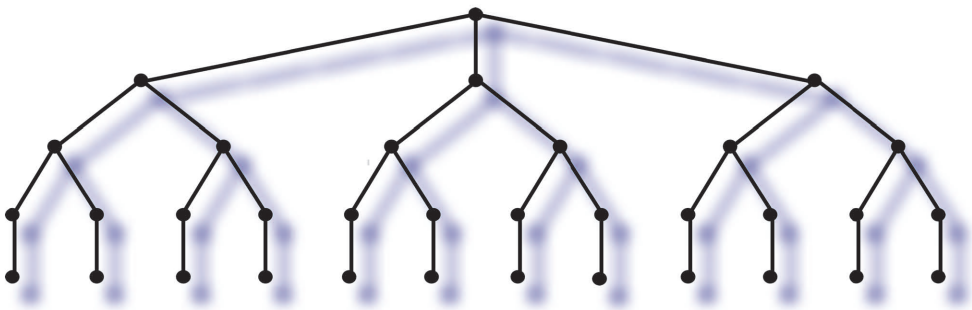
Edited by: Miloš Kopa

ON SELECTED SOFTWARE FOR STOCHASTIC PROGRAMMING



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FOREWORD

Stochastic programming aims at capturing complexities of real systems that develop in time and involve a large number of uncertainties (modeled as random), many decision variables and constraints. It may viewed as an extension of linear and nonlinear optimization models and a number of computer codes have been written to solve certain specific applications. Stochastic programs are quite involved and it took a long time until generally applicable, efficient solution methods have been developed. Only in the1980ties a tape collecting various computer codes for stochastic programming problems appeared as a result of the project "Numerical Methods for Stochastic Programming" of the International Institute of Applied Systems Analysis, IIASA, Laxenburg, under participation of many experts from various countries; see Part III of the collection Numerical Techniques for Stochastic Optimization Problems, Springer 1988, edited by Yu. M. Ermoliev and R. J-B. Wets. At the same time, an idea to create a user-friendly system of stochastic programming solvers was delineated and has been advanced at the Institute for Operations Research of the University of Zurich since that time for almost 30 years to the present SLP-IOR.

Another tendency was to exploit the existing commercial optimization software to solving some of stochastic programming applications. This was e.g. the case of AIMMS and GAMS. Ten years ago we purchased and started to use GAMS which included also the OSL-SE module, the stochastic extension of OSL. Unfortunately, OSL-SE is no more supported.

To develop a user-friendly and reliable software remains one of crucial tasks for supporting the contemporary large-scale applications of stochastic programming and it was announced as a leading theme of the XI International Conference on Stochastic Programming in Vienna in 2007. To be well prepared we spent the Fall term 2006 of our research seminar "Stochastic programming and approximation" studying various existing software systems. The first part of the collection Applications of Stochastic Programming, SIAM 2005, edited by S. W. Wallace and W. T. Ziemba, and the web page of stochastic programming www.stoprog.org provided an excellent guidance. The next step was to learn the performance of the software systems from the point of view of users. Naturally, the experiments were run for the software which was free or with an open access for us. The description of SLP-IOR, AMPL studio and SPInE and applications of GAMS accompanied by our comments form the main part of this booklet. The last chapter provides a brief introduction to the COIN system which is being developed and may replace our favorite GAMS OSL-SE module in the future. We regret that we could not include Stochastics which was not available to us.

The tests are mainly devoted to solution of multistage stochastic linear programs and are run on one instance of an investment problem. As an exception a short chapter devoted to Portfolio Safeguard (PSG) is included. PSG does not provide yet a tool to solving multistage stochastic programs but it represents an interesting user oriented approach: to delineate the field of applications (at present, finance problems), to develop software for computing various relevant nonlinear functions and to apply special solvers.

We appreciate the encouragement and help of authors of the above mentioned software and modeling systems who agreed with a brief presentation of their products in this booklet. In the order of chapters, we thank Peter Kall and Janos Mayer for SLP-IOR, Stan Uryasev for PSG, Robert Fourer for AMPL, Gautham Mitra for SPInE and Franz Nelissen for GAMS. Without their support we could be hardly able to move forward. Helpful discussions with Jan Polívka are gratefully acknowledged.

We hope that this booklet will encourage our colleagues and students who need to solve numerically various applied projects in the area of stochastic programming and will provide them a guiding line. It was written by young participants of the seminar "Stochastic programming and approximation," Michal Branda, Jana Čerbáková and Miloš Kopa from Charles University Prague, whose work was partly supported by the Grant Agency of the Czech Republic (grants 201/05/H007, 201/07/P107, 402/08/0107), and by Michal Kaut from Molde University College in Norway.

Jitka Dupačová

Prague, September 2008