Stochastic Programming

Carlos Narciso Bouza Herrera

Stochastic Programming:

Introduction to Stochastic Programming John R. Birge,François Louveaux,2011-06-15 The aim of stochastic programming is to find optimal decisions in problems which involve uncertain data This field is currently developing rapidly with contributions from many disciplines including operations research mathematics and probability At the same time it is now being applied in a wide variety of subjects ranging from agriculture to financial planning and from industrial engineering to computer networks This textbook provides a first course in stochastic programming suitable for students with a basic knowledge of linear programming elementary analysis and probability The authors aim to present a broad overview of the main themes and methods of the subject Its prime goal is to help students develop an intuition on how to model uncertainty into mathematical problems what uncertainty changes bring to the decision process and what techniques help to manage uncertainty in solving the problems In this extensively updated new edition there is more material on methods and examples including several new approaches for discrete variables new results on risk measures in modeling and Monte Carlo sampling methods a new chapter on relationships to other methods including approximate dynamic programming robust optimization and online methods The book is highly illustrated with chapter summaries and many examples and exercises Students researchers and practitioners in operations research and the optimization area will find it particularly of interest Review of First Edition The discussion on modeling issues the large number of examples used to illustrate the material and the breadth of the coverage make Introduction to Stochastic Programming an ideal textbook for the area Interfaces 1998 *Stochastic Programming* Kurt Marti,Peter Kall,1995-04-06 Proceedings of the 2nd GAMM IFIP Workshop on Stochastic Optimization Numerical Methods and Technical Applications held at the Federal Armed Forces University Munich Neubiberg M nchen Germany June 15 17 1993 **Introduction to Stochastic Programming** John R. Birge,François Louveaux,2006-04-06 This rapidly developing field encompasses many disciplines including operations research mathematics and probability Conversely it is being applied in a wide variety of subjects ranging from agriculture to financial planning and from industrial engineering to computer networks This textbook provides a first course in stochastic programming suitable for students with a basic knowledge of linear programming elementary analysis and probability The authors present a broad overview of the main themes and methods of the subject thus helping students develop an intuition for how to model uncertainty into mathematical problems what uncertainty changes bring to the decision process and what techniques help to manage uncertainty in solving the problems The early chapters introduce some worked examples of stochastic programming demonstrate how a stochastic model is formally built develop the properties of stochastic programs and the basic solution techniques used to solve them The book then goes on to cover approximation and sampling techniques and is rounded off by an in depth case study A well paced and wide ranging introduction to this subject **Stochastic Linear Programming** Peter Kall,János Mayer,2005-07-25 Peter Kall and J nos 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 Models Theory and Computation 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 The application area of stochastic programming includes portfolio analysis financial optimization energy problems random yields in manufacturing risk analysis etc In this book models in financial optimization and risk analysis are discussed as examples including solution methods and their implementation Stochastic programming is a fast developing area of optimization and mathematical programming Numerous papers and conference volumes and several monographs have been published in the area however the Kall and Mayer book will be particularly useful in presenting solution methods including their solid theoretical basis and their computational issues based in many cases on implementations by the authors The book is also suitable for advanced courses in stochastic optimization **Stochastic Programming** Francesco Archetti,G. Di Pillo,Mario Lucertini,1986 *Lectures on Stochastic Programming* Alexander Shapiro,Darinka Dentcheva,Andrzej Ruszczy?ski,2014-07-09 Optimization problems involving stochastic models occur in almost all areas of science and engineering such as telecommunications medicine and finance Their existence compels a need for rigorous ways of formulating analyzing and solving such problems This book focuses on optimization problems involving uncertain parameters and covers the theoretical foundations and recent advances in areas where stochastic models are available In Lectures on Stochastic Programming Modeling and Theory Second Edition the authors introduce new material to reflect recent developments in stochastic programming including an analytical description of the tangent and normal cones of chance constrained sets analysis of optimality conditions applied to nonconvex problems a discussion of the stochastic dual dynamic programming method an extended discussion of law invariant coherent risk measures and their Kusuoka representations and in depth analysis of dynamic risk measures and concepts of time consistency including several new results *Applications of Stochastic Programming* Stein W. Wallace,William T. Ziemba,2005-06-01 Consisting of two parts this book presents papers describing publicly available stochastic programming systems that are operational It presents a diverse collection of application papers in areas such as production supply chain and scheduling gaming environmental and pollution control financial modeling telecommunications and electricity Encyclopedia of Optimization Christodoulos A. Floudas,Panos M. Pardalos,2008-09-04 The goal of the Encyclopedia of Optimization is to introduce the reader to a complete set of topics that show the spectrum of research the richness of ideas and the breadth of applications that has come from this field The second edition builds on the success of the former edition with more than 150 completely new entries designed to ensure that the reference addresses recent areas where optimization theories and techniques have advanced Particularly heavy attention resulted in health science and transportation with entries such as Algorithms for Genomics Optimization and Radiotherapy Treatment Design and Crew Scheduling **Stochastic Programming** Kurt Marti,Peter Kall,2013-12-14 In

order to obtain more reliable optimal solutions of concrete technical economic problems e g optimal design problems the often known stochastic variations of many technical economic parameters have to be taken into account already in the planning phase Hence ordinary mathematical programs have to be replaced by appropriate stochastic programs New theoretical insight into several branches of reliability oriented optimization of stochastic systems new computational approaches and technical economic applications of stochastic programming methods can be found in this volume

Stochastic Programming V.V. Kolbin,1977-06-30 This book is devoted to the problems of stochastic or probabilistic programming The author took as his basis the specialized lectures which he delivered to the graduates from the economic cybernetics department of Leningrad University beginning in 1967 Since 1971 the author has delivered a specialized course on Stochastic Programming to the gradu ates from the faculty of applied mathematics management processes at Leningrad University The present monograph consists of seven chapters In Chapter I which is of an introductory character consideration is given to the problems of uncertainty and probability used for modelling complicated systems Fundamental indications for the classification of stochastic pro gramming problems are given Chapter II is devoted to the analysis of various models of chance constrained stochastic programming problems Examples of technological and applied economic problems of management with chance constraints are given In Chapter III two stage stochastic programming problems are investigated various models are given and these models are qualitatively analyzed In the conclusion of the chapter consideration is given to the transport problem with random data the problem of the determination of production volume and the problem of planning the flights of aircraft as two stage stochastic programming problems Multi stage stochastic programming problems are investigated in Chapter IV The dependencies between prior and posterior decision rules and decision distributions are given Dual problems are investigated **Stochastic Programming, Algorithms and Models** Julia L. Higle,S. Sen,1996 **Introduction to Stochastic Dynamic Programming** Sheldon M. Ross,2014-07-10 Introduction to Stochastic Dynamic Programming presents the basic theory and examines the scope of applications of stochastic dynamic programming The book begins with a chapter on various finite stage models illustrating the wide range of applications of stochastic dynamic programming Subsequent chapters study infinite stage models discounting future returns minimizing nonnegative costs maximizing nonnegative returns and maximizing the long run average return Each of these chapters first considers whether an optimal policy need exist providing counterexamples where appropriate and then presents methods for obtaining such policies when they do In addition general areas of application are presented The final two chapters are concerned with more specialized models These include stochastic scheduling models and a type of process known as a multiproject bandit The mathematical prerequisites for this text are relatively few No prior knowledge of dynamic programming is assumed and only a moderate familiarity with probability including the use of conditional expectation is necessary Stochastic Programming András Prékopa,2013-03-09 Stochastic programming the science that provides us

with tools to design and control stochastic systems with the aid of mathematical programming techniques lies at the intersection of statistics and mathematical programming The book Stochastic Programming is a comprehensive introduction to the field and its basic mathematical tools While the mathematics is of a high level the developed models offer powerful applications as revealed by the large number of examples presented The material ranges form basic linear programming to algorithmic solutions of sophisticated systems problems and applications in water resources and power systems shipbuilding inventory control etc Audience Students and researchers who need to solve practical and theoretical problems in operations research mathematics statistics engineering economics insurance finance biology and environmental protection

Stochastic Programming Horand Gassmann,Stein W. Wallace,W. T. Ziemba,2013 This book shows the breadth and depth of stochastic programming applications All the papers presented here involve optimization over the scenarios that represent possible future outcomes of the uncertainty problems The applications which were presented at the 12th International Conference on Stochastic Programming held in Halifax Nova Scotia in August 2010 span the rich field of uses of these models The finance papers discuss such diverse problems as longevity risk management of individual investors personal financial planning intertemporal surplus management asset management with benchmarks dynamic portfolio management fixed income immunization and racetrack betting The production and logistics papers discuss natural gas infrastructure design farming Atlantic salmon prevention of nuclear smuggling and sawmill planning The energy papers involve electricity production planning hydroelectric reservoir operations and power generation planning for liquid natural gas plants Finally two telecommunication papers discuss mobile network design and frequency assignment problems *Stochastic Decomposition* Julia L. Higle,S. Sen,2013-11-27 Motivation Stochastic Linear Programming with recourse represents one of the more widely applicable models for incorporating uncertainty within in which the SLP optimization models There are several arenas model is appropriate and such models have found applications in air line yield management capacity planning electric power generation planning financial planning logistics telecommunications network planning and many more In some of these applications modelers represent uncertainty in terms of only a few seenarios and formulate a large scale linear program which is then solved using LP software However there are many applications such as the telecommunications planning problem discussed in this book where a handful of seenarios do not capture variability well enough to provide a reasonable model of the actual decision making problem Problems of this type easily exceed the capabilities of LP software by several orders of magnitude Their solution requires the use of algorithmic methods that exploit the structure of the SLP model in a manner that will accommodate large scale applications **Stochastic Programming** Carlos Narciso Bouza Herrera,2017 This book is concerned with fostering theoretical issues on stochastic programming and discussing how it can solve real life problems The book presents applications which solve the optimization of concrete problems in electricity markets market equilibria resource markets and environments Each chapter presents a survey on the main results concerned

with its contents and discusses their impact by illustrating how they are applicable in real life The authors use concrete real life problems and simulation motivated experiments for illustrating the behavior of the stochastic models discussed The target audience for this title is graduate students or researchers in optimization approximation statistics operations research and computing as well as professionals dealing with applications where uncertainty may be modeled by using stochastic optimization and academics The contributors are well known specialists in stochastic programming **Stochastic Programming** Willem K. Klein Haneveld,Maarten H. van der Vlerk,Ward Romeijnders,2019-11-06 This book provides an essential introduction to Stochastic Programming especially intended for graduate students The book begins by exploring a linear programming problem with random parameters representing a decision problem under uncertainty Several models for this problem are presented including the main ones used in Stochastic Programming recourse models and chance constraint models The book not only discusses the theoretical properties of these models and algorithms for solving them but also explains the intrinsic differences between the models In the book s closing section several case studies are presented helping students apply the theory covered to practical problems The book is based on lecture notes developed for an Econometrics and Operations Research course for master students at the University of Groningen the Netherlands the longest standing Stochastic Programming course worldwide **Stochastic Programming** Gerd Infanger,2010-11-10 From the Preface The preparation of this book started in 2004 when George B Dantzig and I following a long standing invitation by Fred Hillier to contribute a volume to his International Series in Operations Research and Management Science decided finally to go ahead with editing a volume on stochastic programming The field of stochastic programming also referred to as optimization under uncertainty or planning under uncertainty had advanced significantly in the last two decades both theoretically and in practice George Dantzig and I felt that it would be valuable to showcase some of these advances and to present what one might call the state of the art of the field to a broader audience We invited researchers whom we considered to be leading experts in various specialties of the field including a few representatives of promising developments in the making to write a chapter for the volume Unfortunately to the great loss of all of us George Dantzig passed away on May 13 2005 Encouraged by many colleagues I decided to continue with the book and edit it as a volume dedicated to George Dantzig Management Science published in 2005 a special volume featuring the Ten most Influential Papers of the first 50 Years of Management Science George Dantzig s original 1955 stochastic programming paper Linear Programming under Uncertainty was featured among these ten Hearing about this George Dantzig suggested that his 1955 paper be the first chapter of this book The vision expressed in that paper gives an important scientific and historical perspective to the book Gerd Infanger Risk Management in Stochastic Integer Programming Frederike Neise,2008-09-25 The author presents two concepts to handle the classic linear mixed integer two stage stochastic optimization problem She describes mean risk modeling and stochastic programming with first order dominance constraints Both approaches are applied to optimize the operation of a dispersed

generation system   <u>Stochastic Programming 84</u> András Prékopa,Roger J.-B. Wets,1986

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