OPTIMA

MATHEMATICAL PROGRAMMING SOCIETY NEWSLETTER

№ 40 *July* 1993

DMV Establishes Optimization Group and *Opt-net*

The Special Interest Group in Optimization (SIGOPT, i.e. *Fachgruppe Optimierung* in German) has been created under the auspices of the Deutsche Mathematiker Vereinigung (DMV) with the purpose of encouraging cooperation amongst its members, and of facilitating communication between them. This call for membership is directed to all those interested in mathematical optimization, both in theory and practice.

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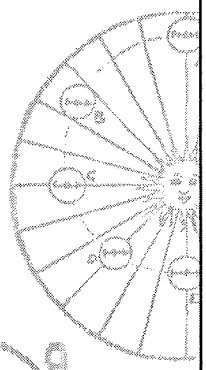
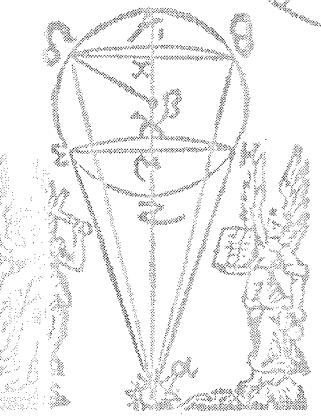




Opt-net Founded to Increase Communication

The newly founded Fachgruppe Optimierung of the Deutsche Mathematiker Vereinigung (DMV), known in English as the Special Interest Group in Optimization (SIGOPT), intends to intensify communication among its members. For this purpose, SIGOPT has established *opt-net*. This forum, however, is not limited to SIGOPT, but is open to all scientists and students of mathematics, computer science, economics, electrical engineering etc. who are interested in optimization or who want to obtain relevant information. PAGE TWO ►

NUMBER 40

DMV Establishes Optimization Group and *Opt-net*

SIGOPT provides a forum for discussing actual and future developments in a broad variety of disciplines associated with optimization and actively supports interdisciplinary research and applications to industry. Membership is encouraged, particularly for those who already are members of societies such as AMS, DMV, GAMM, GMÖOR, SIAM, as well as anyone else interested in optimization. In particular, SIGOPT encourages students and younger scientists to become involved in research in optimization. To cover administrative costs, members may be asked for a small financial contribution.

The annual Mathematical Optimization Conference is organized by its members, the first of which will be held at Vitte/Hiddensee in Germany in September 1993. In the following three years, the conference will be part of larger conferences: in Berlin, as part of OR '94, organized jointly with GMÖOR, DGOR, SVOR, ÖGOR; in Ulm, under the sponsorship of DMV; and the year after under the sponsorship of GAMM. Further workshops will be held on special aspects of mathematical optimization.

To facilitate communication among members of the optimization community, the electronic forum, ***opt-net***, has been installed at the Konrad-Zuse-Zentrum in Berlin (ZIB). The main purpose of ***opt-net*** is to provide an efficient means of communication among its participants. Each member of ***opt-net*** has a unique e-mail identification at ZIB. To receive e-mail at a new address anywhere in the world, the user merely sends an e-mail message to ZIB and all mail will be redirected to the new address. Members also may receive a weekly electronic digest, and will be able to use a number of other facilities.

Access to ***opt-net*** is possible using Internet and all academic post office networks. (For more information on ***opt-net***, please see the accompanying article.)

H. TH. JONGEN
RWTH AACHEN

K. LOMMATZSCH
HUMBOLDT UNIVERSITY BERLIN

U.T. ZIMMERMAN
TU BRAUNSCHWEIG

Opt-net Founded to Increase Communication

Opt-net has properties that you have always wanted to take advantage of!! For instance, you can search for colleagues who share the same interests, have your e-mail messages forwarded, send conference announcements conveniently, give information on papers etc.

Among other aspects, ***opt-net*** includes:

- a moderated forum for discussion (called digest) that distributes contributions through a mailing list to which you can subscribe,
- e-mail addresses for all subscribers (virtual mailboxes),
- a WhitePage service with "whois" and other search facilities,
- a key for an interactive access to ZIB's electronic library, eLib, and
- an ***opt-net*** archive within eLib with various search facilities.

Every subscriber to ***opt-net*** has the possibility to use the following facilities — actively or passively — via ZIB's eLib for mathematical software:

- dialogue access to NetLib and the Reduce Network Library (RedLib), which has a comprehensive collection of mathematical software;
- distribution service for documents (PostScript, TeX), programs (sources, binaries), data and reports;
- automatic announcement of contributions in Internet and USENET (Archie, WAIS, IMP); and
- access to information from Internet (Telnet, mail, ftp) and all scientific and postal networks (via WIN, Datex-P, X.400).

To receive in-depth information on ***opt-net*** just send the following three e-mail messages:

opt-net*-Request@ZIB-Berlin.De*

Subject: Help

opt-net*-Request@ZIB-Berlin.De*

Subject: Story

opt-net*-Request@ZIB-Berlin.De*

Subject: Manual

Your message need not include any text. The ***opt-net*** server will read your e-mail address and the "Subject" line and then will send you the document requested. "Help" gives you some initial information on the functioning of ***opt-net***. "Story" explains what can be done with ***opt-net*** by telling a story and "Manual" is a compact and complete reference manual containing descriptions of all functions and commands used in ***opt-net***.

"Participation in *opt-net* is free of charge. *Opt-net* also can be used by persons who are not members of the DMV-Fachgruppe Optimierung or of *opt-net*."

These three documents give you information on all services offered by *opt-net*; particularly on how to register with *opt-net*, how to obtain the digest, how to send in contributions and, of course, how to become a member of the Fachgruppe Optimierung of the DMV. *Opt-net* will experience continuous development if there is sufficient demand; your proposals can contribute to this.

Above all, *opt-net* is intended to enable a convenient and efficient exchange of information. Which topics of discussion and what kinds of information will dominate *opt-net* in the future remains to be seen. This will depend on the subscribers to the net and on the development of their interests and demands. Please send your *opt-net* contributions by e-mail to the following address: *opt-net@zib-berlin.de*. The subject line should contain a brief description of the contents of your contribution and should begin with the sender's name.

The text of the contribution can be of any shape and — in principle — of any contents. If the text is of mathematical contents it should start with the "Mathematics Subject Classifikation" (MSC 1991) of its contents that Zentralblatt fuer Mathematik and Mathematical Reviews have agreed to use, e.g. primary: 90C05, 90C06; secondary: 90C35.

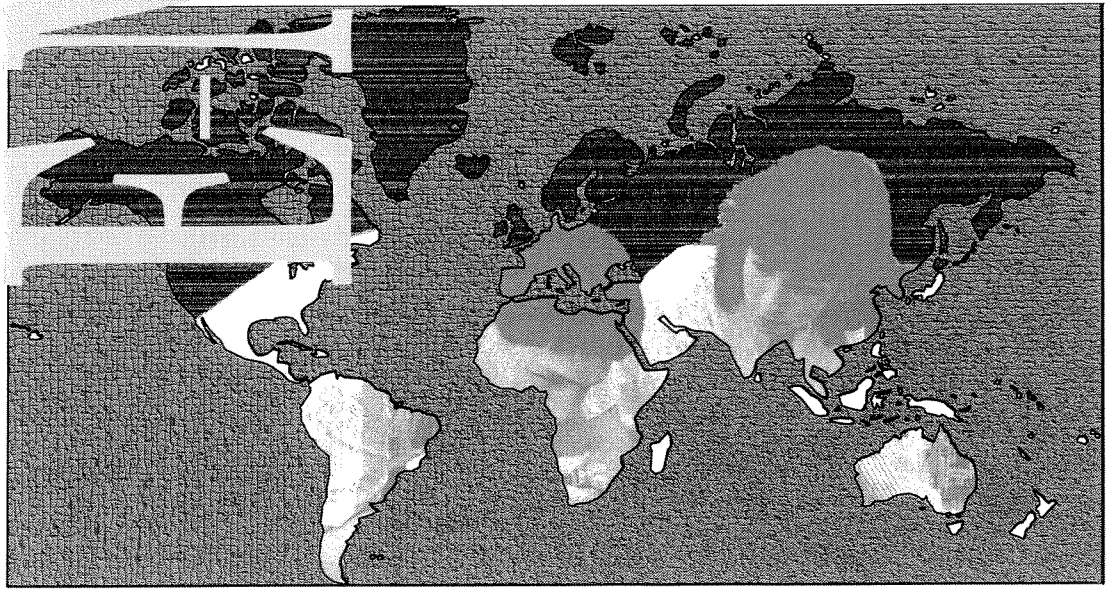
All contributions, however, will be examined by a moderator. The moderator may reject contributions sent in if they seem to be inadequate or of little value for the *opt-net* community. The moderator of *opt-net* is Uwe Zimmerman (TU Braunschweig). His e-mail address is *opt-net@zib-berlin.de*.

The language of *opt-net* will be English, since there is no comparable international forum for optimizers and the Fachgruppe Optimierung of the DMV wants to share this facility with interested colleagues from other countries.

Participation in *opt-net* is free of charge. *Opt-net* also can be used by persons who are not members of the DMV-Fachgruppe Optimierung or of *opt-net*.

With the creation of *opt-net*, a tool has been made available that makes use of today's technical potential and will help its users to pursue their mathematical interests more efficiently. However, *opt-net* cannot live without members. First of all, *opt-net* needs some members to start working. It takes up its technical service today, and its inner life is to commence soon. Just try and register with *opt-net* ; maybe you'll like it. A network can, of course, never be better than its members.

— M. GRÖETSCHEL, PRESIDENT OF THE DMV AND VICE PRESIDENT OF ZIB



PRIZES

1994 NOMINATIONS INVITED

Call for Nominations for the **Beale-Orchard-Hays Prize** for Excellence in Computational Mathematical Programming

This award is dedicated to the memory of Martin Beale and William Orchard-Hays, pioneers in computational mathematical programming. The prize is awarded every three years. The 1994 prize of $1,500 and an award certificate will be presented in August 1994, at the University of Michigan, during the Awards Session of the International Symposium on Mathematical Programming, sponsored by the Mathematical Programming Society. 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:***

- experimental evaluations of one or more mathematical algorithms,
- the development of quality mathematical programming software (i.e. well-documented code capable of obtaining solutions to some important class of MP problems) coupled with documentation of the applications of the software to this class of problem (note: the award would be presented for the paper which describes this work and not for the software itself),
- the development of a new computational method that improves the state-of-the-art in computer implementations of MP algorithms coupled with documentation of the experiment which showed the improvement, or
- 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 or methods for reducing the cost of empirical testing).

2 ***It must have appeared in the open literature.***

3 ***If the paper or book is written in a language other than English, then an English translation also must be included.***

4 ***Papers eligible for the 1994 award must have been published within the years 1990-93.***

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.

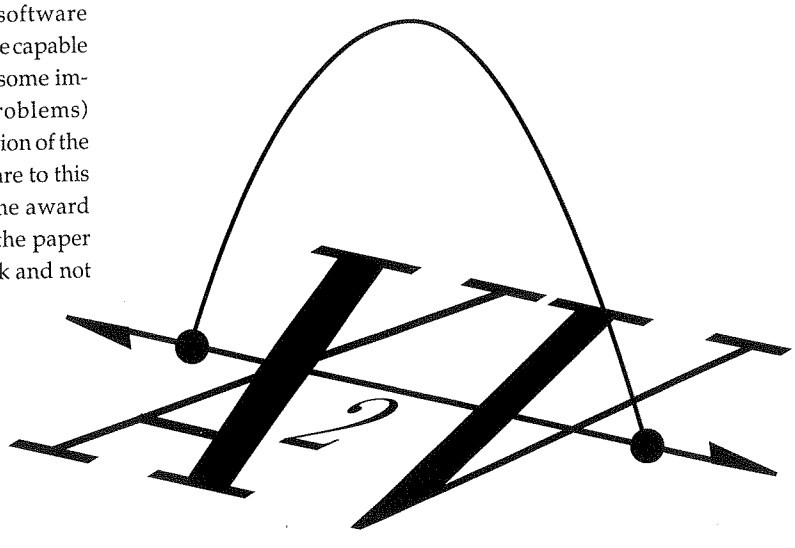
Nominations will be judged on the following criteria: magnitude of the contribution to the advancement of computational and experimental mathematical programming; originality of ideas and methods; and clarity and excellence of exposition.

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

Nominations should be mailed to:

Professor Laurence A. Wolsey
CORE
34 Voie du Roman Pays
B-1348 Louvain-la-Neuve
Belgium

The deadline for submission of nominations is **Jan. 1, 1994.**



Call for Nominations for the **George B. Dantzig Prize**

Nominations are solicited for the George B. Dantzig Prize, administered jointly by the Mathematical Programming Society (MPS) and the Society for Industrial and Applied Mathematics (SIAM). This prize is awarded to one or more individual s for original research which, by virtue of its originality, breadth and depth, is having a major impact on the field of mathematical programming. The contributions eligible for consideration must be publicly available and may address any aspect of mathematical programming in its broadest sense. Strong preference is given to contributions by individuals under 50 years of age.

PRIZES

To be awarded at the XVth International Symposium on Mathematical Programming to be held in Ann Arbor, MI, U.S.A., Aug. 15-19, 1994.

The prize will be presented at the symposium. Past Dantzig Prize recipients have been: M.J.D. Powell and R.T. Rockafellar in 1982, E.L. Johnson and M.W. Padberg in 1985, M.J. Todd in 1988, and M. Gröetschel and A.S. Nemirovsky in 1991.

The prize committee members are: Michael J. Todd, Chairman; Martin Groetschel; Ellis L. Johnson and R. Tyrrell Rockafellar.

Please send nominations to Michael J. Todd, School of Operations Research & Industrial Engineering, 206 Engineering & Theory Center Building, Cornell University, Ithaca, NY 14853-3801, U.S.A., or by e-mail to *miketodd@cs.cornell.edu*. Nominations are due by **Sept. 30, 1993**, and should provide a brief one- or two-page description of the nominee's outstanding contributions, and, if possible, a current resume including a list of the nominee's publications.

Call for nominations for the **D. Ray Fulkerson Prize** in discrete mathematics

The specifications for the Fulkerson Prize read:

"Papers to be eligible for the Fulkerson Prize should have been published in a recognized journal during the six calendar years preceding the year of the Congress. The extended period 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 a 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 usually is not far removed from practical applications, the judging of papers will be based on their mathematical quality and significance."

The nominations for the award will be presented by the Fulkerson Prize Committee (Alexander Schrijver, Chairman; Alan J. Hoffman; and Éva Tardos) to the Mathematical Programming Society and the American Mathematical Society.

Please send your nominations by **Jan. 15, 1994**, to:

Alexander Schrijver,
CWI
Kruislaan 413
1098 SJ Amsterdam,
The Netherlands

Announcement by the Mathematical Programming Society of the **A.W. Tucker Prize**

The Mathematical Programming Society invites nominations for the A.W. Tucker Prize for an outstanding paper authored by a student. The award will be presented at the symposium. All students, graduate and undergraduate, are eligible. Nominations of students who have not yet received their first university degree are especially welcome. In advance of the Symposium, an award 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 award committee will select the winner and present the award prior to the conclusion of the Symposium. The members of the committee for the 1994 A.W. Tucker Prize are: Thomas M. Liebling, Swiss Federal Institute of Technology, Lausanne; Andrew R. Conn, Thomas J. Watson Research Center, Yorktown Heights; William H. Cunningham, University of Waterloo; Clovis Gonzaga, COPPE, Federal University of Rio de Janeiro; and Jean-Philippe Vial, University of Geneva.

Eligible papers may concern any aspect of mathematical programming; they may be original research, an exposition or survey, a report on computer routines and computer experiments, or a presentation of a new and interesting application. The paper must be solely authored, and completed after January 1991. The paper and the work on which it is based should have been undertaken and completed in conjunction with a degree program.

Nominations must be made in writing to the chairman of the awards committee

Thomas M. Liebling
Swiss Federal Institute of Technology
Department of Mathematics
MA (Ecublens)
CH-1015 Lausanne
Switzerland

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 not more than two pages in length; and a brief biographical sketch of the nominee.

Nominations must be sent to the chairman **no later than Dec. 31, 1993**. (Postmark on letter recommended.)

JOURNALS

Vol. 58, No. 3

E. Balas, S. Ceria and G. Cornuejols, *"A lift-and-project cutting plane algorithm for mixed 0-1 programs"*

E. Balas and M. Fischetti, *"A lifting procedure for the asymmetric traveling salesman polytope and a large new class of facets"*

L. Qi and J. Sun, *"A non-smooth version of Newton's method"*

K. Taji, M. Fukushima and T. Ibaraki, *"A globally convergent Newton method for solving strongly monotone variational inequalities"*

R.M. Freund, *"Projective transformations for interior-point algorithms, and a superlinearly convergent algorithm for the w-center problem"*

P.T. Thach, *"D.c. sets, d.c. functions and non-linear equations"*

Vol. 59, No. 1

M. Kojima, N. Megiddo and S. Mizuno, *"Theoretical convergence of large-step primal-dual interior-point algorithms for linear programming"*

S. Mizuno, R. Saigal and J.B. Orlin, *"Determination of optimal vertices from feasible solutions in unimodular linear programming"*

A.N. Iusem, *"On the convergence of iterative methods for symmetric linear complementarity problems"*

S. Dempe, *"Directional differentiability of optimal solutions under Slater's condition"*

J.A. Ventura and D.W. Hearn, *"Restricted simplicial decomposition for convex constrained problems"*

S. Chopra and M.R. Rao, *"The partition problem"*

A. Tamir, *"A strongly polynomial algorithm for mininum convex separable quadratic cost flow problems on two-terminal series-parallel networks"*

Vol. 59, No. 2

M.J. Todd, *"Combining phase I and phase II in a potential reduction algorithm for linear programming"*

Y. Ye, O. Güler, R.A. Tapia and Y. Zhang, *"A quadratically convergent O(nL)-iteration algorithm for linear programming"*

P. Gritzmann and V. Klee, *"Computational complexity of inner and outer j-radii of polytopes in finite-dimensional normed spaces"*

J.C. Bean and R.L. Smith, *"Conditions for the discovery of solution horizons"*

P. Tseng, *"Dual coordinate ascent methods for non-strictly convex minimization"*

A.S. Nowak and T.E.S. Raghavan, *"A finite-step algorithm via a bimatrix game to a single controller non-zero-sum stochastic game"*

E.R. Panier and A.L. Tits, *"On combining feasibility, descent and superlinear convergence in inequality constrained optimization"*

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W.P. Adams and H.D. Sherali, *"Mixed integer bilinear programming problems"*

C. Dang, *"The D_2-triangulation for simplicial homotopy algorithms for computing solutions of non-linear equations"*

V. Jeyakumar and X.Q. Yang, *"Convex composite multi-objective non-smooth programming"*

K. Tone, *"An active-set strategy in an interior-point method for linear programming"*

M. Kojima, S. Mizuno and A. Yoshise, *"A little theorem of the big $\mathcal{M}$ in interior-point algorithms"*

K. Murota, *"Hierarchical decomposition of symmetric discrete systems by matriod and group theories"*

L.U. Uko, *"Remarks on the generalized Newton method"*

D. Bienstock, M.X. Goemans and D. Simchi-Levi, *"A note on the prize -collecting traveling salesman problem"*

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P. Tseng and D.P. Bertsekas, *"On the convergence of the exponential multiplier method for convex programming"*

G. Cornuejols and F. Harche, *"Polyhedral study of the capacitated vehicle routing problem"*

F. Barahona, *"On cuts and matchings in planar graphs"*

J. Sun, *"A convergence proof for an affine-scaling algorithm for convex quadratic programming without non-degeneracy assumptions"*

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J.E. Martinez-Legaz and S. Romano-Rodriguez, *"Lower subdifferentiability of quadratic functions"*

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D. Siegel, *"Updating of conjugate direction matrices using members of Broyden's family"*

G. Di Pillo, L. Grippo and S. Lucidi, *"A smooth method for the finite minimax problem"*

O. Güler and Y. Ye, *"Convergence behavior of interior-point algorithms"*

J. Rohn, *"A note on solvability of a class of linear complimentarity problems"*

T.L. Magnanti, P. Mirchandani and R. Vachani, *"The convex hull of two core capacitated network design problems"*

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A.V. Karzanov and V.N. Lebedev, *"Cyclical games with prohibitions"*

J.-S. Pang and S.A. Gabriel, *"NE/SQP: A robust algorithm for the non-linear complementarity problem"*

L. Kuntz and S. Scholtes, *"Constraint qualifications in quasidifferentiable optimization"*

M.M. Kostreva and M. Wiecek, *"Linear complementarity problems and multiple objective programming"*

O.E. Flippo and A.H.G. Rinnooy Kan, *"Decomposition in general mathematical programming"*

BOOK REVIEWS

The Probabilistic Method

By N. Alon and J.H. Spencer, with an Appendix by Paul Erdös
John Wiley and Sons
1992

ISBN 0-471-53588-5

The *probabilistic method* was founded and developed by Paul Erdös. One of the main issues is to prove that certain combinatorial objects exist, by showing that the probability of their existence (in an appropriate probability space) is positive. Often, this also leads to an effective randomized algorithm to find such an object.

For example, using this method, the existence of graphs which simultaneously have a large chromatic number and a large girth is shown, and also shown are graphs with both a large clique number and a large coclique number.

Related is the work by Erdös and Alfréd Rényi studying *random graphs*, showing that a random graph with a high enough edge probability has, e.g., a perfect matching, or a Hamiltonian circuit.

This pioneering work formed the basis for a wealth of further research, extending the depth and power of the methods and detecting several important and unexpected further applications in fields such as discrete mathematics, combinatorial geometry, combinatorial optimization, algorithmics, theoretical computer science, number theory, coding, game theory and percolation. The application to theoretical computer science has raised an especially intriguing stream of questions and results.

The book, by Noga Alon and Joel Spencer, gives a splendid in-depth overview of these results. Alon and Spencer are two leaders in the field, and several of the deep results discussed in the book were obtained by the authors themselves. The book consists of 15 chapters and is divided into two parts: "Meth-

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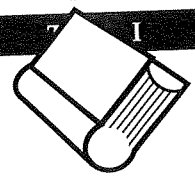


ods" and "Topics." Between any two chapters there is an intermezzo called "The Probabilistic Lens," describing a "gem" of one to two pages: an elegant and short proof of some combinatorial or other result with the probabilistic method (not always based on the previous chapter).

Part I "Methods" begins with chapters on "The Basic Method," "Linearity of Expectation," "Alterations" and "The Second Moment," introducing the basics of the probabilistic method and applying it to graph theory (e.g. coloring, tournaments, cliques and independent sets), hypergraphs, Ramsey theory, number theory and combinatorial geometry.

Chapter 5, "The Local Lemma," gives 'Lovász Local Lemma,' a very powerful tool. In its symmetric form, it states: *Let $A_1,\ldots,A_n$ be events in a probability space. Suppose that each event A_i is mutually independent of a set of all other events A_j but at most d, and that* $\Pr(A_i)$ p *for all i. If ep(d+1) 1 then* $\Pr(\wedge_{i=1}^{n}\bar{A}_i)>0$. As corollaries of the local lemma, the chapter gives theorems on hypergraphs, Ramsey numbers, covering three-space by open unit balls, the linear aboricity of graphs and Latin transversals. As the book mentions, "There is no known proof of any of these results which does not use the local lemma." Moreover, some results of Beck on converting the local lemma to an algorithmic method are described.

Following that are chapters on "Correlation Inequalities" (like the FKG-inequality), with applications to linear extensions of partially ordered sets, "Martingales," with applications to the chromatic number, and "The Poisson Paradigm" (with Jason's inequalities and Brun's sieve).

Chapter 9, "Pseudo-Randomness," then describes the results on expanders, which form building blocks in parallel sorting networks, and the "Rödl-nibble," the tool designed by V. Rödl to construct dense packing of k-cliques in an l-uniform complete hypergraph.

Part II, "Topics," starts with Chapter 10, "Random Graphs," giving bounds on the edge probability of a random graph so as to imply certain properties, such as having a subgraph of a certain kind or having a certain chromatic number. It also discusses *phase transition*, the phenomenon that a random graph on n vertices with edge probability c/n has only small components if $c<1$, but has one 'giant' component as soon as $c>1$. This phenomenon connects to percolation and to 'freezing' in mathematical physics.

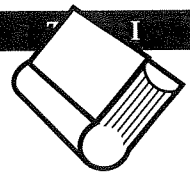
In Chapter 11, "Circuit Complexity," the famous lower bound results of A.A. Razborov for the complexity of Boolean circuits are described. They are lower bounds on the size of Boolean circuits of given depth determining e.g. whether a given graph has a perfect matching or a Hamiltonian circuit. The results belong to the few lower bounds of algorithmic complexity, and the proofs fully exploit probabilistic methods.

Chapters 12-14 discuss "Discrepancy" (including the Beck-Fiala theorem), "Geometry" (properties of points in Euclidean space, geometric realizations of sign matrices, -nets and Vapnik-Chervonenkis dimension), and "Codes and Games" (Shannon's theorem and balancing vector games).

The last chapter, "Derandomization," discusses how the randomized algorithms in some cases can be turned to an efficient deterministic algorithm, such as, for instance, finding fair partitions and good colorings.

The 'gems' include: the Erdös-Ko-Rado theorem on intersecting families of sets, Brègman's upper bound on the permanent, the number of Hamiltonian paths in a tournament, Turán's theorem, the Weierstrass approximation theorem, random walks, Sperner's theorem on maximal antichains, unbalancing lights and the efficient packing of convex bodies.

"The book is very well-written, giving clear and short arguments for well-stated theorems. It can be read and understood by those not familiar with advanced probability theory . . ."



The authors mention in the preface: "It seems impossible to write an encyclopedic book on the probabilistic method; too many recent interesting results apply probabilistic arguments, and we do not even try to mention all of them." Indeed, the field now is too much extended to overview everything happening, and the authors are to be congratulated for making such a fine selection. A topic not covered is the recent works of Dyer, Frieze, Kannan, Lovász, Szimonovits on random polynomial-time algorithms for approximating the volume of convex bodies. This might be too recent and too much in a stage of continuous refinement yet to give a balanced account.

The announcement on the cover, "with an Appendix by Paul Erdös," seems to serve promotional purposes mainly. This appendix forms a quite marginal part of the book. It consists of three pages, mentioning a few problems in Erdösian style.

The book is very well-written, giving clear and short arguments for well-stated theorems. It can be read and understood by those not familiar with advanced probability theory — wherever necessary, the book gives explanation. The book can very well serve both as a textbook in an undergraduate course or at a graduate research seminar, and as a reference work for researchers in discrete mathematics, mathematical programming and theoretical computer science.

— A. SCHRIJVER

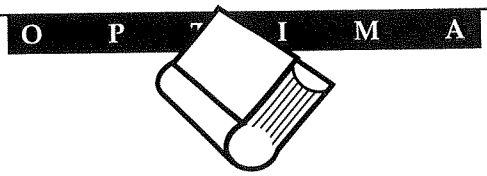
Network Models in Optimization and Their Applications in Practice

By F. Glover, D. Klingman and N.V. Phillips
Interscience Series in Discrete Mathematics and Optimization, John Wiley and Sons
1992

ISBN 0-471-57138-5

It is unlikely that the runner who brought the victory news to the ancient Athenians from Marathon used a shortest-path algorithm to plan his route! In any event, network optimization problems have been prevalent throughout time. However, it was not until the modern era of T. Koopmans and L.V. Kantorovich — in Russia and the U.S. respectively — that network optimization models were formally posed in the context of practical applications. And it was not until G.B. Dantzig's work with the simplex algorithm that theoretically sound and computationally efficient methods were developed for solving network optimization problems.

Since the early days of linear programming, the field of network optimization has developed dramatically: Network optimization algorithms are one to two orders of magnitude faster than general-purpose linear programming solvers. Several important applications have been developed for industrial, government and research settings alike. Modeling tools that ease the specification of large network models also have appeared. But it was not until the book by Glover, Klingman and Phillips appeared that one could grasp the significance of network models for practical applications. Even more importantly, however, there now is a *well-written* book to introduce students and practitioners to the art of network modeling. This reviewer, who learned network modeling by "osmosis" from some of the pioneers in this field as a graduate student, wished that this book had been written earlier.



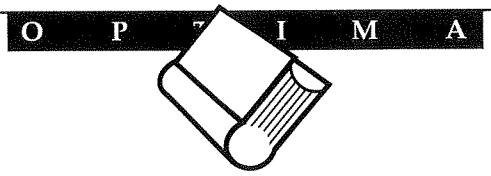
The book — as the title suggests — emphasizes modeling aspects of network optimization. The authors take a two-pronged approach that I liked. First, they discuss general principles for the design of network models. For example, how do we use multiple arcs to model a goal programming problem? How do we replicate a network to model time lags? The list of tricks the authors introduce is long, creative and — for the most part — very useful. I detected only a few contrived examples. Then, the authors present case studies of network applications in practice. These case studies illustrate the use of the general principles in specific applications of practical significance. All of the cases also could serve as excellent examples of management science/operations research applications in practice. Some very popular cases are collected in this book, including: Manpower planning for the U.S. military, product distribution planning for Citgo Petroleum Corp., W.R. Grace Co.'s problem of processing, production and distribution of chemical products and so on. Readers of this book will learn both principles of network modeling, and will enrich their understanding of real applications of network models. Most of the cases are structured in parts: This enables students to learn how to attack complex problems by breaking them into pieces. The authors have done an excellent job in transferring their collective expertise onto these pages.

"Readers of this book will learn both principles of network modeling, and will enrich their understanding of real applications of network models."

The book coins the term *netform*, meaning the network flow-based formulation, in Chapter 1 and gives a brief historical background and a preview of applications. The book does not become interesting until Chapters 2 and 3. Here, one is introduced to several variations of network models, and their algebraic and graphical descriptions. To the extent that one can be taught — instead of grow into — modeling, these two chapters achieve the goal. A complete convention for network diagrams is introduced, which influences the rest of the book, and, I suspect, will influence future developers of network models.

The remaining three chapters develop more advanced topics of network models: Chapter 4 addresses dynamic models. That is, model formulations that capture the dynamic, time-dependent behavior of a system. A typical example is the inventory model. Of course, it is assumed that all future data is known with complete certainty at the beginning of the planning horizon. This is not the authors' fault. The literature on mathematical programming usually deals with deterministic data. But this reviewer could not leave unmentioned the increasing importance of *robust optimization* models for planning under uncertainty. Nevertheless, the authors point out the importance of uncertainty in multiperiod models. Netforms provide a convenient framework within which one can identify the potential impact of uncertainty and perform post-optimality, "what-if," analysis. I suspect that pointing out this challenge will prompt further developments in how to handle uncertainty.

Chapter 5 introduces *generalized* networks, that is, networks with multipliers. This class of models is very important in practical applications. Arc multipliers can be used to model change of units (e.g. in transforming raw material into finished goods for production modeling) or gains or losses (e.g. in models of cash-flow management). Negative multipliers can be used to model the proportional use of some resources. Chapter 6 introduces network models with discrete requirements. The introduction of 0-1 variables in a network formulation, together with the use of arc multipliers, makes for a very powerful modeling tool. Applications are illustrated from flight training scheduling in the U.S. Air Force, the planning of cotton gin operations in the Rio Grande Valley and others.



There is nothing "advanced" about the coverage of these topics. They all are presented in a non-technical fashion that will not discourage novices. The authors state that no mathematical sophistication beyond college algebra is required, and they are right. But this simplicity of presentation does not take anything away from rigor.

I do not share the authors' view that this book can be used as the basis for a one-semester course. I would rather use it together with a book on network algorithms to teach both the science and the art of network optimization. This is a more likely usage of the book in most courses on network optimization that this reviewer is familiar with. I also suspect that this book will be used for its excellent case studies of mathematical programming applications, even in courses where network optimization is not the primary focus.

This book contains an impressive bibliography at the end of every chapter. The index is mediocre. The quality of the illustrations is excellent and so is the authors' sense of when to use them. One omission of the book is the treatment of nonlinearities that have extended further the applicability of network forms over the last decade. While such problems have been treated algorithmically in recent books, the authors have missed an opportunity to give us a modeling treatment as well. This, together with the cursory treatment of uncertainty, are my major complaints. Otherwise, the book coverage is extensive. I highly recommend it as a useful addition to the library of practitioners and academic modelers, and for classroom teaching in courses on network optimization. I also would encourage faculty of mathematical programming courses — in both engineering and business schools — to consider using this book for its excellent application cases.

— S. ZENIOS

Gallimaufry

OPTIMA

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The Computer Science Technical Section of ORSA awarded its 1993 prize for research excellence in the interface between operations research and computer science to **Robert Fourer, David M. Gay** and **Brian W. Kernighan** for their work on *AMPL: A Modeling Language for Mathematical Programming*. The award was made at the spring TIMS/ORSA meeting in Chicago. ¶**Panos Pardalos** has joined the ISE department, University of Florida, as Associate Professor. ¶EURO XIII will be held in Glasgow, Scotland, July 19-22, 1994. ¶Second Announcement for the 15th MPS Symposium in Ann Arbor, MI, Aug. 15-19, 1994, will be mailed in September. E-mail address is xvismp@um.cc.umich.edu. ¶**Deadline** for the next OPTIMA is Oct. 1, 1993.

Books for review should be sent to the Book Review Editor,
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