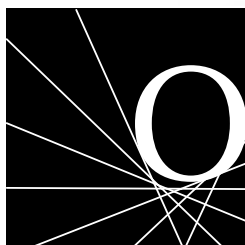


N°60



# P T I M A

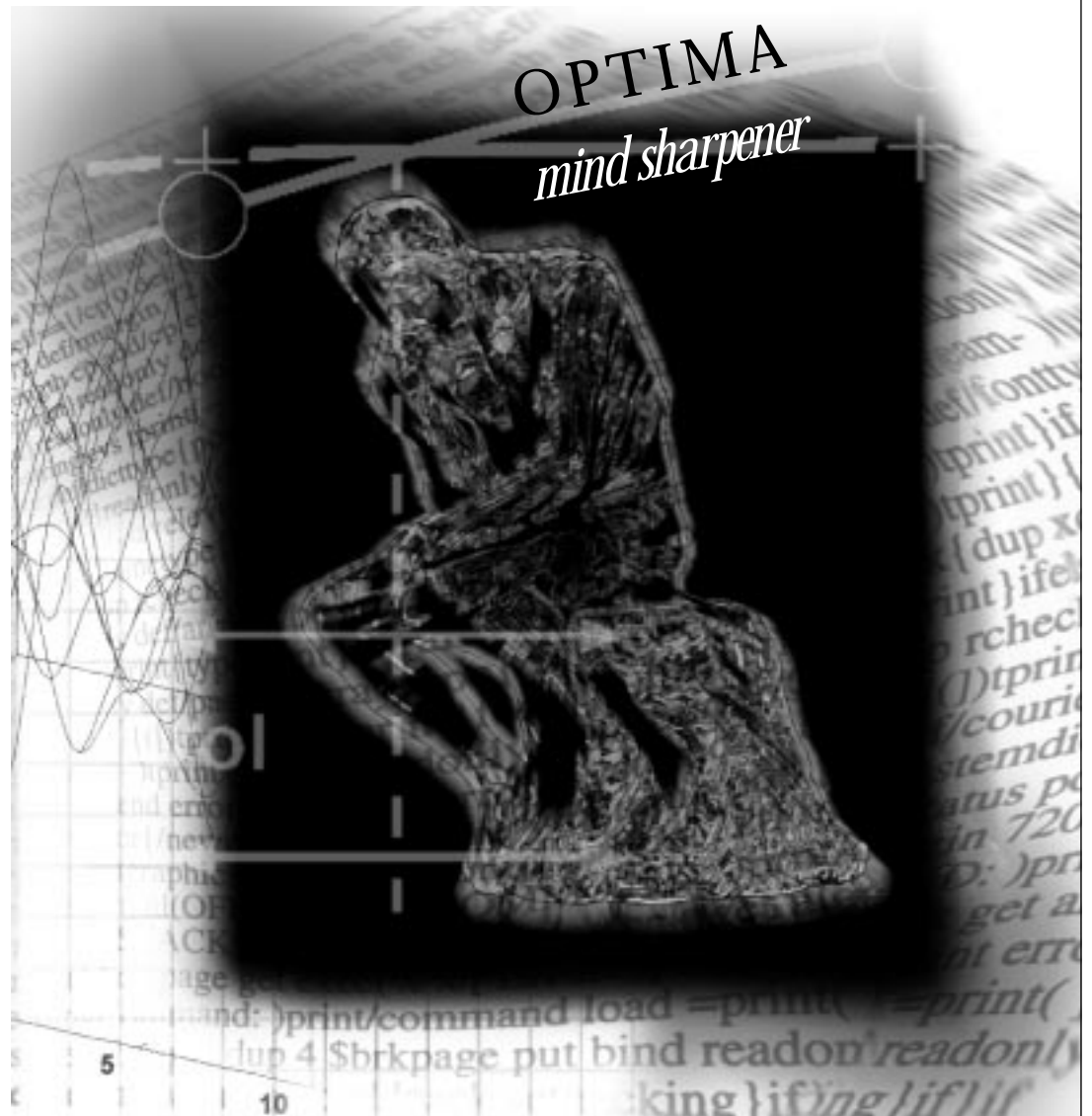
*Mathematical Programming Society Newsletter*

DECEMBER 1998



N U M B E R  
**60**

This is the first in a series of contributions to our column by Robert Bosch. We invite OPTIMA readers to submit solutions to the problems to Robert Bosch (bobb@cs.oberlin.edu). The most attractive solutions will be presented in a forthcoming issue of OPTIMA! Enjoy! -Karen Aardal



# A Pentomino Exclusion Problem

Robert A. Bosch

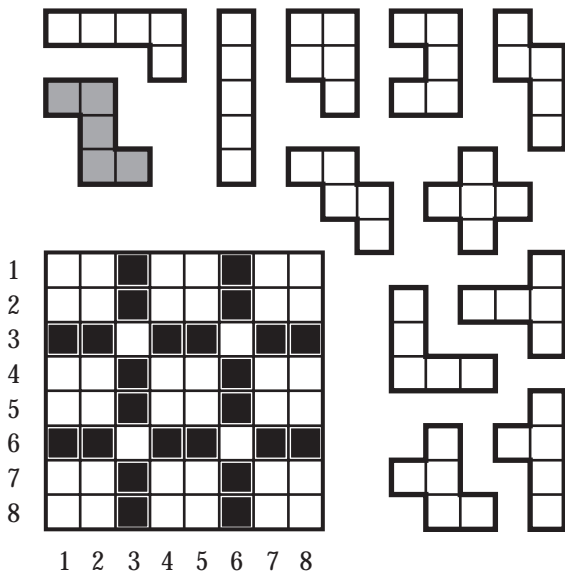


Figure 1

Figure 1 demonstrates that it is possible to place twenty-four monominoes on an  $8 \times 8$  board in such a way that they leave no room for any pentominoes.

Is it possible to exclude the pentominoes with fewer monominoes? Solomon Golomb, the “inventor” of polyominoes and the author of *Polyominoes: Puzzles, Patterns, Problems, and Packings*, believes that the answer is no. (See [1, p. 27].) Here, we use integer programming to prove that twenty-four is indeed minimal.

**An IP Formulation**

The most straightforward way to model the problem is to let  $x_{ij}$  equal 1 if a monomino is placed on the row  $i$ , column  $j$  square of the board, and let  $x_{ij}$  equal 0 if that square is left empty. Clearly the objective is to minimize

$$\sum_{i,j} x_{i,j}$$

And clearly (see Figure 1) the constraints all take the same form as the following ones:

$$x_{1,1} + x_{1,2} + x_{2,2} + x_{3,2} + x_{3,3} = 1,$$

$$x_{1,3} + x_{2,1} + x_{2,2} + x_{2,3} + x_{3,1} = 1,$$

$$x_{1,2} + x_{1,3} + x_{2,2} + x_{3,1} + x_{3,2} = 1,$$

and

$$x_{1,1} + x_{2,1} + x_{2,2} + x_{2,3} + x_{3,3} = 1,$$

which prohibit the shaded pentomino in Figure 1 from being placed—in its “standard orientation” or in any rotated or reflected form—in the upper left corner of the board. In fact, it is easy (but a bit unpleasant) to show that  $63n^2 - 240n + 196$  such constraints can be used to exclude all twelve pentominoes from an  $n \times n$  board.

**Results**

We used CPLEX (version 4.0.9, with all parameters kept at default settings) to solve the IP corresponding to the  $8 \times 8$  pentomino exclusion problem. On our initial attempt, the branch-and-bound tree grew too large, and CPLEX terminated with an “out of memory” error message.

On our second attempt, we added 84 simple valid inequalities (to ensure that every  $3 \times 2$  rectangle contains at least two monominoes), as well as constraints to guarantee that the upper half (right half) of the board receives at least as many monominoes as the lower half (left half).

The additional constraints had a big impact: our second attempt required only 690 seconds (on a 200 MHz Pentium) and 5,605 nodes. The optimal solution (containing 24 monominoes) is displayed in Figure 2.

**Problems**

Interested readers may enjoy trying to solve the following problems:

1. Devise a better formulation for the  $n \times n$  pentomino exclusion problem. *Hint:* See Figure 3. *Benchmarks:* On the best formulation we have found to date, CPLEX needed only 12 seconds and 15 nodes to find an optimal solution to the  $8 \times 8$  pentomino exclusion problem, 42 seconds and 19 nodes to find an optimal solution to the  $10 \times 10$  problem, and 275 seconds and 55 nodes to find an optimal solution to the  $12 \times 12$  problem.
2. A subset of the pentominoes spans a board if its members can be placed on the board so that they exclude the remaining pentominoes. Devise an IP formulation for finding the smallest set of pentominoes that *spans* the  $n \times n$  board. For which values of  $n$  is this problem feasible? (See [1, p. 8].)

We will present solutions in a future issue of OPTIMA. Please send solutions or comments to [bobb@cs.oberlin.edu](mailto:bobb@cs.oberlin.edu).

**Reference**

[1] S.W. Golomb, *Polyominoes: Puzzles, Patterns, Problems, and Packings* (Princeton University Press, Princeton, NJ, 1994).

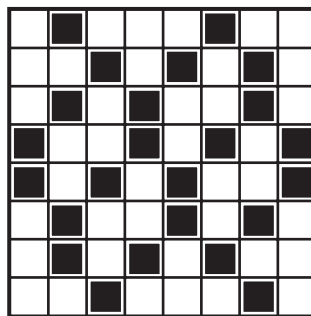


Figure 2

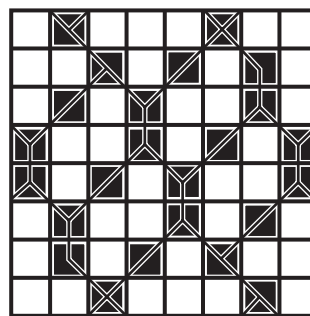


Figure 3

# Conference



- ▶ **DIMACS Conference on Large Scale Discrete Optimization in Manufacturing and Transportation**  
February 8-10, 1999, DIMACS Center, Rutgers.
- ▶ **DIMACS Conference on Mobile Networks and Computing**  
March 24-26, 1999, DIMACS Center, Rutgers  
URL: <http://dimacs.rutgers.edu/Workshops/Mobile/index.html>
- ▶ **INFORMS National Meeting**  
May 2-5, 1999, Cincinnati, OH  
URL: <http://www.cba.uc.edu/dept/qa/cinforms/>
- ▶ **Optimization in Computational Chemistry and Molecular Biology**  
May 7-9, 1999, Princeton, NJ  
floudas@titan.princeton.edu, pardalos@ufl.edu
- ▶ **Sixth SIAM Conference on Optimization**  
May 10-12, 1999, Atlanta, GA  
URL: <http://www.siam.org/meetings/op99>
- ▶ **Optimization Days 1999**  
May 10-12, 1999, Montreal, Canada  
URL: <http://www.crt.umontreal.ca/JOPT/>
- ▶ **NSF/CBMS Regional Conference in the Mathematical Sciences**  
**Combinatorial Optimization: Packing and Covering**  
May 24-28, 1999, Lexington, Kentucky  
URL: <http://www.ms.uky.edu/~jlee/cbms.html>
- ▶ **Seventh Conference on Integer Programming and Combinatorial Optimization - IPCO '99**  
June 9-11, 1999, TU Graz, Graz, Austria  
URL: <http://www.opt.math.tu-graz.ac.at/ipco99>
- ▶ **Workshop on Continuous Optimization**  
June 21-26, 1999, Rio de Janeiro.  
URL: <http://www.impa.br/~opt/>  
February 28, 1999: Deadline for submission of abstracts for contributed presentations
- ▶ **Computational Mathematics Driven by Industrial Applications**  
June 21-27, 1999, Martina Franca, Apulia, Italy  
URL: <http://www.math.unifi.it/CIME/>
- ▶ **Fourth International Conference on Industrial and Applied Mathematics**  
July 5-9, 1999, Edinburgh, Scotland  
URL: <http://www.ma.hw.ac.uk/iciam99>
- ▶ **First ASMO UK/ISSMO Conference on Engineering Design Optimization**  
July 8-9, 1999, Ilkley, West Yorkshire, UK  
URL: [http://www.brad.ac.uk/staff/vtoropov/asmo\\_uk/asmoukc.htm](http://www.brad.ac.uk/staff/vtoropov/asmo_uk/asmoukc.htm)
- ▶ **19th IFIP TC7 Conference on System Modeling and Optimization**  
July 12-16, 1999, Cambridge, England  
URL: <http://www.damtp.cam.ac.uk/user/na/tc7con>  
January 31, 1999: Deadline for submitted papers
- ▶ **Sixth International Conference on Parametric Optimization and Related Topics**  
October 4-8, 1999, Dubrovnik, Croatia  
URL: <http://www.math.hr/dubrovnik/index.htm>

## *Final Report on the IMACS/GAMM International Symposium on Scientific Computing, Computer Arithmetic and Validated Numerics*

### - SCAN-98 Conference

#### Budapest, Hungary

#### September 22-25, 1998

The conference had more than 100 participants, and about 100 accepted talks from 21 countries. After some cancellations, more than 70 talks were held, and additionally nine highlighted, plenary talks. These figures indicate a large participation, which was partly caused by the attraction of the organizing country, Hungary, but the effective support system also contributed to the success. In the framework of the latter, more than 20 participants received some kind of financial support. It is important that we could cover the participation fee of six young participants (possibly their first conference participation). The number of East European participants was relatively high. These results are especially valuable, since in contrast to the usual two year period, the current meeting was organized just one year after the last SCAN-xx conference. The scientific level of the SCAN-98 symposium is highlighted by the fact that 12 editors of the main international journal of the field, *Reliable Computing*, participated with talks.

The organization of the conference was supported by the Hungarian Scientific Research Fund (OTKA), by the Hungarian National Technology Development Institute (OMFB), and by the Gesellschaft fuer Angewandte Mathematik und Mechanik (GAMM). We received organizational and scientific support from the international scientific organizations IMACS and GAMM. The full program and the volume of extended abstracts are available, along with other information, on the web site of the conference (<http://www.inf.u-szeged.hu/~scan98>).

The submission of manuscripts and the editorial tasks began after the meeting. After the usual refereeing procedure, the papers will appear in a special issue of *Reliable Computing* and in an edited volume published by Kluwer Academic Publishers. These publications are expected to appear within one year.

-DR. TIBOR CSENDES, HEAD OF THE ORGANIZING COMMITTEE

**MAPSP '99****Fourth Workshop on Models and Algorithms for Planning and Scheduling Problems****Announcement and Call for Papers**

Following three successful workshops (Lake Como, Italy, in 1993; Wernigerode, Germany, in 1995; and Cambridge, England, in 1997), the Fourth Workshop on Models and Algorithms for Planning and Scheduling Problems is to be held in Renesse, The Netherlands, June 14-18, 1999. The conference hotel, De Zeeuwsche Stromen, is located in the dunes of Renesse, a beach resort in the province of Zeeland.

The workshop aims to provide a forum for scientific exchange and cooperation in the field of planning, scheduling and related areas. To maintain the informality of the previous workshops and to encourage discussion and cooperation, there will be a limit of 100 participants and a single stream of presentations.

Contributions on any aspect of scheduling and related fields are welcome.

**Conference Organizers**

Emile Aarts, Philips Research Laboratories, Eindhoven; Han Hoogeveen, Eindhoven University of Technology; Cor Hurkens, Eindhoven University of Technology; Jan Karel Lenstra, Eindhoven University of Technology; Leen Stougie, Eindhoven University of Technology; and Steef van de Velde, Erasmus University, Rotterdam

**Invited Speakers**

Michel Goemans, CORE, Louvain-la-Neuve, Belgium; Martin Grötschel, ZIB, Berlin, Germany; Michael Pinedo, New York University, New York, USA; Lex Schrijver, CWI, Amsterdam, The Netherlands; Eric Taillard, IDSIA, Lugano, Switzerland; Richard Weber, Cambridge University, Cambridge, England; Joel Wein, Polytechnic University, Brooklyn, USA; and Gerhard Woeginger, Technische Universitaet Graz, Austria

**Preregistration**

If you are interested in participating, please send an email to [mapsp99@win.tue.nl](mailto:mapsp99@win.tue.nl). You will be included in our email list for further notifications. Pre-registration does not bear any obligations, but helps us to plan the schedule and keep

you informed. In your email please include: last name, first name, affiliation, email address, and whether or not you intend to give a talk. Presentations will be selected on the basis of a one page abstract to be submitted no later than **March 1, 1999**.

**Important Dates**

**March 1, 1999** - Deadline for abstract submission; **April 1, 1999** - Last date of notification of acceptance; **May 1, 1999** - Last date for early registration; and **June 14-18, 1999 - MAPSP '99**.

**Registration Costs** include fee and accommodation, based on double room occupancy. Prices mentioned are tentative.

**Early registration fee:** NLG 800

**Late registration fee:** NLG 900

**Supplement for single room:** NLG 125

**Beach party: to be announced**

The deadline for early registration is May 1, 1999. To register, please consult the conference web site.

**Information Sources**

For up-to-date information, consult the conference web site

(<http://www.win.tue.nl/~mapsp99>).

**NSF/CBMS Regional Conference in the Mathematical Sciences****Combinatorial Optimization: Packing and Covering**

**University of Kentucky Department of Mathematics; Lexington, Kentucky**

**May 24-28, 1999**

This five-day conference, held at the University of Kentucky, is devoted to the topic of packing and covering in combinatorial optimization. Detailed information about the conference is available at the web site (<http://www.ms.uky.edu/~jlee/cbms.html>). The main activity of this conference is a series of ten lectures by Dr. Gerard Cornuejols of Carnegie Mellon University.

**Principal Speaker:**

Dr. Cornuejols is a leading researcher in the study of polyhedral and graph-theoretic methods for combinatorial optimization problems. He has made some of the fundamental and difficult contributions to the study of balanced matrices, balanced 0,+1,-1 matrices, perfect 0,+1,-1 matrices, ideal 0,1 matrices, and balanced hypergraphs. He was co-winner of the Lanchester Prize in 1977 (Operations Research Society of America). He has held a CORE Fellowship (1981-82), a Von Humboldt Fellowship (1982), a CNRS Fellowship (1985-86) and a DIMACS Fellowship (1993). Dr. Cornuejols is the President-Elect of the Optimization Section of INFORMS, the Editor of Mathematics of Operations Research and an Associate Editor of Operations Research Letters.

**Organizing Committee:**

Kristina Vuskovic, Chair (University of Kentucky), Michael Jacobson (University of Louisville), Andre Kezdy (University of Louisville), Carl Lee (University of Kentucky), Jon Lee (University of Kentucky), Jenő Lehel (University of Louisville)



**6th Twente Workshop on Graphs  
and Combinatorial Optimization**

**University of Twente**

**Enschede, The Netherlands**

**26 - 28 May, 1999**

The TWENTE WORKSHOP on graphs and combinatorial optimization is organized biennially at the Faculty of Mathematical Sciences at the University of Twente. Topics are graph theory and discrete algorithms (both deterministic and random) and their applications in operations research and computer science.

We try to keep a 'workshop atmosphere' as much as possible and, so far, have succeeded in scheduling no more than two presentations in parallel. We also try to keep the costs as low as possible in order to make the workshop particularly accessible to young researchers. Prospective speakers are asked to submit an extended abstract of

their representation, which will be refereed by a programming committee. Your extended abstract should be at least three but not more than four pages and should reach the organizers before **March 12, 1999**.

The accepted extended abstracts will be collected as a conference volume to be available at the workshop and to be published in a volume of *Electronical Notes in Discrete Mathematics (ENDM)*.

The external program committee members include: J. A. Bondy (Lyon), R. E. Burkard (Graz), W. J. Jackson (London), F. Maffioli (Milano), R. H. Möhring (Berlin), B. Reed (Paris), R. Schrader (Cologne), and C. Thomassen (Copenhagen).

A normally refereed special issue of *Discrete Applied Mathematics* will be devoted to the proceedings of the workshop.

If you are interested in participating in the 6th Twente Workshop, please pre-register now informally. Give your complete postal address as well as your e-mail address, and indicate whether you would like to give a presentation (ca. 30 min - please include the topic if you know it already). You should have received an official registration form and more detailed information by December 1998.

Further information on the workshop will be available at the web site

(<http://www.math.utwente.nl/~tw6>)

.  
-H.J. Broersma, U. Faigle,  
C. Hoede, J.L. Hurink  
Faculty of Mathematical Sciences  
University of Twente  
P.O. Box 217  
7500 AE Enschede,  
The Netherlands  
e-mail: [tw6@math.utwente.nl](mailto:tw6@math.utwente.nl)

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# Reviews

## *Interior Point Techniques in Optimization: Complementarity, Sensitivity and Algorithms*

Benjamin Jansen  
Kluwer Academic Publishers, 1997

ISBN 0-7923-4430-8

In this book, interior-point methods are used to derive several new results in a variety of problems in mathematical programming, e.g., in linear, convex and semidefinite programming as well as variational inequalities. It contains theoretical, algorithmic and some computational results. The basic concept used throughout the book is complementarity, which measures the distance of a solution to optimality.

One interesting result is deriving a way of performing sensitivity analysis for linear and quadratic programming problems using optimal partitions which are provided by interior-point solutions. Another interesting analysis is that of primal-dual Dikin-affine scaling algorithms. These algorithms, introduced in the book, are proven to outperform the classical primal-dual affine scaling methods for linear programming in both theory and practice. These algorithms are studied for nonlinear problems as well.

The target-following approach studied for linear programming offers a warm start as well as a unifying and easy way to analyze primal-dual interior-point methods for linear programming. This approach has further been extended to convex programming as well as variational inequalities, enriching the theory of interior-point methods for these areas and opening new problems.

The book is a very good reference for those interested in the theoretical efficiency of interior-point methods and sensitivity analysis for linear and nonlinear programming problems, and thus is of interest to many researchers and practitioners in optimization.

—FARANAK SHARIFI MOKHTARIAN AND JEAN-LOUIS GOFFIN

## *Advances in Linear and Integer Programming*

edited by J. Beasley  
Oxford University Press, New York,  
1996

ISBN 0-19-853856-1

During the last fifty years, linear and integer programming have become quite important fields in mathematics, computer science and operations research, not only by their intrinsic interest but also due to their many applications in several areas of science, engineering and economics. Simplex and interior point algorithms are considered to be the most relevant techniques for solving linear programs. The efficiency of these algorithms depends on careful implementations that exploit the sparsity and structure of the models to be solved. Branch-and-bound algorithms have become quite popular for finding global minima of integer programs. These procedures require efficient linear programming solvers and incorporate cutting plane generators in order to compute lower and upper bounds that reduce the overall search for the optimum.

The first chapters of the book, edited by J. Beasley, address many relevant features of simplex, interior point and branch-and-bound algorithms, while the last chapter is concerned with the connections between computational logic and integer programming. The editor has invited recognized experts in these areas to write each one of the seven chapters and this has produced an excellent book full of information about many relevant issues on the computation of optima for linear and integer programming, and for computational logic.

In chapter 1, Maros and Mitra present an interesting discussion of the most important features of an implementation of the simplex algorithm for the solution of large scale linear programs, namely data structures, basis factorization and updates, pricing, degeneracy and preprocessing. The integration of simplex and interior point algorithms in a robust code and its use in a branch-and-bound method also deserve special attention. The authors still report some numerical experiments with large scale linear programs to

highlight the performance of some simplex codes that are available worldwide.

In chapter 2, Roos and Vial give an impressive tutorial about the theoretical issues of interior point algorithms. The authors start by describing the theory of linear programming in the light of the ideas of these methods. Then the so-called target (path-following) algorithms are discussed with special emphasis on their convergence and complexity. The predictor-corrector and the infeasible interior point algorithms also deserve a careful treatment in this chapter.

Chapter 3 was written by Gondzio and Terlaky and includes an enjoyable report on the important aspects of an implementation of interior point algorithms for solving large scale linear programs without special structure. Among many relevant topics, the treatment of degeneracy and ill-conditioning and the process for switching to a simplex method deserve a special reading.

In chapter 4, Resende and Pardalos produce a convincing explanation of how to implement interior point algorithms for the solution of linear network flow problems. The special structure of these models requires iterative linear equation solvers for finding search directions in these algorithms. The incorporation of preconditioners and the design of special stopping criteria are mandatory for these implementations and deserve a careful treatment. Many numerical results are included to illustrate the performance of these techniques on the solution of network flow models with a large number of nodes and arcs.

Recently there has been much interest in the design of strong inequalities (cutting planes) that are added to the constraints of an integer program in order to get lower bounds for branch-and-bound algorithms. Lucena and Baisley present an interesting discussion of this subject in chapter 5. The implementation of such ideas employs column and row generation, which are subjects addressed by the authors in their article. Preprocessing, the computation of upper bounds and the node choice are also relevant issues in a branch-and-bound implementation and deserve full treatment. Numerical experiments with two classes of structured integer programs are reported to highlight the efficiency of these techniques in practice.

The use of interior point algorithms in integer programming is quite well analyzed by Mitchell in chapter 6. The author starts by discussing the so-called interior point cutting plane algorithm, giving special attention to the early termination and restarting for the interior point algorithm and to the processes for adding and dropping constraints and fixing variables. Then the incorporation of an interior point method in a branch-and-bound algorithm is addressed. This chapter terminates with some information about parallelization and other interior point approaches.

In the last chapter of this book, Williams and Brailsford present a pleasant tutorial about computational logic and its connection with integer programming. The authors start by discussing the representation of logic propositions as linear constraints with zero-one variables. In the remaining part of the chapter the algorithms for computational logic are surveyed, together with their relationships with cutting planes and branch-and-bound methods for integer programming.

In conclusion, J. Beasley and his guests have done an excellent job in producing a high quality comprehensive study of the most relevant techniques for the solution of linear and integer programming and computational logic. I strongly recommend this book as a reference for researchers and practitioners in these areas.

-JOAQUIM JUDICE

### *Algorithms for Nonlinear Programming and Multiple-Objective Decisions*

Berç Rustem  
J Wiley & Sons Ltd., Chichester,  
1998

ISBN: 0-471-97850-7

This book addresses nonlinear optimal decision problems for dynamic systems with multiple objectives under uncertainty. Static nonlinear problems are the basis of investigations. Multiple objectives and uncertainty are tackled via quadratic programming, nonlinear programming, nonlinear constrained min-max, mean-variance optimization and non-cooperative Nash games.

Being the methodological pivot of the book, nonlinear programming algorithms are presented in detail, up to proofs of convergence rates. In particular, this concerns active set and interior point methods for quadratic programming, projected gradient methods, sequential quadratic programming algorithms involving augmented Lagrangians, and Newton-type algorithms.

On the modeling side, the book places accent on two particular approaches in multi-objective optimization and in optimization under uncertainty. Regarding multiple objectives, the book focuses on weighted least squares approximation of target (or bliss) points and leaves out linear models and discussions from the viewpoint of Pareto optimality. Regarding uncertainty mean-variance, optimization has the main role, and there is a chapter on worst case analysis via constraint min-max problems. Scenario optimization and its extensions to stochastic programming are omitted from the text.

The book is written mainly for researchers in computational methods for decision making and optimal design, and computer scientists interested in quantitative decision support. Its strong points are in serving this community with a self-contained introduction into nonlinear programming tailored to needs for tackling multiple-objective decisions under uncertainty from the specific viewpoint adopted in the book. Ample references encourage further reading.

The author also addresses people interested in multiple-objective decisions in general. Here it has to be admitted that the field of multi-objective (or vector) optimization is wider than the sector selected by the author, and only scarce references are given towards issues not covered by the book.

For specialists in nonlinear programming the book has its appeal mainly in the area of the presented applications. The methodological part on nonlinear programming algorithms, although self-contained, has a supporting function rather than the character of a comprehensive textbook or research monograph.

-RÜDIGER SCHULTZ



## Bylaws and Prize Rules of *The Mathematical Programming Society*

**The membership approved of amendments to the MPS Constitution at the business meeting in Lausanne. The revised constitution was published in OPTIMA No. 55.**

**In December 1998, a few changes of the bylaws were approved of by the MPS Council. Some of these changes were technical, some reflect recent practice, and the Bylaw on Regional and Technical Sections is new. For completeness, the revised bylaws and prize rules are published here.**

**The Council would like to thank Jan Karel Lenstra for his painstaking work on the revision.** –Karen Aardal

### *Bylaws on Council Election and Committee Membership*

1 July 1979

1. The Council will consist of the four members receiving the most votes, subject to the proviso that at most two members are from a single country, as determined by the individual's permanent residence.

2. In the case of committees joint with other Societies, where it would be inappropriate for the Chairmen of the Society and of the Executive Committee to be ex-officio members, such membership will be waived. A designated committee member representing MPS will be responsible for keeping the Executive Committee informed of the committee's progress, accomplishments, and decisions.

### *Guidelines for Proposals to Organize International Symposia on Mathematical Programming*

Revision, 1998

Approximately five years prior to each of the International Symposia on Mathematical Programming, interested parties are invited to submit proposals to host the symposium. Guidelines and associated background information are given below for those who wish to offer such proposals. The material is in four parts:

1. Traditions under which the symposia are held.
2. Provisions of the Mathematical Programming Society Constitution.
3. Recommendations and requests of the

Council of the Society.

4. Financial arrangements.

#### 1. Basic traditions

The traditions of these symposia extend unbroken from 1951. They have been held since then at two to four year intervals. Since 1964, they have regularly been three years apart and, with a single exception, every second meeting has been held in North America. They have provided a comprehensive forum for presentation of research results in the mathematics of mathematical programming, in algorithms and computation, and in modeling. Through 1970, they were intermittently organized when the time seemed ripe by leading members of the mathematical programming research community. During 1971-72, the Mathematical Programming Society was established, in large measure in order to insure continuation of the symposia by providing for the carry-over of funds and procedures from each symposium to the next. There was general agreement at that time that the Society should maintain the already well established traditions as to scope, objectives and procedures for holding the symposia.

In 1988 the Council decided that there will be a separate Symposium Advisory Committee for every symposium. Six years prior to the symposium in question, the Symposium Advisory Committee is appointed, and its chair designated, by the Chairman of the Society, subject to Council approval. The Chairman of the Society and the Chairman of the Executive Committee are ex officio members of the committee.

During the first three years, the committee prepares the selection of the symposium site by Council. For this purpose it solicits proposals by publishing a call for proposals in Optima (the Society newsletter) and by any other appropriate means, and it visits possible sites. During the second period of three years, the committee is the official link between the Society and the Organizing Committee, and it advises the Organizing Committee on all relevant issues.

About three years prior to the symposium, the Council of the Mathematical Programming Society selects a place and time (plus or minus at most a few weeks) for the next symposium, taking into account the recommendation of the Symposium Advisory Committee. The main cri-

teria for selection of the location are:

1. Existence of mathematical programming researchers in that geographic area who are interested in organizing the symposium.
2. Attendance open to prospective participants from all nations.
3. Availability of an attractive facility with a sufficient number of meeting rooms, standard lecture equipment, etc.
4. Availability of a sufficient supply of reasonably economical hotel and/or university dormitory rooms fairly near the meeting facility.

Concurrently with the selection of the site, the Chairman of the Mathematical Programming Society, in consultation with the Chairman of the Executive Committee and the Symposium Advisory Committee, and subject to Council approval, selects a Chairman or Co-Chairmen of the Local Organizing Committee for the symposium. The main criteria for selection of the latter are that they be respected mathematical programming researchers and that they have energy and enthusiasm for the task. After his appointment, the Chairman of the Organizing Committee forms the Organizing Committee, drawing largely or entirely on mathematical programmers who live in the area in which the symposium will be held.

Subsequently, the Chairman of the Society, in consultation with the Chairman of the Organizing Committee and the Symposium Advisory Committee, appoints a world leader in mathematical programming to be Chairman of the Program Committee. The Organizing Committee, in consultation with the Chairman of the Program Committee and the Symposium Advisory Committee, selects a Program Committee, which should comprise quite a number of prominent mathematical programming researchers, from all parts of the world. The Program Committee has only an advisory role. It is available to the Organizing Committee as a sounding board and a source of suggestions concerning the technical program of the symposium; it should be invited by the Organizing Committee to submit suggestions about the choice of plenary and invited speakers.

Limited only by a few broad guidelines, the Organizing Committee has almost complete freedom in planning the technical program and other arrangements. In particular:

1. It solicits invited and contributed papers, and formulates the technical program. There will be parallel sessions and plenary sessions. As far as possible the speakers at the plenary sessions should be chosen to represent different parts of the world as well as different aspects of mathematical programming. It should be noted that, traditionally, the symposia have endeavored to give everyone who wishes to speak a chance to be heard, rejecting papers only on the grounds that their subject matter lies entirely outside the field or presents clearly incorrect results.
2. It takes responsibility for soliciting funds from appropriate institutions for use in ways which are intended to enhance the value of the symposium; for example, travel assistance funds for important contributors who would not otherwise be able to attend.
3. It contracts for meeting rooms and living accommodations, and plans social events such as a cocktail party and banquet.
4. To whatever extent it deems desirable, it invites societies and institutions other than the Mathematical Programming Society to be co-sponsors of the symposium.

## 2. Provisions of the Constitution of the Society

Section V of the Constitution of the Society is called "International Symposia." It stipulates:

1. International Symposia are sponsored by the Society at intervals of between 24 and 48 months. The Chairman of the Society nominates and the Council elects the Chairman for the organization of the next International Symposium.
2. Fees for the International Symposium are fixed by the local organizing committee, in consultation with the Chairman of the Society. The Council shall adopt guidelines regarding the financial obligations between the Society and the organizing committee.

It is appropriate to note also that several paragraphs of the Constitution's Section IV (which is called "Council") relate to International Symposia:

- in 3: The Chairman of the Society will chair a business meeting on the occasion of any International Symposium held during his term of office.
- in 5: The Treasurer shall make a financial report to the Society at the International Symposium held within his term of office.
- in 7: At each International Symposium there will be a meeting of the outgoing Council and of the incoming Council. These meet-

ings may be combined at the discretion of the Chairman.

## 3. Recommendations and requests of the Council

1. A plenary session should be scheduled for the presentation of prizes.
2. No distinction whatsoever should be made between members and nonmembers of the Society in forming the Organizing Committee and the Program Committee, nor in selecting plenary, invited and contributed papers. In order, however, to maintain the Society, the symposium organizers should:

- (a) Set a modestly lower registration fee for members of the Society than for nonmembers.
- (b) Make provisions for nonmembers to join the Society as part of advance registration for the symposium by mail, or during registration in person at the symposium. Nonmembers who join the Society should pay the reduced registration fee.
- (c) Schedule and publicize a business meeting of the Society, as called by the Constitution.
- (d) Provide a room for use of the Council throughout the symposium.

3. The Organizing Committee should:

- (a) Provide an adequate forum for the reporting of the activities of Committees of the Society.
- (b) Seek the agreement of the Editors-in-Chief and the Council concerning any publication of symposium papers.
- (c) Get the approval by the Council for any significant departure from tradition.
- (d) No activities which give the appearance that the Society is passing judgment on the relative merits of commercial products or services shall be organized without formal approval by the Council.

## 4. Financial arrangements

The Society can provide seed money to the Organizing Committee. It is expected, however, that the Committee will attempt to cover all expenses through registration fees, grants and institutional support; hence, that after the symposium, the seed money will be returned to the Society.

The Organizing Committee should develop a budget which covers all anticipated income and expenses. The Chairman and the Treasurer of the Society should have access and an opportunity to comment on the proposed budget. At

the end of the symposium, the Organizing Committee should provide the Treasurer of the Society with a financial report.

In case there is any surplus of symposium funds, at least half of it will become part of the funds of the Society. The Organizing Committee may make a proposal to the Council for using the remaining surplus on activities that will benefit the international mathematical programming community. At the request of the Organizing Committee and subject to approval of the budget by the Chairman and the Treasurer of the Society, the Council will provide a guarantee of at most \$15,000 against losses of the symposium. Agreements will be made in writing prior to the symposium.

## *Bylaw on IPCO Conferences*

### Revision, 1998

1. The Society sponsors a series of Conferences on Integer Programming and Combinatorial Optimization (IPCO Conferences) as well as a series of proceedings of these conferences. The program of an IPCO Conference consists of presentations of original work dealing with theoretical, algorithmic, computational and practical aspects of integer programming and combinatorial optimization. The proceedings contain the full text of the presentations and are available at the beginning of the conference.
2. An IPCO Conference will be held in two out of every three years, namely, in every year in which no International Symposium on Mathematical Programming takes place.
3. The Council selects the location of an IPCO Conference and appoints the Chairman of the Program Committee and the Chairman of the Organizing Committee, on the basis of proposals by the Executive Committee. Each of these chairmen forms his own committee, subject to approval by the Chairman of the Society. In order to guarantee good communication between the two committees, the chairman of each is a member of the other.
4. The locations of the IPCO Conferences are preferably chosen in such a way that, if the international symposia are also taken into account, an alternation between North America and Europe is achieved. This is a guideline, not an iron-clad rule. In particular, it does not exclude the selection of a location on another

continent for any meeting.

5. The task of the Program Committee is to solicit extended abstracts of possible presentations, to select the presentations on the basis of the extended abstracts, and to collect the full papers for publication in the proceedings. In the call for papers, the Program Committee emphasizes the breadth of the subject matter of the conference and specifies the nature of an extended abstract. The Program Committee will meet, in order to discuss the submissions and to select the papers.

6. The Organizing Committee is responsible for the local and financial organization of the conference, for the collection of the camera-ready copy of the proceedings, and for its timely delivery at the publisher. The budget of an IPCO Conference includes the costs of the meeting of the Program Committee and of one copy of the proceedings for every registered participant.

7. The Publications Committee of the Society is responsible for the publication of the proceedings. If the publisher of the proceedings is other than the Society, then the Publications Committee should try to reach a long-term agreement with that publisher.

### ***Bylaw on Publications***

4 January 1994

1. The Society publishes journals and newsletters to inform members and others about current events and new developments in the field of mathematical programming, and to contribute to public understanding of that field. The publications program of the Society is under the general authority of the Council, which may establish new Society publications and/or discontinue existing ones. All funds deriving from publications of the Society are the property of the Society.

2. Operational responsibility for the publications program is vested in the Publications Committee, which operates under the guidance of, and reports to, the Council. The Publications Committee is appointed, and its chair designated, by the Chairman of the Society with the approval of the Council. Specific responsibilities of the Publications Committee include, but are not limited to, the following:

- (a) Making recommendations to the Council on publications policy and administration.
- (b) Overseeing all operational publications matters including the editorial operations, costs, quality, timeliness, pricing, distribution, advertising, and circulation of all publications.
- (c) Supervising the editors of the publications, to include initiation of review and search processes when required, and recommendation of editorial candidates.
- (d) Representing the Council to the publisher of the publication, if that publisher is other than the Society.

3. To manage individual publications, editors are appointed by the Chairman with the approval of Council. The Council may authorize suitable honoraria for editors. Specific responsibilities of editors include, but are not limited to:

- (a) Managing the operations of their publications, including in particular the areas identified in 2(b) above, in compliance with policy and budget guidance given by the Council and the Publications Committee. As part of the management process, editors may set up and administer editorial funds using monies provided by the Society. Such monies remain the property of the Society.
- (b) Appointing editorial staff (e.g., associate editors) as needed.
- (c) Reporting at least annually to the Council, through the Publications Committee, on the operations and financial status of their publications.

4. Under normal circumstances the term of appointment of an editor will be three years. Editors may serve more than one term.

5. When an editor's term approaches its end, or when required by other circumstances, the Publications Committee will charge a committee to review the state of that editor's publication. The review committee's report will include the recommendation of a person to serve as editor during the next term.

### ***Bylaw on Society Prizes***

Revision, 1998

#### **Awarding the prizes**

1. All prize winners shall be informed of their selection, and must indicate acceptance within a reasonable time.

2. The prize will normally be awarded in a ceremony at a Society meeting. If a recipient does not attend the award ceremony, the Society will send the award via registered mail to any address designated by the awardee.

3. In the absence of an acceptance or appropriate mailing instructions from an awardee within a reasonable time, all material parts of the award shall be deemed to be forfeited and revert to the Society.

4. In the event of such a forfeiture the awardee will be listed as a prize winner in any subsequent published listing of prizes, unless the Society has been specifically requested not to do so by the awardee.

5. If an awardee seeks at some future time to claim a forfeited award, approval of the Council of the Society will be required.

The above permits a prize to be awarded even if the recipient was never heard from. This is felt to be unavoidable if only merit is used as a criterion. Also it is possible that there is insufficient time between notification of the awardee and the award ceremony to permit contact.

#### **Supporting the prizes**

In case the fund of any of the prizes sponsored or cosponsored by the Society is depleted, the Society will consider supporting the prizes out of its own resources.

### ***Bylaw on Regional and Technical Sections***

17 November 1998

#### **Regional sections**

Regional sections can be established in any region, be it a country, a part of a country, or a collection of countries.

Any group of at least six MPS members from the region in question can propose the establishment of a regional section. All MPS members in the region automatically become members of the regional section. A region needs at least 15 MPS members to have a regional section. Each regional section must be approved by the Council.

Regional sections can organize themselves as they wish. Each section must have a leader, who must be approved by the Council. When a regional section is established, the proposers must suggest an initial leader. When the Council is asked to approve a leader, the proposers must also suggest the length of the term. It is the duty

of the leader to make sure that a new leader is suggested before his or her own term ends.

The name of a regional section is "The Mathematical Programming Society - ... Section." The regional leader has the right to use the title "Leader of the ... Section of the Mathematical Programming Society," the MPS letterhead, with the name of the section clearly visible, and the name of MPS. Any use of the name has to be reported to, but not approved by, the Council.

Regional sections are financially independent of MPS, and do not collect fees. The Council can give loans or hand money to regional sections.

#### Technical sections

Technical sections can be established in any area of mathematical programming, be it theoretical, computational, or applied.

Any group of at least 15 MPS members can propose the establishment of a technical section. Membership is voluntary. Each technical section must be approved by the Council.

Technical sections can organize themselves as they wish. Each section must have a committee and a leader, both approved by the Council. When a technical section is established, the proposers must suggest an initial committee and leader, and a term. It is the duty of the leader to make sure that a new leader is suggested before his or her own term ends.

Technical sections are financially independent of MPS, and can collect fees. The Council can give loans or hand money to technical sections.

#### Financial Guidelines

Revision, 1998

##### 1. Activities to be supported

The financial resources of the Mathematical Programming Society are to be used for the following purposes: (a) secretariat services; (b) publications of the Society; (c) support of the International Symposia on Mathematical Programming; (d) support of conferences, symposia, congresses, etc.; (e) support of the prizes of the Society; (f) support of the regional and technical sections; (g) honoraria; (h) necessary expenses of the Society's officers and approved committees; (i) travel necessary for the conduct of the business of the Society.

##### 2. Treasurer's responsibilities

1. The treasurer shall have the responsibility for the custody of all funds of the Society, and shall cause to be disbursed such funds of the Society as may be ordered by the Council, or as may be ordered by other officers of the Society within their authority as granted by the Council.
2. The treasurer will maintain or create such checking or other accounts as required for the transaction of Society business, with himself, the Chairman of the Society, the Chairman of the Executive Committee, and such other officers as the Council may designate as alternative signatories. He may also authorize the maintenance or creation of other accounts as required, such as for the use of the Editor-in-Chief, with appropriate alternative signatories.
3. Before January 1, or other date set by the Executive Committee, of each year the Treasurer shall prepare a budget following the policies approved by the Council. This budget shall include, but need not be limited to, editorial expenses and expenses of the various committees and officers of the Society. This budget shall be submitted to the Council for approval via the Executive Committee.
4. Accompanying the budget will be a statement of all the Society's accounts and an analysis, based on the best information available, of the present state of the Society's finances and its prospects for the coming year.
5. On or about August 1 of each year the Treasurer will transmit to the Executive Committee a dues recommendation for the following year and an updated version of the year's budget and the analysis above.

##### 3. Unbudgeted expenditures

1. The Council empowers the Executive Committee to authorize the expenditure of funds, in excess of the budgeted amounts, up to 5% of the total budget per year and \$500 for a single item, for purposes set forth in Section 1. Expenditures in excess of these limits which have not been previously budgeted require Council approval.
2. The Chairman of the Society and the Chairman of the Executive Committee are empowered to authorize the expenditure of "petty cash funds" not to exceed a total of \$200 per year for each. These funds shall be used for specific goods and services of small and temporary value.

#### Fulkerson Prize

Revision, 1995

The Fulkerson Prize for outstanding papers in the area of discrete mathematics is sponsored jointly by the Mathematical Programming Society and the American Mathematical Society. Beginning in 1979, up to three awards of \$750 each will be presented at each (triennial) International Congress of the Mathematical Programming Society; they will be paid out of a memorial fund administered by the American Mathematical Society that was established by friends of the late Delbert Ray Fulkerson to encourage mathematical excellence in the fields of research exemplified by his work. Beginning in 1994, the amount of each award is \$1,500.

Papers to be eligible should form the final publication of the main result(s) and should have been published in a recognized journal, or in a comparable, well refereed volume intended to publish final publications only, during the six calendar years preceding the year of the Congress. Extended abstracts and prepublications, and articles published in journals, journal sections or proceedings that are intended to publish non-final papers, are not included. The extended period of six years is in recognition of the fact that the value of fundamental work cannot always be immediately assessed. The prizes will be given for single papers, not series of papers or books, and in the event of joint authorship the prize will be divided.

The term "discrete mathematics" is intended to include graph theory, networks, mathematical programming, applied combinatorics, and related subjects. While research work in these areas is usually not far removed from practical applications, the judging of papers will be based on their mathematical quality and significance.

The Selection Committee for the awards will have two members appointed by the Chairman of the Mathematical Programming Society and one member appointed by the President of the American Mathematical Society. The committee members will serve for at most two rounds of awards, with terms overlapping where possible for the sake of continuity. One of the initial MPS appointees will be the first chairman of the committee; subsequent chairmen should whenever possible be veterans of the previous round of awards. The Selection Committee will devise

its own procedures for acquiring nominations or otherwise searching out papers of interest, taking pains, however, not to overlook the work of young, relatively unknown mathematicians.

### **George B. Dantzig Prize**

Revision, 1988

#### **Guidelines**

The prize is awarded jointly by the Mathematical Programming Society (MPS) and the Society for Industrial and Applied Mathematics (SIAM). The prize is awarded for original research, which by its originality, breadth and depth, is having a major impact on the field of mathematical programming. The contribution(s) for which the award is made must be publicly available and may belong to any aspect of mathematical programming in its broadest sense. Strong preference will be given to candidates that have not reached their 50th birthday in the year of the award.

#### **The Prize Committee**

There will be an ad hoc Prize Committee appointed for each award jointly by the Chairman of MPS and the President of SIAM. The committee will consist of four members, one designated "Chairman" by the Chairman of MPS, and it will represent a diversified view of mathematical programming. Committee appointments should be made at least two years before the prize award date. The MPS has the responsibility to notify its Chairman and the President of SIAM to make the appointments.

For continuity, committee members will normally serve on two successive prize committees with the committee chairman being a second term member. Thus two new members will be appointed and two members will be reappointed every three years. Committee members will be members of MPS and/or SIAM. At least two members of the committee will be MPS members and at least two will be members of SIAM. The membership of the committee should also reflect the international character of the societies.

#### **Committee procedure**

The committee is responsible for the solicitation and evaluation of nominations. A call for nominations should be placed in appropriate SIAM, MPS, and other publications. Nominations should be accompanied by a letter of recommendation. The full committee should meet at least

once, early enough to permit extended discussions regarding the qualifications of the candidates.

The committee will deliver its final report with its nominee(s) at least six months prior to the prize award date. The committee will complete its duties with the awarding of the prize. If the committee reports that no prize can be awarded, then the prize money will be used to increase the endowment and the duties of the committee will be completed.

The nomination(s) for the award should be presented by the Prize Committee to the Executive Committees of the SIAM Council and of MPS, via the President of SIAM and the Chairman of MPS. The nomination(s) for the award must be accompanied by a written justification and a citation of about 100 words that can be read at the award date.

Both SIAM and MPS must accept the nomination(s). Objection by either one of the two societies will nullify the nomination(s). If the nomination(s) of the Prize Committee is rejected by MPS and/or SIAM, the Prize Committee may propose a second nomination.

#### **Prize award date**

A prize award will be considered every three years. If no prize is awarded, the award date moves ahead three years.

#### **The prize fund**

MPS has the responsibility for soliciting and providing the funds necessary for the prize award. The fund will come from a contributed endowment. These funds are to be sent directly to SIAM, to be contributed to the George B. Dantzig Prize Fund in care of SIAM. SIAM has the responsibility for managing and administering the prize fund.

#### **Description of the award**

The award is to include a certificate containing the citation and a cash prize, the amount of which is to be determined by the Executive Committee of the SIAM Board and of MPS. Normally the amount of the prize will be approximately the available proceeds from the endowment minus travel expenses from the endowment as noted below. Travel expenses for the award recipient(s) to the meeting will normally be paid by the George B. Dantzig Prize Fund, or as necessary, out of the operating funds of the Society that hosts the award. It is the option of the hosting organization to make the

payment of travel expenses contingent on the delivery of a major lecture at the meeting.

#### **The award presentation**

The award will be presented at the International Symposium of MPS except every third time it will take place at a national meeting of SIAM, either the National (spring) or fall meeting of SIAM in the year of the award. Presentation will be made by the Chairman of MPS (or his designate) when MPS is hosting the award, or otherwise by the President of SIAM (or his designate). The recipient is expected to make a short acceptance speech.

#### **Change to these specifications**

Any changes to these specifications must have the approval of MPS and the SIAM Council and Board of Trustees.

### **Beale-Orchard-Hays Prize for Excellence in Computational Mathematical Programming**

#### **Purpose**

To be eligible a paper or a book must meet the following requirements:

1. It must be on computational mathematical programming. The topics to be considered include:
  - (a) experimental evaluations of one or more mathematical programming algorithms,
  - (b) the development of quality mathematical programming software (i.e., well-documented code capable of obtaining solutions to some important class of mathematical programming problems) coupled with documentation of the application of the software to this class of problems (note: the award would be presented for the paper that describes this work and not for the software itself),
  - (c) the development of a new computational method that improves the state-of-the-art in computer implementations of mathematical programming algorithms coupled with documentation of the experiment that showed the improvement, or
  - (d) the development of new methods for empirical testing of mathematical programming techniques (e.g., development of a new design for computational experiments, identification of new performance measures, methods for reducing the cost of empirical testing).
2. It must have appeared in the open literature.
3. Documentation must be written in a language

acceptable to the Screening Committee.

4. It must have been published during the three calendar years preceding the year in which the prize is awarded.

These requirements are intended as guidelines to the Screening Committee but are not to be viewed as binding when work of exceptional merit comes close to satisfying them.

#### **Frequency and amount of the award**

The prize will be awarded every three years. The award will be presented at the awards session of the International Symposium on Mathematical Programming sponsored by the Mathematical Programming Society. The prize consists of \$1,500 and a plaque.

#### **Judgement criteria**

Nominations will be judged on the following criteria:

1. Magnitude of the contribution to the advancement of computational and experimental mathematical programming.
2. Originality of ideas and methods.
3. Degree to which unification or simplification of existing methodologies is achieved.
4. Clarity and excellence of exposition.

#### **The Awards Committee**

The screening process will be carried out by a committee of four to eight people appointed by the Chairman of MPS. The appointment of the committee must be made at least one year prior to the awarding of the prize.

Each committee member will read all nominations and provide to the Chairman of the committee his or her assessment based on the four criteria noted above. The Screening Committee reserves the right to determine that there will be no prize given for that meeting.

#### **Nominations**

Nominations must be in writing and include the title(s) of the paper(s) or book, the author(s), the place and date of publication, and four copies of the material. Supporting justification and any supplementary materials are welcome but not mandatory. All nominations must be received at least six months prior to the awards date. The Screening Committee reserves the right to request further supporting materials from the nominees.

#### **A. W. Tucker Prize**

The A.W. Tucker Prize will be presented at each International Symposium of the Society for an outstanding paper authored by a student. All students, graduate or undergraduate, are eligible. Nominations of students who have not yet received the first university degree are especially welcome. In advance of the symposium an Awards Committee will screen the nominations and select at most three finalists. The finalists will be invited, but not required, to give oral presentations at a special session of the symposium. The Awards Committee will select the winner and present the award prior to the conclusion of the symposium.

#### **Eligibility**

The paper may concern any aspect of mathematical programming; it may be original research, an exposition or survey, a report on computer routines and computing experiments, or a presentation of a new and ingenious application. The paper must be solely authored, and completed since the beginning of the calendar year in which the preceding symposium was held. The paper and the work on which it is based should have been undertaken and completed in conjunction with a degree program.

#### **Nominations**

Nominations must be made in writing to the Chairman of the Awards Committee by a faculty member at the institution where the nominee was studying for a degree when the paper was completed. Letters of nomination must be accompanied by four copies each of: the student's paper; a separate summary of the paper's contributions, written by the nominee, and no more than two pages in length; and a brief biographical sketch of the nominee. The Awards Committee may request additional information. Nominations and the accompanying documentation are due six months prior to the beginning of the symposium, and must be written in a language acceptable to the Awards Committee.

#### **Selection**

The Awards Committee will select the finalists at least three months prior to the beginning of the symposium. It will notify the Chairman of the Society and the Chairman of the Executive Committee at that time. The winner will be

selected by the Awards Committee at the symposium, subsequent to the oral presentations by the finalists. Selection will be based on the significance of the contribution, the skillfulness of the development, and the quality of the exposition.

#### **Endowment**

The Society will solicit contributions to an endowment for the prize.

#### **Disbursements from the endowment income**

The winner will receive an award of \$750 (U.S.) and a certificate. The other finalists will also receive certificates. The Society will also pay partial travel expenses for each finalist to attend the symposium. These reimbursements will be limited in accordance with the amount of endowment income available. A limit in the range from \$500 to \$750 (U.S.) is likely. The institutions from which the nominations originate will be encouraged to assist any nominee selected as a finalist with additional travel expense reimbursement.

#### **Awards Committee**

The Awards Committee will have five members, including a chairman, all appointed by the Chairman of the Society. The members will serve staggered terms covering two successive symposia, with two or three members retiring after each symposium.

*gallimaufry*

Deadline for the next issue of OPTIMA is February 28, 1999.

For the electronic version of OPTIMA, please see:

<http://www.ise.ufl.edu/~optima/>

## Application for Membership

### *I wish to enroll as a member of the Society.*

My subscription is for my personal use and not for the benefit of any library or institution.

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Student applications: Dues are one-half the above rate. Have a faculty member verify your student status and send application with dues to above address.

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UNIVERSITY OF  
FLORIDA

Center for Applied Optimization  
371 Weil  
PO Box 116595  
Gainesville FL 32611-6595 USA

FIRST CLASS MAIL

EDITOR:  
Karen Aardal  
Department of Computer Science  
Utrecht University  
PO Box 80089  
3508 TB Utrecht  
The Netherlands  
e-mail: [aardal@cs.ruu.nl](mailto:aardal@cs.ruu.nl)  
URL: <http://www.cs.ruu.nl/staff/aardal.html>

AREA EDITOR, DISCRETE OPTIMIZATION:  
Sebastian Ceria  
417 Uris Hall  
Graduate School of Business  
Columbia University  
New York, NY 10027-7004  
USA  
e-mail: [sebas@cumparsita.gsb.columbia.edu](mailto:sebas@cumparsita.gsb.columbia.edu)  
URL: <http://www.columbia.edu/~sc244/>

Donald W. Hearn, FOUNDING EDITOR  
Elsa Drake, DESIGNER  
PUBLISHED BY THE  
MATHEMATICAL PROGRAMMING SOCIETY &  
GATOREngineering® PUBLICATION SERVICES  
University of Florida

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AREA EDITOR, CONTINUOUS OPTIMIZATION:  
Mary Beth Hribar  
Tera Computer Company  
2815 Eastlake Ave. E.  
Seattle, WA 98102  
USA  
e-mail: [marybeth@tera.com](mailto:marybeth@tera.com)

BOOK REVIEW EDITOR:  
Robert Weismantel  
Universität Magdeburg  
Fakultät für Mathematik  
Universitätsplatz 2  
D-39106 Magdeburg  
Germany  
e-mail: [weismant@math.uni-magdeburg.de](mailto:weismant@math.uni-magdeburg.de)