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of the INFORMS Computing Society

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Intelligent Mathematical Programming Software: Past, Present, and Future

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Introduction

The practice of mathematical programming has been profoundly affected in recent years by two key trends: the proliferation of powerful and inexpensive computing platforms, and greatly improved solution algorithms. These trends allow experienced mathematical programmers to solve models of much greater scale and complexity than previously possible. But at the same time, these trends have introduced a host of novices to mathematical programming, notably by the solvers embedded in popular spreadsheet software.

From expert to novice, the bottleneck in the mathematical programming process is often not

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Important Notice: The ballot for election of ICS officers is enclosed in this newsletter. Be sure to fill it out and submit it promptly. Election results will be announced at the May meeting in Cincinnati and new officers will assume their offices at that time.

The Institute for Operations Research and the Management Sciences' Computing Society Newsletter

Volume 20, Number 1, Spring 1999

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The ICS Newsletter is published semiannually on April 1st and October 1st by the INFORMS Computing Society (ICS). Manuscripts, news articles, camera-ready advertisement and correspondence should be addressed to the Editor. Manuscripts submitted for publication will be reviewed and should be received by the Editor three months prior to the publication date. Requests for ICS membership information, orders for back issues of this Newsletter, and address changes should be addressed to:

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Message from the Editors

S. Raghavan (U of Maryland)
Tom Wiggen (U of North Dakota)

We are pleased to bring you this issue of the ICS newsletter. You may have noticed a new logo in the upper left corner of the cover. That's the design we chose as the winner of our logo contest announced last fall.

The winning design for our new ICS logo is the creation of **Manuel Laguna**. Manuel wins our logo design prize, a free registration at a future INFORMS meeting.

Altogether, logo contest entries were submitted by five ICS members. Here's a summary of the other designs submitted.

Peter Geddes sent us the design on the left. He actually sent three slightly different variations of this design. The design makes nice use of color (red, white and blue) which you are, unfortunately, not able to appreciate in this monochrome newsletter.

John Chinneck sent us the sketch on the left as his ICS logo concept. It has a background field of zeros and ones, with the letters I, C and S built from the arcs and lines of those digits.

The next entry (on the left), is one of the design variations we received from **Jeffery P. DeLooze**. The INFORMS logo is displayed prominently at the top, with the words "Computing Society" (or just the letters C and S, in some of the variations) displayed below the INFORMS logs. Jeff submitted both color and monochrome renditions of his designs.

David Gay's logo contest entry was a clean and simple design featuring the letters I, C and S arranged within the circumference of a circle.

Proposed ICS logo, ps 18.

The contest judges were the newletter editors (S. Raghavan and Tom Wiggen) and the Computing Society's chair (Harlan Crowder). We want to thank everyone for taking the time and effort to design and submit their logo entries. We did not agree very much at all about the ranking of the entries, except for the fact that the winner was at the top of everyone's list.

The feature article in this month's newsleetter is written by John Chinneck and Harvey Greenberg, and it is appearing simulteously in both this newsletter and the CORS newsletter.

The ICS business meeting in Cincinnati has a major agenda item - namely, the approval of our new society's by-laws. The by-laws draft document is printed in this newsletter so you can study it before the business meeting.

Our members are very active and continue to receive attention, awards and prizes. Please notice the announcements of the major awards presented to Harvey Greenberg and Michael Fu (back page) and the the honors received by other members (in "News about Members"). Be sure to send us your news for future issues, so we can continue to broadcast these messages.

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the numerical computation of a solution. Instead the critical tasks are creating, analyzing, understanding, and communicating models and instances, with clear implications for decision support. Some form of automated assistance is desirable, even necessary, to handle the scale and complexity of modern mathematical programs. This realization has spurred the development of a foundation for an *Intelligent Mathematical Programming System* (IMPS) [9] over the last two decades.

Formally, we define an IMPS as software that reduces the complexity inherent in the *mathematical programming process*. We define this process more precisely in the next section as a breakdown of the tasks one performs to build, use and maintain a decision-support system whose core is a mathematical program. Our definition of an IMPS is a bit broader than the usual definition given for computer intelligence in that we include aids that do not necessarily involve reasoning; an important example is our inclusion of visualization aids.

The development of software tools supporting the process of mathematical programming has been an active area of research over many years, particularly in recent times. A recent bibliography [13] gives more than 500 citations referring to some aspect of an IMPS over the period 1953-1996, of which more than 80 pertain specifically to software.

Our goal in this article is to summarize the kinds of tasks that might be undertaken by an ideal IMPS, as suggested by the work undertaken over the past two decades. We also comment briefly on the current state of the art. We are in the process of compiling a survey of existing IMPS software – if we have not already contacted you, you are invited to contribute a description of software that we might otherwise miss (see Appendix). To summarize briefly, there is a gratifying volume of IMPS software, yet there remain numerous parts of the modeling process that are in need of suitable tools. This is a fertile area for research.

1. The Mathematical Programming Process

Figure 1 is a simplified diagram of the main objects in the mathematical programming process. A *mathematical model* is extracted from the *problem domain* by making appropriate approximations of relationships (objectives and constraints). As data is collected, various *instances* of the model, which differ according to the specific data used, can be formulated and solved. The solver results for various instances can be collected as *case studies*. The loop is closed when the case study results are compared to the problem domain. Unexpected or erroneous results, or other questions raised by the case study results, may lead to modifications of the mathematical model or the data, and the modeling/analysis cycle repeats.

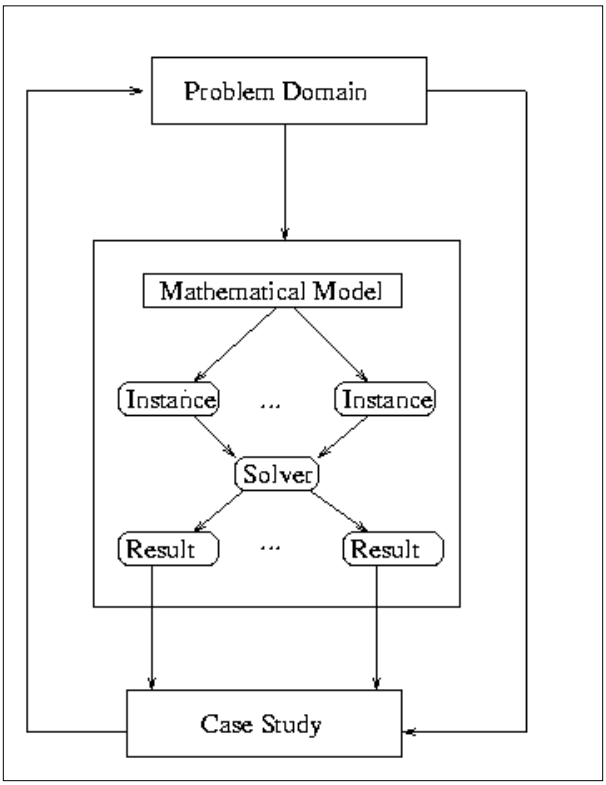

Figure 1. A Simplified View of the Mathematical Programming Process

The process in Figure 1 is idealized. Many modeling projects are neither top-down (i.e. starting with model structures and progressing towards data acquisition) nor bottom-up (i.e. starting with a rich database and inferring appropriate relationships). The flow is often middle-out, or hopscotch.

The mathematical programming process itself can be viewed as a cycle of functions applied to the objects in Figure 1. The following describes the seven main functions in the process, all of which are involved in any modeling project, and all of which can benefit from automated assistance.

Expressing the Model. Especially for large and complex models, it is vital to have a convenient way of expressing the model such that errors and omissions can be detected. Some algebraic modeling languages and graphical interfaces are in this category. There are two related functions: *documentation*, or recording a description for others to know the model, and *verification*, or ensuring that what you think is in the computer-resident model is actually there.

Viewing the Model and Instances. Different views of the model and its instances include algebraic, schematic, graphical, and natural language. Individual modelers may find some views more natural, assisting their understanding of the model or solution. Even the same individual may want different views for insights, so an IMPS must be able to accommodate a broad range of *cognitive differences*. *Reporting* is a related function that may include interactive query, generating internal files for later analysis, or creating overhead slides for presentation.

Simplifying the Model. Automatic simplification of models to improve solver performance is well established, for example in the pre-solve routines in LP solvers of commercial quality. Perhaps more important is the idea of simplification to improve human understanding, for example automatic rewriting of modeling language source code to give a simpler model expression, such as finding an underlying netform.

Debugging. This is the process of removing the mechanical errors in an instance, and perhaps in the model itself. Correcting models that are mechanically correct, but that are faulty representations of reality, is the province of the general analysis tools, treated separately. Various kinds of errors are common in mathematical programs, sometimes leading to infeasibility, unboundedness, and non-viability. Debugging the model can be approached via debugging of model instances, or can be approached directly at a symbolic level.

Data Management. A large volume of data is collected and generated in many mathematical programming processes. Database techniques are commonly used to manage the information, and may lend themselves in the future to the application of related technologies, such as data mining. We make only limited observations in this category because the subject is vast and merits special attention.

Scenario Management. Typically, many instances of a model are solved, each representing a *scenario*. A *case study* is a collection of related scenarios, and cases could overlap (i.e., have some of the same scenarios). The large volume of information generated in this way must be processed and filtered so that important conclusions are readily apparent to the analyst.

General Analysis. There are numerous general questions about any mathematical model. For example: Are there specific relationships among the data? What are the nonlinear functional shapes? What drives the price of a certain variable? General analysis tools help in answering such questions by providing the means to probe the model in various ways. *Validation*, or determining how well the model represents reality, is a related function. For example, is a linear programming model an adequate representation of the system, given the decisions that it is designed to support? As another example, consider *redundancy analysis:* is the constraint redundant because other constraints are more restrictive, or due to economic preference?

The environment in which the modeling project is carried out can add to the complexity, thereby increasing the need for automated assistance. For example, a model may be eclectic, with different people responsible for different parts of the model

(e.g. the National Energy Modeling System [20]). It is also typical that a model will be applied or modified by people other than those who built it. Intelligent aids are indispensable in both cases.

2. How Software Can Assist: Past, Present and Future

Past IMPS software shows clearly that the greatest challenge in developing systems that will last over the long term is in coping with the undermining effect of rapid changes in software technology. Our survey so far indicates that many systems are no longer active because of an implementation decision tying the software to a development system that no longer exists or that would require ongoing heavy maintenance to keep up with the host platform. Systems built to run on many platforms tend to survive provided they continue to offer competitive capabilities.

The shape and capabilities of future IMPSs are inextricably linked with developments in computing, both hardware and software. The progression to faster and better user interfaces offers great opportunities for research towards better exploitation of that technology for improved IMPSs. The explosive growth of the World Wide Web is already impacting the teaching of mathematical programming; for example, Java codes that enable interactive computing in real time are available. We can expect further collaborative development and solution of immense models via the web. These will require the creation of intelligent assistants to help manage the process.

We now briefly summarize some of the specific ways in which the functions in the mathematical programming process are currently assisted by software.

Expressing and Viewing Models. There are numerous ways to express complex mathematical programs, including algebraic modeling languages, constraint logic programming languages, graphical interfaces, and spreadsheets. See [15] for a survey.

The expression of a model must be a complete description that captures sufficient relevant details for decision support. The idea of views is broader, and includes any representation that provides a useful insight, including views that suppress or omit details. Model expression and viewing are part of the *discourse* component [12] of an IMPS, i.e. how we and the computer communicate information about the model and its instances.

In discourse, language styles may differ, such as algebraic or procedural. *Network modeling languages* can use a graphical user interface or can be a specialized variant of algebraic modeling languages (e.g. Proflow [5]). *Constraint logic programming* languages offer yet another way to express, as well as to view, logical relations. Some systems can provide a more natural language discourse in support of model analysis.

One tabular expression is a *block schematic*, which represents the model with special cell syntax [1,15,18]. We also use tables to view data with different *slices* and *aggregations*, common in most algebraic languages. Process views can be constructed as a combination of these [1]. S*preadsheets* are a special kind of tabular discourse, where cells contain model logic and data intermixed. *Graphics* can be iconic or diagrammatic. *Matrix graphics* can provide useful views, for example a very large matrix can be displayed with a single pixel lighted for any cell having a nonzero entry, or positive entries can be shown by a + sign and negative entries by a – sign. See Greenberg and Murphy [14] for a general analysis of structures and a survey of systems in which graphics and matrix graphics are used.

Some views are not standard in mathematical programming, but stem from database concepts, such as *dependency relations* – e.g., which functions and variables depend on a particular set. The MODLER [11] system provides views of this type.

In the ideal IMPS, the modeler should have a choice of ways of expressing the model, and should be able to switch easily between a wide variety of views as needed. The vast majority of current systems provide a single means of expressing the model, and usually no other views. MIMI [1] is perhaps the most sophisticated commercial system, allowing several modes of expressing and viewing the model. MProbe [7]

also offers various tabular views as well as profile plots of nonlinear functions of many dimensions, and an algebraic view via a link to AMPL. MODLER [11] provides multiple views, but it requires algebraic input; ANALYZE [10] offers the ability to choose between various tabular, network graphic, matrix, and algebraic views.

There is a need for basic research on views that provide insight for model forms beyond linear. One promising avenue for research is animation; see the pioneering work by Jones [17].

Simplifying Models. Most commercial solvers, and some modeling languages, include a pre-solve capability, but they are designed as "black boxes" to speed up optimization, not as analysis tools. However, there are a few tools that reveal simplifications of the model aimed at improving human understanding. MProbe [7] allows the examination of nonlinear functions of many dimensions to determine whether they are candidates for simplification (e.g. linearization). ANALYZE [10] allows exploration of the model for simplifications in LPs and MILPs. GAMSCHK [19] reads GAMS language input and gives a report on ways in which the model can be simplified. Redundancy analysis, via a general analysis tool such as ANALYZE, can also be used to simplify a model, though few practitioners understand how and why this is done.

Debugging Models. Classical software provides for the detection of non-optimal states, but not the underlying errors. Modern software provides assistance in diagnosing a cause with suggestions for remedy and prevention.

Infeasibility debugging has a long history. Methods of successive bound tightening have been included in LP pre-solve routines for many years, and are sometimes capable of detecting infeasibility and providing useful feedback through the traceback of the sequence of reductions (see the REDUCE command in ANALYZE, for example). However, in recent years most large commercial LP solvers have moved to the isolation of an *Irreducible Infeasible Subsystem* (IIS) [4,6,16]. An IIS is often a tiny fraction of the constraints in the model and has the property that it is infeasible, but any proper subset is feasible; thus every constraint in the IIS contributes to that infeasibility. Finding an IIS helps to focus the diagnostic effort. See Chinneck [6] for a recent survey of the state of the art in infeasibility analysis for all forms of mathematical programs.

Unboundedness debugging can theoretically be done by applying infeasibility debugging to the dual (at least in LP, and with some caveats in NLP and MIP), but examples show this is not effective. Underlying causes of unboundedness can be very different, such as a negative cycle in a network model. Such causes might be better sought directly, rather than rely on a technique aimed at primal infeasibility.

Nonviability is a property of a network model in which at least one arc flow variable is forced to zero by the structure of the network model (not by upper bounds on the arc flows); this can happen in all forms of network models, including *processing networks* [2]. Because it is unlikely that the modeler intends an arc that cannot support flow, such a mechanical error should be flagged prior to model solution. Chinneck [2,3] has developed methods for identifying and isolating nonviability, and these have been implemented in academic prototype software. It is interesting to note that any general LP can be viewed as a process network from its activity I/O structure [14].

A generalization of nonviability refers to any variable that is forced to a fixed value by the constraints in the model. Given this interpretation, methods and software remain to be developed for all non-network forms of mathematical programs.

General Analysis. General analysis software is responsible for providing a suite of tools for probing the model in various ways to answer questions and provide insights. As examples, consider two tools created by the authors.

ANALYZE provides computer assistance for analyzing linear mathematical programs and their solutions. There are three levels of use. The lowest level provides convenient interactive query and, combined with MODLER, enables syntax-directed report writing [8]. The second level provides procedures to assist analysis in a variety

of ways. Standard sensitivity questions, such as *What if …?, Why …?* and *Why not …?*, can be answered with easy access to information about the solution. In addition, diagnostic analysis, such as debugging an infeasibility, can be resolved efficiently either by internal routines or links with external information, such as an IIS obtained from MINOS(IIS) [4]. The third level is an artificially intelligent environment that includes translations of objects into English and rule-based reasoning.

MProbe provides estimates of nonlinear function shape (e.g. convex, concave or both), the extent of the shape, function range, slope analog, plotting of a function between two arbitrary points in n-space, model navigation, and estimates of constraint effectiveness. It also provides estimates of the shape of the constrained region (convex or nonconvex) and the likelihood of finding a global optimum (based on the shape and sense of the objective function, and the shape of the constrained region). User-defined sorting can be used to isolate classes of constraints that are likely to cause MILP difficulties.

Data Management. Many modeling languages allow direct connection of the mathematical model with common or proprietary database formats. Access to large databases has been an important aspect of mathematical programming systems since their inception. Interfacing with spreadsheets is a more recent development, proving to be just as important, though for different users.

Scenario Management. For generations, this has been done by model managers, using control tables in a way that made the management process very difficult. MathPro [18] is an example of a system built specifically to improve scenario management. Cross-scenario analysis is currently a human endeavor with minimal computer assistance. It is an open question how to use information from a set of scenarios advantageously when solving (or specifying) a new scenario. The IMPS responsibility is to provide tools to enable such analysis. The tool could be as simple as a link to some other module, like a statistics package.

3. Conclusions

The process of mathematical programming can be quite complex, and it is becoming even more so in step with advances in computing hardware and software and improved algorithms. We are in an era that is reminiscent of the early days of general computer programming, when there was little assistance for the programmer, who was forced to use a simple text editor to create programs, and was forced to pore through core dumps to debug errors. Now the general programmer has a host of computer assistants: code editors that highlight reserved words, flag errors as they are typed, and can jump to variable definitions and show calling hierarchies, on-line documentation, debuggers, profilers, etc. Mathematical programming is at an early stage of developing its own specialized tools to assist in the process of creating, exploring, and maintaining useful models. Actually solving model instances is no longer the major barrier to effective mathematical programming; the ability to cope with the inherent complexity is. Intelligent mathematical programming systems aim to break through this barrier.

Appendix: Adding to the Software Survey

If you have knowledge of software that exhibits some aspect of an IMPS system, please contact one of the authors to provide the following information:

- Name of software system.
- Contact names and addresses for the developers or informants (including email).
- Sources of information about the software: published papers, technical reports, books, web sites, etc.
- Comments on how the software contributes to each of the seven functions in the mathematical programming process.

References

1. Chesapeake Decision Sciences, *MIMI User Manual*, New Providence, NJ, 1988.
2. J.W. Chinneck, Formulating Processing Networks: Viability Theory, *Naval Research Logistics* 37 (1990), 245-261.
3. J.W. Chinneck, Viability Analysis: A Formulation Aid for All Classes of Network

Models, *Naval Research Logistics* 39 (1992), 531-543.
4. J.W. Chinneck, MINOS(IIS): Infeasibility Analysis Using MINOS, *Computers & Operations Research* 21:1 (1994), 1-9. Software available at http://www.sce.carleton.ca/faculty/chinneck/minosiis.html.
5. J.W. Chinneck, Processing Network Models of Energy/Environment Systems, *Computers and Industrial Engineering* 28:1 (1995), 179-189.
6. J.W. Chinneck, Chapter 14: Feasibility and Viability, in *Advances in Sensitivity Analysis and Parametric Programming*, T. Gal and H.J. Greenberg (eds.), International Series in Operations Research and Management Science, vol. 6, Kluwer Academic Publishers, Boston, MA, 1997.
7. J.W. Chinneck, *Analyzing Mathematical Programs Using MProbe*, Technical Report SCE-98-03, Systems and Computer Engineering, Carleton University, Ottawa, Canada, 1998. Software available at http://www.sce.carleton.ca/faculty/chinneck/MProbe.html.
8. H.J. Greenberg, Syntax-Directed Report Writing in Linear Programming, *European Journal of Operations Research* 72:2 (1994), 300-311.
9. H.J. Greenberg, An Industrial Consortium to Sponsor the Development of an Intelligent Mathematical Programming System, *Interfaces* 20:6 (1991), 88-93.
10. H.J. Greenberg, A Computer-Assisted Analysis System for Mathematical Programming Models and Solutions: A User's Guide for ANALYZE, Kluwer Academic Press, Boston, MA, 1993. DOS and linux versions are available at http://www.cudenver.edu/~hgreenbe/imps/software.html.
11. H.J. Greenberg, *Modeling by Object-Driven Linear Elemental Relations: A User's Guide for MODLER*, Kluwer Academic Press, Boston, MA, 1993. DOS and linux versions are available at http://www.cudenver.edu/~hgreenbe/imps/software.html.
12. H.J. Greenberg, Intelligent User Interfaces for Mathematical Programming, Proceedings of the Shell Conference: *Logistics: Where Ends have to Meet*, C. Van Rijgn (ed.), Pergamon Press, 1989, 198-223.
13. H.J. Greenberg, A Bibliography for the Development of an Intelligent Mathematical Programming System, *Annals of Operations Research* 65 (1996), 55-90. A 1997 version is on the World Wide Web, http://www.cudenver.edu/~hgreenbe/imps/impsbib/impsbib.html.
14. H.J. Greenberg and F.H. Murphy, Views of Mathematical Programming Models and Their Instances, *Decision Support Systems* 13:1 (1995), 3-34.
15. H.J. Greenberg and F.H. Murphy, A Comparison of Mathematical Programming Modeling Systems, *Annals of Operations Research* 38 (1992), 177-238.
16. H.J. Greenberg and F.H. Murphy, Approaches to Diagnosing Infeasibility for Linear Programs, *ORSA Journal on Computing* 3:3 (1991), 253-261.
17. C.V. Jones, *Visualization in Optimization*, Kluwer Academic Press, Boston, MA, 1995.
18. MathPro, Inc., *MathPro Usage Guide: Introduction and Reference*, Washington, DC, 1989.
19. B.A. McCarl, *GAMSCHK User Documentation*, Department of Agricultural Economics, Texas A&M University, College Station, TX, 1998. Software available at http://agrinet.tamu.edu/mccarl/.
20. *National Energy Modeling System Integrating Module Documentation Report*, DOE/EIA-MO57(95), Energy Information Administration, Washington, DC, 1995. This, and related documents, are available at http://www.eia.doe.gov/bookshelf/docs.html.

Minutes of ICS Business Meeting

INFORMS Seattle, October 26-28, 1998

Bjarni Kristjansson, Secretary/Treasurer

Harlan Crowder, the ICS Chair, opened the business meeting on October 26th at 6:15 and went over the agenda.

ICS Officers for 1998-99

Harlan then gave the following list of 1998-1999 ICS officers that are currently serving:
Chair: Harlan Crowder, Vice-Chair/Chair Elect: Ramayya Krishnan, Secretary/Treasurer: Bjarni Kristjansson
Board of Directors: Andy Boyd, Chris Jones (-1999), Carol Tretkoff, Matt Saltzman (-2000), Bruce Golden, Jeff Kennington (-2001)
Newsletter editors: Raghu Raghavan, Tom Wiggen. Associate Editors: Andy Boyd, Ramayya Krishnan, John Hooker.
ICS Prize Chair: Warren Adams

Secretary/Treasurer's Report

The secretary/treasurer, Bjarni Kristjansson, submitted the minutes from the Montreal meeting, which were approved unanimously and made available as a handout. He then gave a status report on the finances of ICS. Due to some serious problems at the INFORMS financial office, the final statements for 1997 were still not available, but we are working on having them available as soon as possible. Generally, the financial status of ICS is relatively good. We have over $15,000 in our account and the last ICS meetings have been moderately profitable.

ICS Prize

The new committee chair, Warren Adams, discussed the ICS Prize for 1999. The committee now includes Carol Tretkoff and John Chinneck, and they are looking for new members. Please contact the committee chair if you are interested in being on the committee.

ICS 2000

Manuel Laguna, the General Chair for the ICS 2000 meeting in Cancun, Mexico gave an update on the preparation for the meeting. There is a new web site available at *http://www-bus.colorado.edu/faculty/laguna/cancun2000.html*.
The deadline for abstract submission is September 17, 1999 and the deadline for manuscripts for the meeting volume will be May 7, 1999. The title for the meeting will be Computing and Optimization in the New Millennium. The registration fees will be as follows:

Status	**Before November**	**After November**
Member	$170	$185
Non-member	$180	$195
Students	$70	$75

The hotel cost at the Westin will be $150 per night. The organizer tried to locate other hotels that might be less expensive, but without success. Advisory committee and the program committee have mostly been selected, but we are still looking for more. We are also exploring having a tour of the surrounding areas of Cancun.

Newsletter

Raghu Raghavan of the University of Maryland and Tom Wiggen of the University of North Dakota are the co-editors of the ICS Newsletter. They reported that ICS has no logos or symbols that it can use and would like to redesign those along with creating a new front page of the newsletter. The newest issue of ICS is in the mail.

Journal on Computing

Bruce Golden reported that the Journal is running well and will publish about 460 pages in '98'. Volume 10, No. 4, which is due out in November, will contain feature article on the World-Wide-Web by Hemant K. Bhargava and Ramayya Krishnan, along with four commentaries on the same subject. The Volume 10, No. 3 contained a cluster on connection between IP and constraint logic programming. Some further feature articles are in progress. The current backlog is about 6-9 months, which is good. The journal has two new area editors: Dick Barr on high performance computing and Mike Taaffe on simulation. 1999 will be Bruce Golden's last year as editor-in-chief. Please start thinking about candidates for the job and feel free to share your suggestions.

INFORMS Vice Chair of IT

Matthew Saltzman announced that he is now the new Vice Chair of IT of INFORMS.

ICS Logo Contest
Harlan Crowder discussed the need for a new logo for ICS since the old one has the letters CSTS in it and is outdated. The new logo needs to be well designed and tasteful because it is used in the journal. John Chinneck said in jest that maybe we might just as well use the ILOG logo since most of our members are already employed by them. Those interested in trying to design a new logo for ICS please send your suggestions to Harlan.

Chair's Report
Harlan Crowder, the chairman for ICS then gave the following report on the state of the society:

By-laws Proposals Review
We should have the new by-laws ready but they are not finished yet. The intention is to have them ready before the next meeting so that they can be accepted then. There was discussion about whether the elections should be allowed, as an option, to be done through email ballots. There are security issues involved that need to be addressed. Matthew Saltzman said this could be implemented so long as it would not be made too complicated. There was general agreement that we should include the permission to do email ballots in the by-laws but not require it.

INFORMS Changes for Section and Society Services
Harlan Crowder gave an overview of the scheduled changes to services offered by INFORMS for sections and societies. The general services will include, as before, financial, election handling, web page management, and the ICS prize. Special services will, for example, include setting up and managing meetings, making promotional "toys", and etc. INFORMS is spending a lot of their financial resources on member services that they would now want to start charging for. Possible billing method would include flat tax for general services and per-use charge for special services.

New INFORMS Meeting Format
Starting in 2001 the format of the INFORMS national meetings will change. INFORMS has compiled some interesting facts about the attendance of their national meetings that are the reason for this proposed change. About 1800-2000 people attend the each meeting while only 400 attend both meetings. This means most people only attend one meeting per year.

The fall meeting will be a large general meeting, similar to before, while the spring meeting will change to a smaller practice oriented meeting. The spring meeting will be by invitation only, with contacts/invitations strongly favored by sections and societies. It will be held for approximately three days during the week and will contain about five different tracks. INFORMS will try to get sections and societies to organize simultaneous meetings in conjunction with the practice meetings. Also in 2001, there is an international meeting that will be held in Hawaii.

Meeting Plan Options for ICS:

- *Maximum meeting plan*: Continue to have the ICS winter meeting every two years but also have an ICS meeting in conjunction with the INFORMS practice meeting.
- *Intermediate meeting plan*: Again continue to have the ICS winter meeting every two even years but have an ICS meeting in conjunction with the INFORMS practice meeting every two odd years.
- *Inferred meeting plan*: Have no ICS winter meetings but have an ICS meeting in conjunction with the INFORMS practice meeting every year.
- *Minimal meeting plan*: A meeting every other year; either as a winter ICS meeting or as a meeting in conjunction with the spring INFORMS practice meeting.

Attendance
The meeting was well attended and this time we think we got almost everyone to sign on the roster before leaving:

Sanjay Saigal, Irv Lustig, Bjarni Halldorsson, Wolfgang Sverggemana, Bob Fourer, Jeff Kennington, Barin Nag, Joe Creegan, Nick Sahinidis, Warren Adams, Roger Rios, Manuel Laguna, Tom Wiggen, Ed Wasil, Gregory Glochner, Steven Coy, Leslie-Ann Yarrow, Martin Shell, Alex Meeraus, John Gregory, H.P. Williams, Dick Barr, John Chinneck, David Gay, Carol Tretkoff, Bruce Golden, James Kelly, Kevin Wood, Robert Vanderbei, Ariela Sofer, David Shanno, Rick Rosenthal, Ken McAloon, Philippe Charman, Philippe Refaw, Ramesh Sharda, Ramayya Krishnan, Mike Shaw, Fred Murphy, Laura Davis, Matthew Saltzman, Harlan Crowder, Bjarni Kristjansson.

Computing and Optimization Tools for the New Millennium

Seventh INFORMS Computing Society Conference

Cancún, México, January 5-7, 2000

Computer science and operations research share an important part of their history. Their interface is responsible for advances that could have not been achieved in isolation. The first six INFORMS Computing Society (ICS) conferences witnessed fascinating developments in the computer science/operations research interface. We would like to take this opportunity to invite you to the seventh ICS conference, which has the goal of bringing together researchers and practitioners in Operations Research, Computer Science, Management Science, Artificial Intelligence, and other related fields. These researchers and practitioners will be responsible for creating the computing and optimization tools for the new millennium.

We are proud to announce that Dr. Richard E. Nance has agreed to be the plenary speaker for this conference. Dr. Nance is the RADM John Adolphus Dahlgren Professor of Computer Science and the Director of the Systems Research Center at Virginia Tech. He has authored over 100 papers on discrete event simulation, performance modeling and evaluation, computer networks, and software engineering.

We would like to remind everyone that May 7, 1999 is the deadline for submitting full manuscripts for consideration in the edited volume of the conference. We hope to continue the tradition of excellence established in previous ICS conferences, for which we need to count with your support and participation.

For additional information, please visit the conference web site at http://www-bus.colorado.edu/Faculty/Laguna/cancun2000.html

General Co-Chairs:

Manuel Laguna
University of Colorado
Manuel.Laguna@Colorado.Edu

José Luis González Velarde
Monterrey Tech
lugonzal@campus.mty.itesm.mx

CORS 41st National Conference

The 41st National Conference of the Canadian Operational Research Society (CORS) is being held in Windsor, Ontario from June 7 - 9, 1999. The theme of the conference is "Operational Research in Motion", and the conference will feature plenary sessions by Harvey Greenberg, Carl Harris, Gilbert Laporte, and John Mann. The abstract submission date is April 1, 1999 and late fees begin May 1, 1999. For more information on the conference, and for electronic registration and abstract submission, visit the website <www.cors.ca/windsor> or contact the conference chair: Richard J. Caron (rcaron@uwindsor.ca, (519) 253-3000 ext 3043).

ITORMS: Call For Papers

ITORMS, the first electronic journal of INFORMS publishes original, high quality scholarly articles and bibliographies that provide a perspective view of OR/MS and exploit the interactivity offered by the Internet. Published articles are constantly updated by the authors to provide access to the most recent literature on the topic of interest and to other related resources that are available or will be developing on the Internet. You are invited to submit a paper for review for publication in ITORMS. Visit the ITORMS web site at http://www.informs.org/Pubs/ITORMS, or contact the Editor, Ramesh Sharda at sharda@okstate.edu

20th Int'l Conference on Information Systems: Call For Papers

Charlotte, North Carolina
December 12-15, 1999

ICIS'99, with the theme "An IT Vision for the 21st Century", will focus on the impact of emerging information technologies on organizations and people as we enter the next millennium. This requires a deep understanding of the managerial, behavioral, conceptual, and technical aspects of these emerging technologies. **This focused call is an attempt to increase the volume of well-executed technical research presented at ICIS. We are soliciting high-quality papers dealing with technical research topics.** For additional information about technical submissions, please contact one of the Track Co-Chairs specifically responsible for technical submissions: Alan Hevner (completed research) – (813) 974-6753 – ahevner@coba.usf.edu; Salvatore March (research-in-progress) – (612) 624-2017 – smarch@csom.umn.edu; or the Program Chair: Prabuddha De – (937) 229-2316 – pde@udayton.edu. The submission Deadline is May 3, 1999. More ICIS'99 information can be found at http://www.uncc.edu/icis99/.

Discrete Applied Mathematics:

Call For Papers

Discrete Applied Mathematics will publish a special issue on "Foundations of Heuristics in Combinatorial Optimization". Papers are sought in the broad area of heuristics or meta-heuristics for combinatorial optimization problems with a focus on theoretical analysis. In particular, we are soliciting papers on design and/or analysis of heuristics with emphasis on worst-case bounds, domination analysis, probabilistic analysis, theoretical insights generated by experimental analysis, etc. All papers submitted will undergo a standard review process. Four copies of the paper, following the standard guidelines for Discrete Applied Mathematics should be sent by 15 October 1999 to one of the following:

Dr. Z Gregory Gutin
Department of Mathematics & Statistics
Brunel, The University of West London
Uxbridge, Middlesex UB8 3PH, UK

Dr. Abraham Punnen
Dept of Math, Stat, and Computer Science
University of New Brunswick
Saint John, New Brunswick Canada E2L 4L5

MAM3: Call For Papers

The Third International Conference on Matrix-Analytic Methods in Stochastic Models
July 12—14, 2000, in Leuven, Belgium

The conference will provide an international forum for the presentation of recent results on matrix-analytic methods in stochastic models. Its scope includes development of the methodology as well as the related algorithmic implementations and applications in communications, production and manufacturing engineering; it also includes computer experimentation in the investigation of specific probability models. In addition to sessions for the research papers submitted, there will be invited presentations by leading researchers in the field and one session specifically devoted to software packages. Prospective authors are invited to submit a 1 to 2 page abstract before the May 1, 1999 deadline. Manuscripts will be refereed and proceedings published.

Further information will be published on the conference web page at http://www.econ.kuleuven.ac.be/MAM3 and queries should be addressed to MAM3@econ.kuleuven.ac.be

Conference chair: Dr Herlinde Leemans, Katholieke Universiteit Leuven
Programme co-chairs: Dr Guy Latouche, Universite Libre de Bruxelles;
Dr Peter Taylor, University of Adelaide

LGO: An Integrated Model Development and Solver System for Continuous Global Optimization

The program system **LGO**—abbreviating Lipschitz(-Continuous) Global Optimizer—solves multiextremal optimization problems, under almost 'minimal' structural assumptions. The general problem-class considered is min f(x) s.t. a<=x<=b g(x)<=0 (a, x, b are finite real n-vectors; g is an m-vector function; f and g are arbitrary continuous or Lipschitz functions on [a,b]).

LGO is particularly suitable to handle problems that are related to highly nonlinear, complete stand-alone ('black box') system models, or to models supported by limited, difficult-to-use, or tentative (possibly changing) analytical information. The software integrates a suite of robust and efficient global and local scope solvers. These can be applied in fully automatic or interactive operational modes. LGO has built-in model visualization and automatic report generation features, concise on-line help files (and is accompanied by a detailed User's Guide) to assist the application development process. LGO can be directly connected to (arbitrarily complex) applications by simply adjusting the sample (template) user files provided with the software.

LGO has been developed primarily on personal computer platforms (in Lahey Fortan 90), but it is portable to other hardware environments. LF90 supports connectivity to several widely used platforms (MSVB, MSVC++, Borland Delphi and C++, Windows API).Currently, the following versions are readily available:

· LGO/LISK has a consistent DOS and Windows 95/98/NT interface. This implementation can also be directly migrated to several workstation platforms.
· LGO/WiSK is fully Windows-compatible; developed for Windows 95/98/NT. This version is equipped with a menu-driven user interface, providing a fully integrated development environment.
· LGO/CL is a standard Fortran 77 (command line style) version with a simpler text interface; targeted for workstations and mainframes (or for PCs) equipped with a professional Fortran development platform.

LGO is offered to private companies and research organizations; educational and non-profit research discounts are available. (Currently, it is in use in over ten countries.) Potential users are encouraged to send - preferably Fortran coded - test problems, to check out the software.

For further information, please contact J.D. Pinter (Pinter Consulting Services, Halifax, NS, Canada <jdpinter@is.dal.ca>). Dr. Pinter is the author of 'Global Optimization in Action' (Kluwer Academic Publishers, 1996).

Harlan D. Mills Memorial Colloquium

David Parnas and Fred Brooks to speak

Details at http:\\www.isr.wvu.edu/mills/, register at http://sunset.usc.edu/r1/icse99.

The ICSE-affiliated colloquium "Science and Engineering for Software Development" has been organized in honor of Dr. Harlan D. Mills (1919-1996), and as a recognition of his enduring legacy to the theory and practice of software engineering. This year's event will feature keynote addresses by David Parnas and Fred Brooks. The colloquium will take place in Los Angeles on May 18, 1999, the day before the opening of the 23rd International Conference on Software Engineering. The program includes invited presentations, refereed papers, and a panel session. The invited speakers, in addition to Professors Brooks and Parnas, include Jesse Poore and Carmen Trammell. The panel session, to be chaired by Professor Victor Basili, will feature Terry Baker, Susan L. Gerhart, and Al Hevner. The first annual "Harlan D. Mills Practical Visionary Prize" award will be presented. This award is given to an individual who has demonstrated a long-standing and meaningful contribution to both the theory and practice of the information sciences.

Message from the Chair

Harlan P. Crowder, ILOG, Inc.
1080 Linda Vista Avenue, Mountain View, CA 94043
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It has been a pleasure to serve you as Chair of the INFORMS Computing Society this last year. It is a time of rapid change for INFORMS and ICS, and I am happy that you allowed me to participate.

INFORMS is reinventing itself in order to become more relevant in the new century. Starting next year, we will have one INFORMS national meeting and one INFORMS "practice" meeting each year. (The exact name of the practice meeting has not been decided.) The annual national meeting will follow the format of traditional INFORMS meetings. The format of the new practice meetings is still under discussion, but one thing is clear: the societies, technical sections and other component organizations will play an increasingly critical role in the success of INFORMS.

For ICS, this change presents an opportunity to help shape the future of INFORMS. We have always been a well organized and influential organization, first as the Computer Science Technical Section (CSTS) and now as ICS: we have a steady membership; we helped launch and continue supporting an important and influential publication, the *INFORMS Journal on Computing*; and we sponsor a biennial conference that is consistently successful. The new meeting structure and focus will allow us to play an even more important role. The practice meetings will be primarily driven by organizations such as ICS, allowing us greater opportunity and flexibility to organize sessions, tracks of related sessions, and "meetings-within-a meeting" formats to expand and explore our interest in the many relationships of OR/MS and computer science.

Of course, fully exploiting this new opportunity will require a lot of work. If we want to fully participate in the New INFORMS, the level of effort **each year** will be approximately the same level required to organize and execute our biennial ICS conference. That means that a lot more of our members will need to get involved in the Society's organization and operation. But if the past is any predictor of the future, we will rise to the new challenges and ICS will take the lead in helping reinvent INFORMS.

Before we get too carried away about the new millenium, there is one little task we need to accomplish in 1999. We have almost completed our transformation from CSTS to ICS. The last remaining hurdle is the approval of a new set of bylaws for ICS. A draft of our new bylaws appears elsewhere in this newsletter and on the Internet at http://www.math.clemson.edu/INFORMS/ICS/draft-bylaws.html. Thanks to several of you who have caught typos and made suggestions for improvements. Please check out the draft and then come to the ICS business meeting on Monday evening at the Cincinnati INFORMS conference. One of our main activities at the meeting will be voting to approve the new ICS bylaws.

The other important activity, of course, is to welcome the new slate of ICS officers, headed by the new Chair, Ramayya Krishnan.

See you in Cincinnati.

Bylaws of the INFORMS Computing Society of the Institute for Operations Research and the Management Sciences

Article I - Name

The name of this organization is the **INFORMS Computing Society** of the Institute for Operations Research and the Management Sciences (INFORMS). Herein it will be referred to as "ICS."

Article II - Purpose

Operations research and the management sciences (OR/MS) have always stood in close relation to computer science and artificial intelligence (CS/AI). Not only are the ideas and techniques of one highly relevant to the other, but their cross-fertilization has spawned creative research. However, because OR/MS and CS/AI have developed different and largely separate professional cultures, interaction does not always happen naturally and requires encouragement.

The purpose of ICS is : a) to help keep INFORMS members abreast of useful developments in CS/AI, and b) to contribute to the vigor of research and practice in the INFORMS community by encouraging activity on the interface of OR/MS and CS/AI.

ICS intends to achieve its goals by:

1. Sponsoring sessions at INFORMS national meetings;
2. Organizing additional professional meetings and publishing proceedings that focus on the interface;
3. Sponsoring the *Journal on Computing* and other publications as the need may arise;
4. Maintaining a newsletter and electronic forum that communicate recent developments and promote contacts among researchers and practitioners with common interests;
5. Awarding prizes that recognize high-quality work in the interface.

Article III - Membership

1. Any person may become a member of ICS by submitting a membership application with the proper dues.
2. Dues will be set by majority vote at the Business Meeting (c.f. Article V) and will cover the following calendar year. If no action is taken at the Business Meeting, dues will remain the same from year to year.
3. Student and/or retired members may be assessed lower dues than regular members, or no dues, if approved by majority vote at the Business Meeting.
4. Affiliate members may be distinguished as those who are not INFORMS members and assessed higher dues than regular members, if approved by majority vote at the Business Meeting.
5. In all respects other than those specified above, all members have equal rights, duties and privileges.

Article IV - Officers

1. Officers of ICS and their duties are as follows.

Chair.

The chair is the chief administrative officer of ICS and is responsible for the general supervision, direction and control of ICS business affairs. The Chair a) calls, organizes and presides at ICS Business Meetings; b) appoints committees as required, including prize committees; c) appoints the newsletter editor and chairs of ICS professional meetings; d) represents ICS in external affairs; e) submits an annual budget request

to the INFORMS Committee on Subdivisions; f) maintains communication with the person representing ICS on the INFORMS Board; and g) participates in the Nominating Assembly for representatives to the INFORMS Board. The Chair must have been the previous Vice Chair and assumes office upon the completion of the previous Chair's term.

Vice Chair.

The Vice Chair is responsible for organizing ICS-sponsored sessions at two consecutive national INFORMS meetings, beginning with the second meeting that occurs during his/her term. The Vice Chair may delegate part of this responsibility to ICS Board members as desired. In the absence or disability of the Chair, the Vice Chair performs the duties and exercises the powers of the Chair. The Vice Chair becomes Chair upon completion of the term of office.

Secretary/Treasurer.

The Secretary/Treasurer a) takes minutes at ICS Business Meetings; b) notifies members of meetings; c) maintains an electronic forum or other regular contact with members; d) coordinates the election of officers; e) takes responsibility for other matters of correspondence; f) keeps financial records; g) files an annual report describing ICS's activities and financial state with the INFORMS Vice President for Subdivisions at a time designated by the latter (normally after the close of the calendar year).

Board.

In additional to the ICS Chair, Vice Chair and Secretary/Treasurer as ex-officio members, the ICS Board shall consist of six persons. The Board serves as a general policy-making body. Board members may also assist the Vice Chair and other program chairs in organizing sessions at INFORMS and other ICS professional meetings. The Board approves by consensus the annual report and the annual budget request submitted to the INFORMS Subdivisions Committee. The Board must approve by majority vote all dues assessed on ICS members.

2. **Terms of Office**. All terms begin at the conclusion of the spring ICS Business Meeting. a) The terms of the Chair and Vice Chair are one year, and no person may serve as Vice Chair immediately after having served a full term as Chair. b) The term of the Secretary/Treasurer is one year, and no person may serve more than three consecutive terms. c) The term for ICS Board members other than the Chair, Vice Chair and Secretary/Treasurer is three years, and two of these members are elected each year. All offices and Board seats must be occupied by distinct persons, except that a Board member who is elected Vice Chair or Secretary/Treasurer may retain his/her seat on the Board.

3. **Nominations**. The Chair shall appoint a Nominating Committee for the offices of Vice Chair, Secretary/Treasurer and for two positions on the ICS Board, and the Committee shall submit nominations to the current Secretary/Treasurer. The Chair shall also take nominations from the floor during the ICS fall Business Meeting. The Secretary/Treasurer shall invite further nominations in writing and/or electronic form from ICS members during a subsequent period he/she designates. All nominees must be members of ICS at the time of nomination. The nominees for Chair and Vice Chair must be INFORMS members at the time of nomination.

4. **Voting**. The Secretary/Treasurer shall

collect biographies and position statements of all nominees for inclusion on the ballot, which should also provide an opportunity for write-in votes. Each ICS member may vote for at most one candidate for Vice Chair and at most one for Secretary/Treasurer. The candidate with the most votes in each race assumes office. In addition, each ICS member may vote for any number of candidates for the two open Board positions (approval voting). The two candidates receiving the most votes become Board members. Ties in any of these elections are broken by a vote taken at the spring ICS Business Meeting. The election process must be completed before this meeting takes place.

5. **Election Process**. The Secretary/ Treasurer shall forward official ballots to ICS members. Ballots shall be issued by one of the following media: a) letter mail ballot; b) electronic mail; c) a combination of letter mail and electronic mail ballots. Mechanisms for voting by either written or electronic media are to be adopted at the discretion of the Board, but must meet the following criteria to be valid: i) anonymity of the marking of ballots must be maintained; ii) procedures to validate the authenticity and uniqueness of the ballots must be provided; and iii) means to vote must be extended to all ICS members. For example, if electronic mail ballots are used, then those members with no electronic mail access must be accommidated.

Article V - Business Meetings

ICS shall hold a Business Meeting during each regularly scheduled national INFORMS meeting. The quorum for action at a Business Meeting shall be 5% of the membership or 15 persons, whichever is smaller.

Article VI - Responsibilities to INFORMS

ICS and its officers, under charter from INFORMS, are accountable to INFORMS for all operations and procedures. The INFORMS Board may suspend or revoke the ICS charter for inappropriate actions and/or procedures. ICS will submit an annual report to the Vice President for Subdivisions, at a time designated by the latter, summarizing the significant accomplishments and activities during the previous year. This report must include a careful accounting of ICS funds during the year.

Article VII - Dues

Dues to defer annual operational expenses may be assessed on all members by the Board of ICS.

Article VII - Amendments

Amendments to these bylaws may be adopted by two-thirds vote in an ICS Business Meeting, provided that the proposed amendment is distributed to all ICS members at least seven days prior to the meeting. The amendment shall then be submitted to the INFORMS Vice President for Subdivisions and becomes effective on approval by the INFORMS Board.

Article VIII - Rules of Order

Robert's Rules of Order shall govern ICS Business Meetings except in those cases where they are inconsistent with these Bylaws.

Article IX - Transition

These Bylaws shall take affect when a) approved by two-thirds vote at an ICS Business Meeting, and b) approved by the INFORMS Board.

Last updated April 4, 1999

News about Members

Kaushal Chari (kchari@coba.usf.edu), University of South Florida, won the 1998 OrbixAward from Iona Technologies for his project titled: "Distributed Decision Support Over Intranets: An Intelligent Approach". The OrbixAward is awarded annually to the best CORBA-based research project participating in a competition sponsored by Iona Technologies. A detailed press release can be found at http://www.iona.com/info/aboutus/pressroom/archive/orbixawards2.html

Ramayya Krishnan was awarded the W.W. Cooper and Ruth F. Cooper Chair at Carnegie Mellon University.

Professor **Asim Roy** will debate seven members of the Governing Board of the International Neural Network Society (INNS), including three of the Society's past presidents, at the next International Joint Conference on Neural Networks (IJCNN'99) in Washington, D.C. this July. This will be the third time Dr. Roy has engaged the Society in a debate on the fundamental assumptions about the way the brain works and learns. The topic this time is: "BRAINS INTERNAL MECHANISMS - THE NEED FOR A NEW PARADIGM."

New Books

A new book by Anna Nagurney , Network Economics: A Variational Inequality Approach, second and revised edition, has been published by Kluwer Academic Publishers. It provides an updated treatment of variational inequalities and includes such new applications as knowledge networks and environmental networks as well as more established applications such as traffic network equilibrium problems, oligopolistic market and spatial price models as well as financial equilibrium models. It also contains problems for pedagogical and self-study purposes.

Anna's other recent book, Environmental Networks: A Framework for Economic Decision Making and Policy Analysis, a joint work with two of her former students, Kanwalroop Kathy Dhanda and Padma Ramanujam, has been published by Edward Elgar Publishing Company. The environmental networks framework simplifies the analysis of environmental problems and emphasizes the spatial nature of economic activity and pollution dispersion.

Upcoming Meetings

INFORMS Spring 1999 Meeting, Cincinnati OH, May 2-5, 1999. Theme: Delivering to the Global Consumer. General Chair David Rogers, (david.rogers@uc.edu), URL=*http://www.informs.org/Conf/Cincinnati99/*

41st National CORS Conference, Windsor Ontario, June 7-9, 1999. Theme: Operational Research in Motion. Chair: Richard Caron (rcaron@uwindsor.ca). *URL=http://www.cors.ca/windsor/*

15th National Conference of the Australian Society for Operations Research, Gold Coast, Australia, July 4-7, 1999. Theme: Put Theory into Real Life. *URL=http://www.math.fsc.qut.edu.au/asor.*

International Symposium on Operations Research 1999, Magdeburg, Germany, September 1-3, 1999. Chair G. Schwodiauer (schwoediauer@wiwi.uni-madgeburg.de). *URL=http://www.uni-madgeburg.de/SOR99/*

INFORMS Fall 1999 Meeting, Philadelphia PA, November 7-10, 1999. Contact Chair G. Anandalingam (anand@seas.upenn.edu).

Winter Simulation Conference (WSC '99), Phoenix, AZ, December 5-8, 1999. Theme: A Bridge to the Future. URL=*http://www.wintersim.org*

INFORMS Computing Society 7th Biennial Conference, Cancun Mexico, January 5-7, 2000. Chairs: Manuel Laguna and Jose Luis Gonzalez-Velarde.

INFORMS Spring 2000 Meeting, Salt Lake City, Utah. Contact William Giauque (william_giauque@byu.edu).

CORS 2000, Edmonton, Alberta, 29-31 May 2000. Theme: Energy, Environment, and Natural Resources. Contact: erhan.erkut@ualberta.ca or visit URL=*http://www.bus.ualberta.ca/eerkut/CORS2000/*

INFORMS/KORS, Seoul, South Korea, Summer 2000.

17th International Symposium on Mathematical Programming, Georgia Institute of Technology Atlanta, Georgia, USA, August 7-11, 2000. URL=*http://www.isye.gatech.edu/ismp2000/*

Harvey J. Greenberg wins the Larnder Prize

Harvey Greenberg has been selected as the 1999 Larnder Memorial Lecturer. The Harold Larnder Prize, which is financed through the Harold Larnder Memorial Trust of the Canadian Operational Research Society, is awarded annually to an individual who has achieved international distinction in Operational Research. Harvey will receive his award at the CORS-SCRO National Conference (www.cors.ca/windsor) to be held in Windsor, Ontario from June 7 - 9, 1999. His topic for the Larnder Memorial Lecture is *Development of an Intelligent Programming System: Past, Present and Future*. Previous Larnder Lecturers include Paolo Toth (1998), George B. Dantzig (1997) and Jan Karel Lenstra (1996). (A complete list of winners can be found at http://www.cors.ca/handbook/awards/larnder.htm.)

Outstanding Simulation Publication Award

The INFORMS College on Simulation presented its 1998 Outstanding Simulation Publication Award to Professor Michael Fu of the University of Maryland and Professor Jian-Qiang Hu of Boston University, for their recent book entitled Conditional Monte Carlo: Gradient Estimation and Optimization Applications, published by Kluwer Academic Press. The presentation took place on December 14, 1998, during the Opening Session of the Winter Simulation Conference in Washington, DC. The award recognizes outstanding contributions to the simulation literature. Journal articles, proceedings articles, books, and monographs copyrighted in 1994, 1995, 1996, and 1997 were eligible for the 1998 award. The book, which was reviewed in the Spring 1998 CSTS Newsletter, provides a state-of-the-art comprehensive monograph on gradient estimation with perturbation analysis techniques using conditional expectation. The award includes a plaque and a cash prize of $500.

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