Chairman's Report to the Membership

1987 has been a busy year in the affairs of the Mathematical Programming Society. Fueling these affairs has been a continuing discussion on how to extend the interests and benefits of membership in the Society to embrace the developers and users of the models and methods of mathematical programming as well as the theoreticians, and to englobe a more thorough mix of nationalities. While this remains the goal, several steps have already been taken, most notably the reorganization of the journal and the fact that our next Symposium will be held in Tokyo.

The Journal

Beginning in 1988 the journal *Mathematical Programming* will be expanded and reorganized in two parts, *Series A* and *Series B*, and the *Studies* will be discontinued. *Series A* will carry on the function of the journal. It will be published in two volumes per year (vols. 40 and 41 in 1988) of three issues each, with each issue comprising about 120 pages and appearing every two months. Michael J. Todd will continue to be the Editor-in-Chief. Reducing the traditional journal role from three volumes back to two has seemed for some time to be a necessary step.

Series B, subsuming the function of the *Studies*, will permit the timely publication of issues focussed on particular subjects and responding to the interests of the mathematical programming community broadly conceived. It will provide a means for exploring new directions in applications and computational practice as well as theory. It will appear in one volume per year of some 520 pages (vol. 42 in 1988), printed in three issues, appearing separately throughout the year. William R. Pulleyblank will be the Editor-in-Chief. It is expected that research symposia will often serve as the foci of issues of *Series B* so special provisions have been made with the publisher that enable individual issues to be published in book form for distribution as a "proceedings" volume or in other guises for other purposes.

Every member of the Society will receive both *Series A* and *Series B*. This represents a net increase in number of pages of some 15% and is made possible by an agreement concluded with North-Holland this spring after several months of intense negotiation. The officers of the Society are

'88 Symposium Report: Mathematical Programming in Japan

In this short report, I would like to introduce some features of the Japanese Mathematical Programming community and hope it will help the '88 MPS visitors understand our state of the art.

Three Generations

Like other countries, the MP activities in Japan began as one branch of the Operations Research Society (ORSJ) which celebrated its thirtieth anniversary last year. In 1956, S. Moriguti introduced Dantzig's simplex method to Japan. Since then LP, network LP, NLP, combinatorial programming and so forth have been introduced, studied and applied extensively in our country.

In 1960, M. Iri published his original work on network flow theory. If we call Iri et al. the first generation, we have the

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satisfied that this is an excellent contract.

The membership should know that an ongoing clause stipulates that if an institutional subscription is due to the promotional efforts of the Society or one of its members then the Society enjoys a continuing bonus of 10% of North-Holland's net receipts from this subscription: so if anyone has reason to believe he or she persuaded an institution to subscribe please inform the Treasurer!

13th International Symposium-Tokyo

It was my privilege to visit Tokyo in November 1987 as Chairman of the Society, to meet there with Masao Iri, Chairman, Kaoru Tone and Hiroshi Konno, Vice-Chairmen, and the members of their Organizing Committee, and to visit the site of the Symposium, Chuo University. I was very impressed by the enthusiasm and efficient organization of the Committee, with each of the many participants assuming one or another specific responsibility. The facilities at Chuo University are excellent. All lecture halls are concentrated in one building and each is amply equipped with projectors and blackboards. If good organization, good taste and effort are any measure this Symposium will be a huge success.

The chief problem is cost due to the level of the yen. The Organizing Committee is working hard to collect extra funds but in an increasingly difficult competitive environment. They are anxious that it be remembered by all that the registration fee of Y 26 000 was worth $100 in August 1985 when it was formally decided to hold the 1988 Symposium in Tokyo, and the fee includes a book containing tutorial and survey lectures. My observation is that Tokyo hotels (with $1 worth 137 yen when I was there) are reasonable compared with hotels in the capital cities of Europe and America.

1988 Dues

The increases in dues for 1988 over 1987 are some 15% or less in all currencies except the U.S. dollar. The increase from $45 to $55 determined several months ago is an increase of 22%, this exception

obviously a result of the fall in the value of the dollar. The increases are otherwise explained by (i) an increase of 15% in the number of published pages received by members and (ii) an increase of over 25% in the fees paid to the International Statistical Institute for secretariat services. Located at the Hague, ISI's cost are in Dutch guilders and they understandably insisted on changing our contract from one defined in U.S. dollars in 1983 to the local currency.

Committees

Executive Committee. Energetically chaired by Jan Karel Lenstra since September 1986, this committee is the body that manages Society affairs according to policies set by the Council.

COAL-Committee on Algorithms. Jan Telgen, Chairman. Members: P. T. Boggs, D. M. Gay, J. K. Ho, K. L. Hoffman, R. H. F. Jackson, G. Mitra, J. B. Orlin, D. R. Rardin, K. Schittkowski, R. B. Schnabel, W. R. Stewart, P. L. Toint, S. W. Wallace.

COAL-Newsletter. Robert R. Meyer, Editor; Jens Clausen, Co-Editor.

Publications Committee. Laurence A. Wolsey, Chairman.

Symposium Advisory Committee. Martin Grötschel, Chairman.

Fulkerson Prize Committee. Manfred Padberg, Chairman, Martin Grötschel and Gian-Carlo Rota.

Dantzig Prize Committee. Olvi L. Mangasarian, Chairman, Katta Murty, George Nemhauser and Margaret Wright.

Membership Committee. Karla L. Hoffman, Chairman.

COSP-Committee on Stochastic Programming. Andras Prekopa, Chairman, John Birge, Jitka Dupacova, Juri Ermoliev, Peter Kall, Yves Smeers, Roger Wets and William Ziemba.

Orchard-Hays Prize Committee. John A. Tomlin, Chairman, Richard H. F. Jackson, Michael J. D. Powell and Michael A. Saunders.

A. W. Tucker Prize Committee. Robert G. Bland, Chairman, Hrold W. Kuhn, Alan C. Tucker and Lawrence A. Wolsey.

OPTIMA-The Mathematical Programming Society Newsletter. Donald W. Hearn, Editor, and Achim Bachem, Associate Editor.

Noteworthy Activities

To date four groups have proposed hosting and organizing the 14th International Symposium on Mathematical Programming to be held in 1991. The sites and group leaders are: (i) Amsterdam, The Netherlands, Jan Karel Lenstra, Alexander Rinnooy Kan and Lex Schrijver; (ii) Lausanne, Switzerland, Thomas M. Liebling and Dominique de Werra; (iii) Rio de Janeiro, Brazil, Celso Carneiro Ribeiro; and (iv) Stresa (close to Milano), Italy, R. Maffioli. In view of the sparse membership in South America the possibility of Rio is being postponed to some future date. A firm decision will be made in August, 1988 at Tokyo.

The Brazilians are not, however, losing any time. Ribeiro is organizing an international workshop on Mathematical Programming to be held at the Catholic University of Rio de Janeiro, October 10 to 15, 1988. This conference will undoubtedly be sponsored by the Society.

A major membership drive is about t be launched under the direction of Karla Hoffman together with a broad based international committee.

The COSP Committee is planning to organize the 5th International Conference on Stochastic Programming in Ann Arbor, Michigan in 1989.

The COAL Committee, through its Chairman, Jan Telgen, has voiced to the Executive Committee its concern about the direction in which the Society is evolving as reflected in the papers published by the journal which they view as increasingly theoretical in quality and quantity. They have in writing formally encouraged the Council to consider this view and to decide whether it wishes to do something about it.

In concluding this report I would like to encourage all members to seek to *use the Society*-their Society-to further their professional goals in ways that constructively promote the area of mathematical programming. After all, the Society exists only to serve its members, so members should be inventive in discovering needs that can be served.

Michel L. Balinski
Chairman
December 15, 1987

'88 Symposium Report

second generation represented by the studies in the complementarity and fixed point theory by M. Kojima et al. And now we have the third generation which has entered the community with the interest in Karmarkar's new LP algorithm. (It should be noted that the MP community needs young and brilliant talents to develop theory, algorithms and applications but the number of talented people are very limited and many promising fields such as computer sciences, superconductivity and biosciences are sharing them. We need new fertile subjects of interest to attract such young people. Karmarkar's method is such a rare and big chance.)

Japan Mathematical Programming Symposia

Regarding the forthcoming international Symposium, we must note the Japanese symposia held since 1980. At that time, two MP research groups — one in the Kyoto area chaired by T. Ibaraki and the other in Tokyo chaired by myself, had been organized under ORSJ. The two groups joined to hold the annual symposia of which Iri has been acting as the general chairman. The symposia usually consists of four sessions organized by invited speakers: sessions by the guest speakers, recent advances in MP, MP applications and special topics of the year.

I will list some of the titles from the programs of the last three years, not to be exhaustive, but just to show which subjects are being studied in our country:

1985 - Guests: Preprocessing of mixed integer programming problems (E. L. Johnson), On parallel processors design for solving stochastic programs (R. Wets)
Advances in MP: Trust region in unconstrained optimization (Yamashita), An algorithm to compute a sparse basis of the null space (Kaneko), Solution methods for variational inequalities (Fukushima), A Multiplicative penalty function method for LP (Iri and Imai)
Applications: LP applied to the planning of raw material purchasing (Hanai), Applications of optimization methods to satellite communication systems for effective use of orbit and frequency spectrum (Mizuike and Ito), Production

planning software for wide variety of products in polymer processes (Shikakura)
Polynomial Order Algorithms: Recent topics on minimum cost flow algorithms (Fujishige), Geometric search algorithms and their applications (Asano), A hybrid method for LP (Tone), Notes on improvements of Karmarkar's algorithm (Kojima)
1986-Guests: Pathways to the optimal set in LP (N. Megiddo), A class of algorithms for sequential and parallel solution of algebraic linear and nonlinear systems (E. Spedicato), **Applications:** House reapportionment (Kosiyama and Ichimori), Monthly production scheduling of passenger cars (Ueda), Analysis and evaluation of human knowledge of power system operation (Komai and Sakaguchi), Today and tomorrow of Toyota production system (Kimura)
Production Control and Scheduling: Scheduling in Toyota production system (Kotani), Recent topics on scheduling algorithms (Kawaguchi and Kyan), A shortest path problem with visiting order constraints (Suzuki and Nomura)
Advances in MP: Methods of fast automatic differentiation and applications (Iri and Kubota), The revised Karmarkar algorithm and its computational experiments (Kojima and Tone), Strong unimodularity for matrices and hypergraphs (Ibaraki et al.)
1987-Guests: Notes on defining proportionality between matrices (M. L. Balinski and D. Demange), Optimization problem in electric power system (Aoki)
Computers and MP: ID based cryptsystem (Tsujii et al.), On message complexities of distributed algorithms (Hagihara), Area-efficient drawings of rectangular dual graphs for VLSI floor-plan (Tani et al.)
Applications: New production & material flow control system in steel work (Ueno et al.), The production system of MAZDA (Sasaki), Practical reactive power allocation/operation planning using successive LP (Suzuki et al.)
Advances in MP: Centered Newton method for LP and QP (Tanabe), Stationary point problems and a path-following algorithm (Yamamoto), Sparsity and block-triangulation (Murota), Nondifferentiable programming and semi-infinite programming (Kawasaki)

Who's Who Around Tokyo

The 13th International Symposium on MP will be held at Chuo University in the center of Tokyo. The organizing committee consists of faculties belonging to several universities and institutes around Tokyo. I will list their fields of interest so that visitors can identify those sharing the same interest.

University of Tokyo

M. Iri	Computational aspects of MP, applications of matroids, combinatorial optimization and algorithms, computational geometry.
K. Murota	Combinatorial optimization, numerical analysis.
K. Sugihara	Computational geometry, combinatorial optimization, solid modelling, computer graphics.

Tokyo Institute of Technology

K. Fukuda	Matroid theory, combinatorial optimization.
M. Kojima	LP, NLP, fixed point theory, stability and sensitivity analysis.
H. Konno	IP, nonconvex optimization, optimization in finance & investment.
S. Mizuno	New methods of LP, numerical analysis.
U. Suzuki	Applications of combinatorial optimization.

University of Tsukuba

S. Fujishige	Combinatorial optimization, networks, matroids and submodular functions.
Y. Yamamoto	Fixed point algorithms, stationary point problems.

Saitama University

T. Kobayashi	Network programming.
T. Oyama	Apportionment problem, combinatorial optimization, network optimization.
K. Tone	LP, NLP, semi-infinite programming, application of MP.

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Hitotsubashi University
I. Kaneko   Decision making models, networks and networking.

Sophia University
T. Asano   Computational geometry, combinatorial optimization.
S. Suzuki   MP and its applications, queue network theory, approximation theory.

Keio University
M. Ozawa   numerical analysis, scheduling.

Waseda University
S. Morito   Interface between mathematical scheduling theory and practical shop management.

Science University of Tokyo
R. Hirabayashi   NLP, IP.
H. Yabe   NLP, nonlinear least squares.

Chuo University
S. Shinoda   Network optimization, combinatorial optimization, applications to communication systems.

Bunkyo University
R. Manabe   Network programming, applications in industry.

The Institute of Statistical Mathematics
K. Tanabe   NLP, interior point method for LP from the point of view of the Newton method.
T. Tsuchiya   NLP, LP, automatic differentiation.

Central Research Institute of Electric Power Industry
T. Ohya   Computational geometry, MP in electric power industry.

A Welcome

Will you find interest in MP activities in Japan? From my very personal point of view, there is definite interest because MP is gradually becoming the method of choice for promoting the efficiency of our industries even though they are not completely aware of the fact. With the limited growth rate in recent days, what else can better plan their efficiency? The industries include not only manufacturing but also services, marketing and finance, reflecting the shift to so-called soft engineering in the Japanese economy.

Although I introduced only a part of MP activities in our country, you are sure to see many interesting people from the four islands of Japan, all of whom welcome you enthusiastically.

Looking forward to seeing you soon in Tokyo!   –K. Tone

Daily Expenses for Meals and Local Transportation in Tokyo

The 13th International Symposium on Mathematical Programming will be held August 29-September 2, 1988, in Tokyo. However, it seems that the recent high rate of exchange of Japanese Yen may cause foreigners to hesitate to visit Japan. In response to the Editor's request, I will try to describe how much our daily life costs in Tokyo.

Costs of meals span a wide range, from inexpensive to very very expensive. In general, Japanese restaurants present in their show windows samples of dishes together with their prices. Restaurants without such samples are usually very expensive. Restaurants in hotels are also relatively expensive. We can find less expensive restaurants in almost every part of Tokyo.

Many coffee shops set "morning-serve" time typically from 8:00 to 10:00, during which breakfast including bread, eggs, vegetables and coffee, for example, is offered for 400 - 500 Yen. Many restaurants set "lunch-service" time typically from 11:30 to 13:30 or 14:00, during which lunch is offered for 500 - 1,200 Yen. At lunch-service time, restaurants with high rank also offer less-expensive dishes, so that we can enjoy them at relatively low cost. The restaurant in Chuo University, where the Symposium will take place, also offers lunches around 500 Yen.

For dinners there is no special "service time". We can usually have dinners for 800 - 2,000 Yen.

Dishes with the above prices can be found without any special effort. For those who want to save more, we have many shops for fast food such as hamburgers and fried chicken, coin machines for canned coffee, and supermarkets.

As for local transportation, subway lines are in general most convenient. The central part of Tokyo is covered with a dense, and a little complicated, network of subway lines, so that we can move from one place to another only by subways. There are several busy centers in central Tokyo; for example Akasaka, Shinjuku, Shibuya, Ikebukuro, and Ueno. These centers are interconnected by subway lines, and we can move between them for 120 or 140 Yen. JR line and many other private lines connect the central part of Tokyo and the suburbs, and an hour trip from central Tokyo costs about 500 - 1,000 Yen. In general the JR line is more expensive than other private lines.

The daily rate of hotels reserved for the meeting range from 5,900 to 20,000 Yen. For details refer to the 2nd announcement for the 13th International Symposium on Mathematical Programming, which will be sent to you if you contact:

Organizing Committee for the 13th International Symposium on Mathematical Programming
c/o The Operations Research Society of Japan
Gakkai-Center Bldg.
2-4-16 Yayoi, Bunkyo-ku
Tokyo 113
JAPAN

(Editor's Note: On January 14, 1988 the exchange rate was 126.2 Yen per US dollar.)
     –K. Sugihara

Conference Notes   *Call for Papers*

Optimization Days 1988
May 2, 3, 4, 1988
Montreal University Campus

Abstract, including authors' names and affiliations, should be limited to one page $8^1/_2$ x 11 and submitted no later than January 31, 1988. Contact: Professor Jacques A. Ferland, Dept. I.R.O., Université de Montréal, C.P. 6128, Succ A, Montréal (Québec) H3C 3J7, Canada.

–J. Ferland

Conference on Matrix Spectral Inequalities
The Johns Hopkins University, Baltimore, Maryland
June 20-24, 1988

The principal lecturer, Robert C. Thompson, will give 10 lectures on inequalities for eigenvalues, singular values, and invariant factors with applications to control theory and functional analysis. Apply now, but not later than April 8, 1988, to ensure consideration for on-campus housing and financial support. Contact: Roger Horn, Department of Mathematical Sciences, The Johns Hopkins University, Baltimore, Maryland 21218. MSC_HRAH@JHUVMS

Tenth Symposium on Mathematical Programming with Data Perturbations
May 26-27, 1988

A Tenth Symposium on Mathematical Programming with Data Perturbations will be held at The George Washington University's Marvin Center on May 26-27, 1988. This symposium is designed to bring together practitioners who use mathematical programming optimization models and deal with questions of sensitivity analysis, with researchers who are developing

techniques applicable to these problems. CONTRIBUTED papers in mathematical programming are solicited in the following areas:
(1) Sensitivity and stability analysis results and their applications.
(2) Solution methods for problems involving implicitly defined problem functions.
(3) Solution methods for problems involving deterministic or stochastic parameter changes.
(4) Solution approximation techniques and error analysis.

CLINICAL" presentations that describe problems in sensitivity or stability analysis encountered in applications are also invited.

ABSTRACTS of papers intended for presentation at the Symposium should be sent in triplicate to Professor Anthony V. Fiacco. Abstracts should provide a good technical summary of key results, avoid the use of mathematical symbols and references, not exceed 500 words, and include a title and the name and full mailing address of each author. The deadline for submission of abstracts is March 11, 1988.

APPROXIMATELY 30 minutes will be allocated for the presentation of each paper. A blackboard and overhead projector will be available.

Sponsored by: the Department of Operations Research and the Institute for Management Science and Engineering, School of Engineering and Applied Science, The George Washington University, Washington, DC 20052. Phone: (202) 994-7511.

International Meeting on Parallel Computing Methods, Algorithms, Applications
September 28th-30th, 1988- Verona (ITALY)

The meeting will be held at Verona University. The invited speakers are: D. Bini (Italia), C. Canuto (Italia), M. Cosnard (Francia), L. C. W. Dixon (Inghilterra), J.

Dongarra (U.S.A.), I. Duff (Inghilterra), D. J. Evans (Inghilterra), I. Galligani (Italia), L. Grandinetti (Italia), D. Parkinson (Inghilterra), A. Quarteroni (Italia), G. Radicati (Italia), R. Rossi (Italia), U. Schendel (Germania), F. Sloboda (Cecoslovacchia), F. Zirilli (Italia).

The main topics of the conference are: Linear Algebra, Mathematical Programming and Optimization, and Differential Equations.

The Organizing Committee is the following: L. C. W. Dixon, I. Galligani, L. Grandinetti, C. Nodari Sutti, D. Parkinson, G. Radicati, R. Rossi.

Information requests and application forms are to be addressed to:
Segreteria Convegni
c/o Istituto di Matematica
Via dell'Artigliere, 19
37129 Verona (ITALY)
Tel. + 39 45 8098216

A Call for Papers

The Canadian Journal of Administrative Sciences is a multidisciplinary journal published by the Administrative Sciences Association of Canada. This journal is regarded as one of the best of its kind among the multidisciplinary journals in North America.

The editor, Professor Jean-Charles Chebat, welcomes research articles on **Management Science**. Please forward your papers addressed as follows:

Professor Jean-Charles Chebat
CANADIAN JOURNAL OF ADMINISTRATIVE SCIENCES
P. O. Box 8888, Station A
Montreal, Quebec
H3C 3P8

The area editor in Management Science is Dr. Carl-Louis Sandblom, Technical University of Nova Scotia.

There are no specific topics. Papers are evaluated on an anonymous basis. The rate of acceptance is approximately 1 out of 5.

❧ *Technical Reports & Working Papers*

Cornell University
School of Operations Research
and Industrial Engineering
Upson Hall
Ithaca, NY 14853

M. Phelan, *"Some Problems of Estimation from Poisson Type Counting Processes,"* TR 718.

Y. Herer, *"Buffer Placement in Sequential Production Lines: Still Further Studies,"* TR 719.

M. Todd, *"Exploiting Special Structure in Karmarkar's Linear Programming Algorithm,"* TR 720.

M. Todd, *"Improved Bounds and Containing Ellipsoids in Karmarkar's Linear Programming Algorithm,"* TR 721.

D. Heath and R. Kertz, *"Leaving An Interval in Limited Playing Time,"* TR 722.

D. Heath and W. Sudderth, *"Coherent Inference from Improper Priors and from Finitely Additive Priors,"* TR 723.

M. Hartmann, *"A Note on the Tail Distribution of the Accumulated Value of an Additive Functional of an Irreducible Markov Chain,"* TR 724.

J. Mitchell and M. Todd, *"On the Relationship Between the Search Directions in the Affine and Projective Variants of Karmarkar's Linear Programming Algorithm,"* TR 725.

R. Bland and B. Dietrich, *"A Unified Interpretation of Several Combinatorial Dualities,"* TR 726.

G.A.P. Kindervater and J.K. Lenstra, *"Parallel Computing in Combinatorial Optimization,"* TR 727.

R. Bechhofer and C. Dunnett, *"Subset Selection for Normal Means in Multi-Factor Experiments,"* TR 728.

H. Kaspi, *"Random Time Changes for Processes with Random Birth and Death,"* TR 729.

R. Bland and D. Shallcross, *"Large Traveling Salesman Problems Arising from Experiments in X-Ray Crystallography: A Preliminary Report on Computation,"* TR 730.

D. Joneja, *"Multi-echelon and Joint Replenishment Production and Distribution Systems with Nonstationary Demands,"* TR 731.

R. Bland and D. Jensen, *"Weakly Oriented Matroids,"* TR 732.

R. Bland and D. Cho, *"Balancing Configurations in R^4 by Reflection of Points,"* TR 733.

P. Jackson, C. Jones and J. Muckstadt, *"A Framework for a Computer Aided Logistics System,"* TR 734.

P. Jackson, C. Jones and J. Muckstadt, *"The COSMOS Scheduler,"* TR 735.

J. F. Claver and P.L. Jackson, *"Lot Sizing in Cyclic Scheduling,"* TR 736.

L. Trotter and D. Crystal, *"On Abstract Integral Dependence,"* TR 737.

M. Phelan and N.U. Prabhu, *"Estimation from an Infinite Server Queueing System with Two Demands,"* TR 738.

J.S. Mitchell, *"Shortest Rectilinear Paths Among Obstacles,"* TR 739.

E. Yucesan and L. Schruben, *"Transaction Tagging in Highly Congested Simulation Models,"* TR 740.

J. Mitchell and M.J. Todd, *"Two Variants of Karmarkar's Linear Programming Algorithm for Problems with Some Unrestricted Variables,"* TR 741.

R. Bland, *"Combinatorial Perspectives on Linear Programming, Part I: Linear Programming Duality and Minty's Lemma,"* TR 742.

L. Trotter and S. Tipnis, *"A Generality of Robacker's Theorem,"* TR 743.

R. Bechhofer and D. Goldsman, *"Truncation of the Bechhofer-Kiefer-Sobel Sequential Procedure for Selecting the Normal Population which has the Largest Mean,"* TR 744.

R. Bechhofer, C. Dunnett and A. Tamhane, *"Optimal Allocation of Observations in Subset Selection and Multiple Comparisons with a Control, and Associated Tables (with Application to Drug Screening),"* TR 745.

E. Arkin and J.S. Mitchell, *"An Optimal Visibility Algorithm for a Simple Polygon with Star-Shaped Holes,"* TR 746.

B. Fox, *"Gradient Computation for Transient Markov Chains,"* TR 747.

J. Renegar, *"On the Worst Case Arithmetic Complexity of Approximating Zeros of Systems of Polynomials,"* TR 748.

N.U. Prabhu, *"A Theory of Semi-regenerative Phenomena,"* TR 749.

R. Freund, *"An Analogue of Karmarkar's Algorithm for Inequality Constrained Linear Programs, with a "New" Class of Projective Transformations for Centering a Polytope,"* TR 750.

R.O. Roundy, *"Computing Nested Reorder Intervals for Multi-Item Distribution Systems,"* TR 751.

P.L. Jackson, C. Jones and J. Muckstadt, *"COSMOS-The Cornell Simulator of Manufacturing Operations,"* TR 752.

B. Fox, *"Complexity of Gradient Estimation for Transient Markov Chains,"* TR 753.

R. Barton, *"Testing Strategies for Simulation Optimization,"* TR 754.

B. Fox, *"Computing the Gradient of Expected Reward Up to Absorption,"* TR 755.

University of Maryland at College Park
College of Business and Management
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B. Golden and E. Wasil, *"Ranking Outstanding Sports Records,"* WP87-001.

M. Ball and M. Magazine, *"Sequencing of Insertions in Printed Circuit Board Assembly,"* WP87-002.

L. Bodin and D. Salamone, *"The Development of a Microcomputer Based System for Vehicle Routing and Its Use for Solving Spatial and Temporal Problems,"* WP87-003.

B. Golden, Q. Wang and L. Liu, *"A Multi-Faceted Heuristic for the Orienteering Problem,"* WP87-006.

C. Skiscim and B. Golden, "*Solving k-Shortest and Constrained Shortest Path Problems Efficiently,*" WP87-009.

A. Assad, "*History of Operations Research: Some Anticipatory Thoughts,*" WP87-010.

R. Dahl, K. Keating and L. Levy, "*WHAMII: An Enumeration and Insertion Procedure with Binomial Bounds for the Stochastic Time-Constrained Traveling Salesman Problem,*" WP87-012.

R. Vohra and B. Golden, "*Finding the Most Vital Arcs in a Network,*" WP87-016.

S. Gass, "*Operations Research - Supporting Decisions Around the World,*" WP87-017.

M. Ball and H. Benoit-Thompson, "*A Lagrangian Relaxation Based Heuristic for the Urban Transit Crew Scheduling Problem,*" WP87-019.

A. Assad and C. Skiscim, "*The Maximal Covering Location Problem and Dual Ascent,*" WP87-020.

M. Ball, L. Liu and W. Pulleyblank, "*Two Terminal Steiner Tree Polyhedra,*" WP87-021.

D. Casco, B. Golden and E. Wasil, "*Vehicle Routing with Backhauls,*" WP87-023.

M. Ball, U. Derigs and C. Hilbrand, "*Matching Problems with Generalized Upper Bound Side Constraints,*" WP87-026.

N. Collins, R. Eglese and B. Golden, "*Simulated Annealing - An Annotated Bibliography,*" WP87-028.

Systems Optimization Laboratory
Department of Operations Research
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Stanford, CA 94305-4022

B. C. Eaves and U. G. Rothblum, "*Invariant Polynomial Curves of Piecewise Linear Maps,*" SOL 86-13.

B. C. Eaves and U. G. Rothblum, "*A Flexible Manufacturing and Operator Scheduling Model Solved by Deconvexification Over Time,*" SOL 86-14.

B. C. Eaves, "*Thoughts on Computing Market Equilibrium with SLCP,*" SOL 86-15.

G. B. Dantzig, P. H. McAllister and J. C. Stone, "*Using the PILOT Model to Study the Effects of Technical Change,*" SOL 86-16.

G. B. Dantzig, "*Planning Under Uncertainty Using Parallel Computing,*" SOL 87-1.

G. B. Dantzig and J. A. Tomlin, "*E.M.L. BEALE, FRS: Friend and Colleague,*" SOL 87-2.

K. A. E. Ercikan and F. S. Hillier, "*Heuristic Procedures for 0-1 Integer Programming,*" SOL 87-3.

I. J. Lustig, "*The Equivalence of Dantzig's Self-Dual Parametric Algorithm for Linear Programs to Lemke's Algorithm for Linear Complementarity Problems Applied to Linear Programs,*" SOL 87-4.

G. B. Dantzig, "*Origins of the Simplex Method,*" SOL 87-5.

K. Zikan and R. W. Cottle, "*The Box Method for Linear Programming: Part I-Basic Theory,*" SOL 87-6.

R. Entriken, "*Using MINOS as a Subroutine for Decomposition,*" SOL 87-7.

I. J. Lustig, "*Comparisons of Composite Simplex Algorithms,*" SOL 87-8.

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C. Fraley, "*Computational Behavior of Gauss-Newton Methods,*" SOL 87-10.

I. J. Lustig, "*An Analysis of an Available Set of Linear Programming Test Problems,*" SOL 87-11.

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Y. Yinyu, "*Eliminating Columns in the Simplex Method for Linear Programming,*" SOL 87-14.

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J. Reneger, "*Rudiments of an Average Case Complexity Theory for Piecewise-Linear Path Following Algorithms.*"

F. Glover and D. Klingman, "*Layering Strategies for Creating Exploitable Structure in Linear and Integer Programs.*"

D. Goldfarb and S. Mehrotra, "*A Relaxed Version of Karmarkar's Method.*"

A.J. Hoffman, "*On Greedy Algorithms for Series Parallel Graphs.*"

G.G.L. Meyer, "*Convergence of Relaxation Algorithms by Averaging.*"

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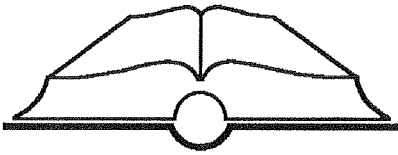
BOOK REVIEWS

Matching Theory

By L. Lovasz and M. D. Plummer
Annals of Discrete Mathematics 29
North-Holland, Amsterdam, 1986
ISBN 0-444-87916-1

Today, combinatorial optimization is considered to be one of the "hot fields" within mathematics. Publication rates almost explode, keeping the scientists of that field in a permanent hurry, which quite often results in a considerable decrease of quality and/or clarity of presentation in publications. From this point of view, *Matching Theory* by L. Lovasz and M. D. Plummer appears to be written outside of time. Everything is developed with splendid clarity, organized in a masterful way and written in an excellent style, sometimes exciting, sometimes humorous, always maintaining lively dialogue with the reader.

This beautiful book (in fact the first that has ever been written on Matching Theory) provides a comprehensive treatment of the subject, leading up to the frontiers of current research. (Unfortunately, however, the recent results of the first author about matching lattices were obtained shortly after completion of the volume and hence do not appear in this book, while the main tools for obtaining them, i.e. ear- and brick decomposition, can already be found there).

The introduction provides an interesting account of the history of matching theory, starting with the "Founders of the discipline", J. Petersen and D. König. The book itself is divided into 12 chapters: 1-Bipartite matching, 2-Flow theory, 3-Size and structure of maximum matchings, 4-and 5-Bipartite (general) graphs with perfect matchings, 6-Some graph theoretical problems related to matchings, 7-Matching and linear programming, 8-Determinants and matchings, 9-Matching algorithms, 10-The f-factor problem, 11-Matroid matching, and 12-Vertex packing and covering.

The authors concentrate on structural problems and polynomial solvability. Consequently, nothing is said about implementational aspects or parallel complexity of the matching problem (although probabilistic methods are sketched in chapter 8. On the other hand, several cross connections to related subjects are at least outlined whenever this seems to be worthwhile to do. So, in fact, one can learn somewhat more than just matching theory from this book. (For example, you will probably be surprised that matchings may be used for proving the existence of Haar measure on compact topological groups, to mention one of the more "exotic" applications). Whenever a general idea originating in a different field is used somewhere, this is explained afterwards. For this purpose, a set of "boxes" has been included, containing some relevant material from other fields (e.g. complexity theory, matroid theory etc.) in a condensed manner. These may easily be skipped by the reader with more background information - a good idea!

Summarizing, this book provides an excellent introduction to Matching Theory. It may well serve as a textbook for students, but it contains some interesting material for experts as well. The list of references given at the end contains about 500 entries. However, as has been mentioned in the introduction of this review, this is, of course, far from being complete and a more extensive bibliography has been announced by the authors.

–W. Kern

Algorithmic Graph Theory

By Alan Gibbons
Cambridge University Press, Cambridge, 1985
ISBN 0-521-28881-9

It is my feeling that there will be never enough books on graph theory and their applications. Indeed, the whole field is diverse and does not form a "theory" in the classical sense. Moreover, due to the steady flow of new ideas from other fields and praxis, graph theory is a rapidly changing subject.

This book centers on the algorithmic aspects of graphs. This is not a novel approach as there are several books with more or less the same orientation. Yet this book brings something new: it presents a very balanced introductory text which stresses the algorithmic and complexity aspects.

The organization of the material is mainly traditional as indicated by headings of Chapters:
1. Introducing graphs and algorithmic complexity; 2. Spanning trees, branchings and connectivity; 3. Planar graphs; 4. Network and flows; 5. Matchings; 6. Eulerian and Hamiltonian tours; 7. Colouring graphs; 8. Graph problems and intractability; Appendix: On linear programming.

However the contents are less traditional and let us list several particulars: Chapter 1 contains a nice discussion of the depth first searching of graphs; Chapter 2 covers not only spanning trees but also optimum branchings; Chapter 4 on network flows covers the minimum - cost flow algorithm; Chapter 5 has maximum weighted matching in general graphs; Chapter 6 discusses the Chinese postman problem; Chapter 8 contains several NP - complete results including the recent Holyer result on factorization of cubical graphs.

Nearly each chapter contains a proof of a deeper result sometimes unexpected for a text of this size (to name just a few examples: Kuratowski's theorem, Cook's theorem, and non-bipartite weighted matching).

I think that the text is a useful addition to the existing literature. It is worthwhile as an introductory text for undergraduate and early graduate students of both mathematics and computer science.

–J. Nesetril

The Travelling Salesman Problem
By E. L. Lawler et. al.
Wiley, Chichester, 1985
ISBN 0-471-90413-9

Combinatorial optimization is coming of age, in fact
1) there has been an impressive growth in its body of knowledge and applications since the first pioneering results became known some thirty years ago; also, the field is attracting more and more researchers: the handful of friends that started it has meanwhile become a sizeable community spread over the whole world;
2) it is providing a common ground for research in all kinds of disciplines such as physics, economics, engineering, computer science, etc.
3) there is an increasing unification and standardization in its terminology and notation, enhanced by the ever growing number of high standard specialized journals;
4) last but not least, note that of late, several outstanding textbooks (the above being an excellent case in point) are giving a wider public access to combinatorial optimization.

The book on the TSP, edited by Lawler, Lenstra, Rinnooy Kan and Shmoys is a delight to read. It claims to be a guided tour of combinatorial optimization, but it really is much more than just that. It is a full grown textbook for the beginner as well as a source of inspiration and reference for the more advanced reader. Not only does it reflect the coming of age of combinatorial optimization, but also the vitality of this discipline with its wealth of challenging old and new open problems.

One of the achievements of the book, only partially explained by item 3) above, is its high degree of "unité de doctrine". Indeed, the book is not a mere collection of surveys, but a well structured, balanced and largely self-contained treatise of some of the major results in combinatorial optimization, sewn together by the travelling salesman's thread.

Yet, the book certainly does not mark the end of the travelling salesman's journey, insofar as more and more of its hidden facets are being discovered by the day. Also, the state of the art regarding the exact solution as well as heuristics has not stood still since the publishing of the book. See, e.g. Padberg/Rinaldi's Branch & Cut code solving a TSP problem with 2392 cities to optimality, or the not quite as spectacular, nevertheless efficient, simulated annealing heuristics.

As will be seen in the list of contents given below, the contributors to the book are some of the most respected and articulate researchers in the field. The editors may be congratulated for their good taste. Moreover, the book has quite certainly profited from the action of the editors' invisible warning finger. Its chapters overlap just enough to add to its coherence, without making it tedious by unnecessary repetitions. Also, and quite unusually, the reader is not unduly irritated or even frustrated by the authors inviting her to fill in "obvious" details that were left out.

Contents:
1. **History, by A. J. Hoffman and P. Wolfe**: A sketch of the history of the TSP from Euler, Kirkman and Hamilton to present times. The TSP is convincingly argued to be a deep problem, by noting e.g. that several methods that shaped mathematical programming, were actually devised in order to tackle it.
2. **Motivation and modeling, by R. S. Garfinkel**: Or, how to cut wallpaper such that patterns match and waste is minimized, as well as many other problems modeled by the TSP.
3. **Computational complexity, by D. S. Johnson and C. H. Papadimitriou**: A remarkable introduction to the general topic of complexity theory and the analysis of algorithms, going well beyond the TSP, introducing P, NP and NP-completeness proof techniques.
4. **Well-solved special cases, by P. C. Gilmore, E. L. Lawler and D. B. Shmoys**: The bright side of TSP: nontrivial special cases that can be solved efficiently, alas a slowly growing class.
5. **Performance guarantees for heuristics, by D. S. Johnson and C. H. Papadimitriou**: A continuation of chapter 3, with the complexity and worst case performance analysis of several heuristics based on various relaxations of the TSP.
6. **Probabilistic analysis of heuristics, by R. M. Karp and J. M. Steele**: "The length of the shortest tour connecting a cloud of random points on the unit square tends to behave a.s. like a deterministic function proportional to the square root of the number of points, as this number

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gets large enough". This classic result by Beardwood et al. leads to an efficient heuristic for the Euclidean TSP. A result of a similar flavour by Walkup is used to analyze a patching algorithm for the asymmetric TSP with uniformly i.i.d. data.

7. Empirical analysis of heuristics, by B. L. Golden and W. R. Stewart: A description and a statistical performance analysis of various heuristics. Estimating a confidence interval for the value of the optimal solution of the TSP based on outputs from heuristics.

8. Polyhedral theory, by M. Grötschel and M. W. Padberg: A lucid and self contained introduction to polyhedral theory in general and to what is known thanks to the authors concerning the TSP in particular.

9. Polyhedral computations, by M. W. Padberg and M. Grötschel: A review of the equivalence of a "good characterization" of the convex hull of a discrete optimization problem and the existence of an efficient algorithm to solve it, with a proof based on the ellipsoid method. How to efficiently identify certain violated constraints (facets) of the convex hull of the TSP. Finally a report on remarkable computational experiences using these inequalities in conjunction with branch and bound codes.

10. Branch and bound methods, by E. Balas and P. Toth: A general introduction to Branch and Bound, a method whose co-fatherhood could rightly be claimed by the first author. A review of the various possible relaxations in conjunction with the TSP. Performance of their and others' state-of-the-art computer codes.

11. Hamiltonian cycles, by V. Chvàtal: "This is a biased exposition, meant to introduce the reader to Hamiltonian graphs rather than to provide an extensive survey of their theory" (quotation from the conclusion of this chapter and an understatement). A very stimulating essay, showing that recognizing Hamiltonian graphs can be tough.

12. Vehicle routing, by N. Chistofides: A review of models and heuristics for this important extension of the TSP.

Bibliography: Comprising over 400 items ranging from Adrabinski to Zanakis.

In summary: Buy the book, you won't regret it!

–Th. M. Liebling

STORM: Quantitative Modelling for Decision Support

By H. Emmons, A. D. Flowers, K. Marthn, C. M. Khot
ISBN 0-8162-2900-7

What's Best!: Decision Support Software from Holden-Day

By S. L. Savage
Holden Day, Oakland, 1986
ISBN 0-8162-3233-4

In recent years personal computers have undergone a rapid improvement of storage and speed. This development has prompted attempts to write Operations Research software for this class of computers. These programs can serve two purposes. First it makes Operations Research available to smaller firms and/or quick decisions. For instance a controller might set up a small linear program to analyse a certain situation (this is practised e.g. in a special course at the Controller Akademie in Ganting, W. Germany). Secondly it might be advantageous to use Operations Research software in an introductory (or advanced) university course on the topic. This could make the tedious "m=3-n=4 -L.P- by-hand-solving" obsolete. Here we review two of these products. "Storm" seems to be better suited for the latter purpose. It is a program package containing all the Operations Research models we learn about in a beginner's Operations Research course. For a practitioner it might be a little bit too much and a little bit too academic. The topics which can be treated are:

1)   Linear Programming (including sensitivity analysis and parametric programming)

2)   The Assignment Problem (solved by the Hungarian method)

3)   The Transportation Problem (solved by a network simplex method; a capacitated version and one with bounds on supply and demand are included)

4)   Queueing Analysis ((M/M/C), (M/D/C), (M/G/C), (M/M/C/K), (M/M/C/K/K))

5)   Project Management (CPM/PERT)

6)   Inventory Management (based on the EOQ-model and its extension)

7) Facility Layout (this is certainly not necessary for quick decision making!)
8) Assembly Line Balancing
9) Investment Analysis
10) Forecasting
11) Production Scheduling
12) Material Requirements Planning
13) Regressions Analysis

Even though this list reads like the contents of an Operations Research textbook, the authors have not been able to agree on a single reference for a single chapter in the manual (e.g. for two different queueing models they quote two different sources).

While "Storm" is mainly a collection of Operations Research programs which run on a PC, "What's best!" is especially designed to be used on and with a PC. "What's best!" can solely solve linear programs. However it seems to me to be made mostly for use in business decisions. Its connection with the Lotus 1-2-3 spreadsheet concept seems to enhance creating programs out of available data. "What's best!" can be a powerful tool.

Overall it can be hoped that software systems like the two reviewed above will increase the importance of Operations Research concepts for middle sized firms.

–M. Leclerc

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Gallimaufry

The 1986 Lanchester Prize was awarded to **Alexander Schrijver** (Tilberg) and **Peter Whittle** (Cambridge) at the ORSA/TIMS meeting in St. Louis. Schrijver received the prize for his research monograph *Theory of Linear and Integer Programming* and Whittle for the monograph *Systems in Stochastic Equilibrium.* Both monographs were published by Wiley in 1986...At the same meeting **George Nemhauser** (Georgia Tech) gave the plenary address and was given an honorary membership in Omega Rho...**Jean-Louis Goffin** (McGill) is on sabbatical at CORE, University Catholique de Louvain in Belgium...**James Ho** (Tennessee) is visiting the OR Department at Stanford during Spring, 1988...**Siriphong ("Toi") Lawphongpanich** has joined the OR Department at the Naval Postgraduate School as an assistant professor.

Deadline for the next **O P T I M A** is June 1, 1988.

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