OR NEWSLETTER

EDITORIAL

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Have you ever been frustrated when you followed up a promising reference, only to discover that it said 'to be published in *The Respectable OR Journal*'? Or somewhat peeved when the paper accepted by '*Fasttrack OR Letters*' took 18 months to finally appear in print? Or discovering in the latest issue of '*Up-to-date OR*' an article that would have saved you several months of work and submitted three years ago, revised two years and 4 months ago, accepted two years and 1 month ago? (*Management Science* — one of the worst — has regular delays of between 29 to 37 months after receipt of the manuscript, 5 of which on the average the paper is with the author(s) for revisions. *JORS* does much better. It tends to publish papers within 16 to 22 moths after receipt and 6 to 9 months after their acceptance!)

I subscribe to or receive a dozen scientific journals. I make an effort to at least read the titles of the papers published in all of them and more often read the abstracts. There is the occasional abstract that leads me to actually read parts and, in rare instances, the whole paper, but most issues offer little of interest to either my teaching or my research. If I collected all the papers that I find relevant for my work in these 12 journals, in most years I would hardly get more than the equivalent of a single issue of *Operations Research* or *EJOR*. It seems that most of my colleagues have the same experience. So why do I collect all these journals? They certainly look impressive in my bookshelves (although after a while their spines tend to fall apart)! But that is hardly a good enough reason to spend close to $2000 on subscriptions? It is true, our graduate students borrow stacks of issues frequently, usually after a time consuming search for a dozen or so journal issues, each containing a single articles of interest. The lucky one may find a special issue on a topic that has several relevant papers. But that is simply a convenience of not having to visit the university library.

There is a further, disturbing phenomenon happening. All too often the material presented in the journals may already be out of date by the time it reaches the printing press, due to the slow refereeing and clogged-up publishing process. I receive more useful and up-to-date stuff from colleagues at other institutions in the form of discussion papers or preprints. Some of my colleagues tell me that they get their latest up-to-date information about research going on or in progress through the Internet. Do you have the same experience?

There is little doubt that OR/MS is a fast moving discipline. New approaches, new algorithms, improved versions of old algorithms, new computer implementations, and novel applications occur at a fast rate, too fast for the journals to keep up. In fact, as Grant Read recently remarked to me, the up-to-date researcher and practitioner is miles ahead of the material published in journals. So, are the journals losing

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their relevance, except for the bean counters at the annual promotion exercises at our universities? Should we be looking at a completely new form of dissemination of research results? For instance, via Internet or the WWW? How can we still make sure that some of the chaff get separated from the corn — some form of refereeing procedure — so that we are not drowning in an overload of mainly worthless information? Computer Science is another field where new development occur at a faster and faster rate. The discipline has already made a partial switch away from journals to have new developments published in the form of minimally refereed conference proceedings, available at the conference itself or shortly afterwards. Should we copy them? It would mean abandoning the policy that all submission to OR conferences are accepted no questions asked. (I personally would welcome that.)

Grant Read pointed out that some form of printed journals could still be useful. Rather than publish regular issues covering a hodge-podge of papers, journals could only publish special issues, dedicated to a given topic. Some of that is already going on. In particular, *EJOR* regularly features special issues under the editorship of recognized experts on the topic. So, why not go a step further? Rather than the hodge-podgeapproach, related papers received and accepted over a given time span on one general topic (or possibly two) could all be collected in a single issue and published as soon as such an issue can be filled, without sticking to a strict periodic schedule of one issue per publishing period. There could even be an explicit understanding that no more than x issues would be published per year. Under such a scheme, topic areas where lots of advances are made would fill their issues faster, while areas with slower rates of output would have fewer issues.

Under such a radical scheme, it would be desirable for journals become somewhat narrower in the topics they consider for publication or that several journals cooperate. For instance, *Management Science, Operations Research, Transportation Science, Mathematics of OR, Journal on Computing, ISR, Organization Science, and Marketing Science,* all published by INFORMS, could pool all their papers and publish them as special issues in the most relevant journal. I am convinced that this would speed up the rate at which hot topics get published. It would also mean that the quality of journals would become more uniform. This would make it less important to publish in prestige journals, since those cooperating would all become prestige journals.

RESOURCE-CONSTRAINED PROJECT SCHEDULING: *Recent Research Results*

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There is significant interest in project scheduling by both practitioners and researchers. A project where both minimal and maximal time lags between successive activities are permitted can be modelled by a cyclic activity-on-node network. Maximal time lags occur, for example, if there are prescribed deadlines or time windows for certain activities. If renewable resources (for instance, machines) whose given capacity is limited are required for carrying out the activities of the project, even the problem of finding a feasible solution is NP-hard.

Two types of objective functions to be minimized occur in practice: project duration (makespan) and measures (of variations) of the consumption of resources (resource levelling). For both types of optimization problems, efficient heuristics have been developed which solve approximately problems with hundreds of activities and several resources: truncated branch-and-bound procedures and, for the minimum project duration problem, priority-rule methods (cf. Brinkmann & Neumann 1995 and Neumann & Zhan 1995).

Make-to-order production has become more and more important in recent years. In make-to-order production, given customer orders and prescribed delivery dates have to be met. In addition, the limited capacity of machines must be observed, and overlapping operations are permitted without the interruption of any jobs. The problem of finding an optimal machine schedule can be modelled as a resource-constrained project scheduling problem (cf. Neumann & Schwindt 1995).

A capacity-oriented hierarchical approach to make-to-order production has been devised by Franck et al. (1996). The planning stages of capacitated master production scheduling, multi-level lot sizing, temporal and capacity planning, and shop-floor scheduling are considered. The optimization problems arising at most stages are modelled as different types of resource-constrained project scheduling problems.

GERT networks have been introduced to model projects whose evolution in time is not uniquely determined in advance (stochastic evolution structure of the project) and where feedback is permitted. The essential features of GERT networks as compared to CPM or PERT networks are that GERT networks possess more general arc weights, several different types of nodes (containing stochastic elements), and cycles to represent feedback (cf. Neumann 1990).

A few single-machine scheduling problems whose precedence constraints are given by tree-like GERT

networks can be solved in polynomial time. Examples are: minimizing the expected weighted sum of the completion times of the activities, or minimizing the maximum expected lateness of the activities (see Neumann 1990). All scheduling problems with two or more identical parallel machines and GERT network precedence constraints are NP-hard. Recently, two types of heuristics for such problems with objective functions $E(maxC)$, $maxE(C)$, and $E(\acute{O}C)$ have been proposed, which are generalizations of algorithms for corresponding deterministic scheduling problems and priority-rule methods (cf. Neumann & Zimmermann 1996).

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Professor Neumann is visiting at the Dept of Management Systems, University of Waikato, Hamilton, NZ, from 29 January - 31 March 1996

O.R. AT MASSEY — An Overdue Update of the Past 3 Years

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OR at Massey has undergone several personnel changes in recent times. From the Mathematics Department, Chris Price left for the Defence Scientific Establishment in Auckland, where his first assignment was to attempt to distinguish between whales and submarines. Chris' research areas are semi-infinite mathematical programming and numerical analysis, neither of which would help him much with such ptoblems; fortunately, like many OR people, he was also trained as an engineer. Julie Falkner replaced Chris, but has subsequently left herself, opting for the unpredictability of Montreal's climate over the all-too-predictable Palmerston North weather. Readers will recall that Julie is also a mathematical modeller/ programmer, with a major research focus of large-scale rostering and scheduling, and her new position is in the transportation research section of GERAD (Groupe d'études et de recherche en analyse des décisions) – mostly in blizzard conditions, we assume. She managed to fit a wedding into her busy schedule. Mahyar Amouzegar has replaced Julie; he arrived from LA in early November last year with his wife and two daughters, after completing his PhD in the Department of Electrical Engineering at UCLA. Mahyar also has a degree in Applied Mathematics from San Francisco State University, and much prefers to say he is from San Francisco than from LA. Wise choice. Mahyar is another mathematical programmer, with interests in global optimization, numerical analysis and environmental applications of OR. We hope he stays longer than his two predecessors, and already continually remind him that PN is a better place for children than is Auckland.

Mark Bebbington joined the Statistics Department as a Lecturer in OR in 1993, after completing a PhD at Cambridge and a Post-Doc at the University of Queensland. His interests lie in Applied Probability, stochastic modelling and computational methods for stochastic processes . Oh, and don't forget Bridge. Or golf. Mark is originally from Wellington, and commutes regularly. We are sad to have lost the talents of Charles Lawoko this month. Although primarily a statistician, Charles taught the Time Series Analysis papers for the OR major. We wish him and his family all the best for their new life in Brisbane, where Charles has taken up a research position at QUT/University of Queensland. Jeff Hunter has been elevated to the Deanship of the Faculty of Information and Mathematical Sciences, so he now has very little time for either research or teaching in OR – except for the optimal scheduling of meetings, the optimal size and

location of circular filing systems, and the minimization of queues outside his new Dean's Suite.

Three PhD students have completed their studies over the past two years. Mark Byrne investigated techniques for solving vehicle routing problems for routes involving both pick-up and deliveries; he is now working for a consulting company owned by the owners of Telecom as a software engineer in NZ, Canada and the US. Peter Frizzell also looked at vehicle distribution and location problems, this time including split deliveries and stochasticity in the data; he is working for a private consulting firm in Wellington, dealing mainly with Geographic Information Systems development and applications. Shane Dye, an ECNZ Scholar, developed a model for NZ's hydro-thermal electricity generation system, using network techniques and progressive hedging strategies. He is now in the second year of a prestigious Norwegian Telecom 3-year Post-Doc at the University of Trondheim, a highly-rated centre for stochastic programming research. As their supervisor, I am proud of their achievements, but annoyed that they all earn more than I do – there must be a lesson there somewhere! A fourth PhD student, Kelvin Watson, submitted his thesis on January 18, the anniversary of his 2-year minimum time limit; his topic was graph theoretic facility layout. Pahiatua born and bred, Kelvin has since found employment in Palmerston North, actually using OR. Four other students are currently pursuing PhD's in OR, in the areas of of Competitive Routing, Search and Rescue, Physical Distribution and Stochastic Orienteering. As we all know, OR is an attractive mix of theory, modelling, computing and application, attractive to high calibre students with quantitative backgrounds who are dissatisfied with the clinical abstraction of mathematics or the empiricism of statistics.

Undergraduate numbers in OR remain steady, but will hopefully increase due to the greater awareness of OR provided by the initial offering of 60.140 Introduction to Operations Research in 1995. Student numbers at the 200 and 300 level are down in 1996, at only 16 and 10 respectively; this is possibly due to the fallout from the decreasing popularity of Mathematics. At the 400-level there are three times as many students in the OR papers as there are in the Mathematics papers, so there is some hope. We will continue to try to improve the profile of OR at Massey, and take advantage of the introduction of OR material in the 6th and 7th forms.

SIMUL8

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Simul8 (get it?) is a Windows, icon-based simulation package. Underneath, I understand from the author it is basically a modified three-phase package but you don't need to worry about any of that because the model is entirely created from a Windows interface.
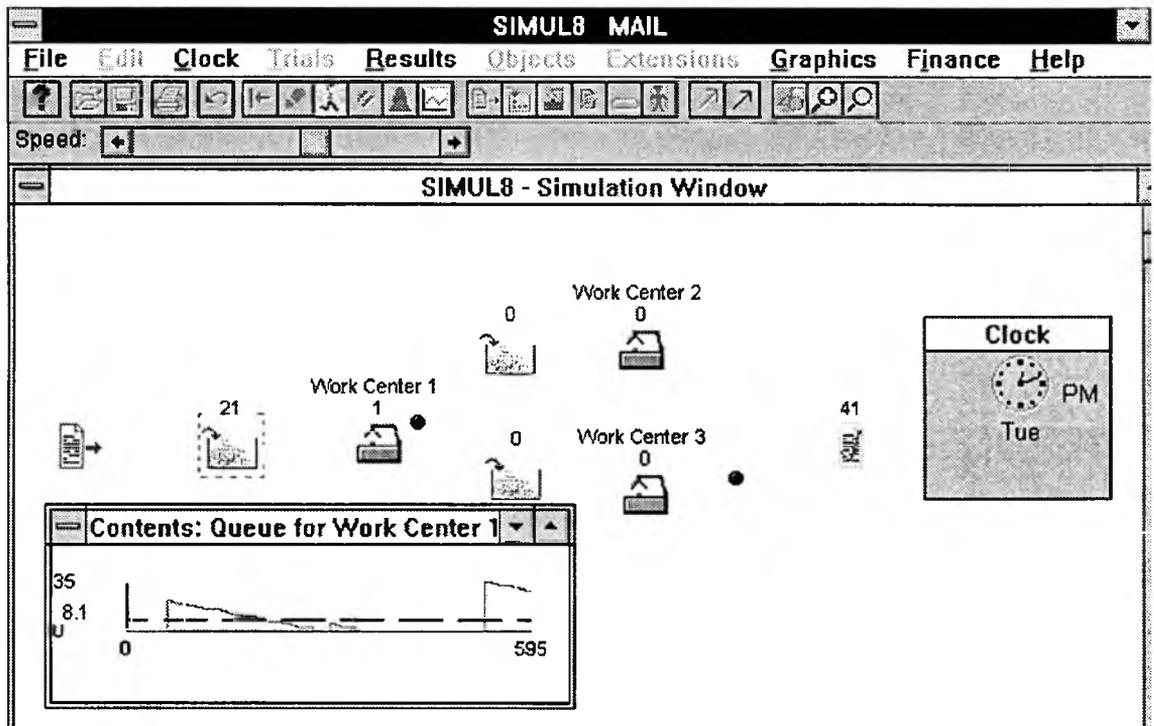
The objects you have available are: Work Entry Points, Storage Bins (these are queues), Work Centres (these delay entities or change their attributes), Work Exit Points (these destroy temporary entities,) Conveyors, and Resources (people or other items you require in order to do work). You drag these objects onto the screen to create the model, then change their attributes by clicking on them. If the path between objects is obvious Simul8 joins them up automatically, otherwise you tell it where and how temporary entities are to be routed around the model. A modest form of automation is provided automatically (little black balls moving between objects.) So a model like the one on the screen above can be set up and running in less than a minute

You can pretty-up your model by drawing or importing any kind of background picture. Objects can be hidden, and parts of the model you do not want to see can be shrunk to single icons, so models can easily be much larger than one Windows screen would suggest.

One of the nice things in the latest (Release 2) version is the automated Results and Trials sections. You select statistics you want (mean waiting times, mean queue lengths and so on) by right-clicking on them when you edit objects. Clicking "Trials" sets up a number of independent replications of the model and calculates confidence intervals which come up on the Results screen.

Where would it work best? Well it certainly fits in with manufacturing/production type models. Workcentres can break down and be repaired. The default setting for the clock is a standard work week and so on. Systems with lots of dumb entities with fairly predictable behaviours are easy to set up. It is not hard to think of complex behaviours that Simul8 would find difficult to deal with, and the output is limited to what it has available. Now in theory of course you can drop back to Visual Basic and have as complex a set of rules or measures as you like, but that seems to me to defeat the one of the great virtues of this package, which is that you can get a credible model running, in front of the client if you want. (The author of Simul8, Mark Elder, is a strong proponent of Visual Interactive Modelling and that is what obviously drives the package.) Better to use a range of "quickie" Simul8 models to get upper and lower bounds on the system behaviour.

How much and where? Well unfortunately Visual Thinking International, 141 St James Road, Glasgow, UK G4 0LT, has just increased the price to $US395. I think it is still a bargain, especially when compared with other manufacturing simulation software. It can do most of what other packages like Witness offer, but it has a lot more flexibility for general-purpose simulation as well. Visual Thinking International have an email address: *100031.2467@compuserve.com*, and a Web page at *http://www.vti.co.uk/vti/home.html*

FROM CHICKEN COOPS TO THINKING PROCESSES

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When Hans asked me to get something for the newsletter from Wellington, I agreed to spread the word amongst other Wellingtonians, which I did (and those of you whom I didn't approach can write something for next time, please!), and thought I'd better write something myself. But what topic to write on? Since then, while mulling over various topics, I have met quite a few old (of course I'm commenting on the number of years I've known them, rather than their ages) OR friends, and we have got onto the subject of what's new, and it occurred to me that my piece could as well be on what's new in my patch.

One of my old patches has been the work by Eli Goldratt, of which The Goal is the most widely read. There have been a number of recent developments here which should be of great interest to the OR community.

In the past OR people may have felt that Eli Goldratt's focus was on manufacturing and not of interest to general OR. Certainly it's true that he started off by solving his friend's production problem concerning the manufacturing of chicken coops. However, what started off as a manufacturing scheduling technique has over the years developed into a set of general problem solving tools, which are of wide applicability to all of us, in our professional and personal lives, and in community work. These tools are well suited to many problems including:
*   setting the direction of the company
*   tailoring of marketing and sales solutions
*   production and logistics
*   distribution
*   project management
*   management skills.

So how did general problem solving tools grow out of chicken coops? First I'll give a quick resume of the way things developed, and then explain why I think the new developments are important. From the chicken coops problem grew the Optimised Production Timetable scheduling technique that threw APICS into uproar, and spawned the controversial software package OPT. The scheduling techniques became popularized as the very effective Drum-Buffer-Rope (see *The Race*) or Synchronous Manufacturing method.

Later came the Theory of Constraints: the five focusing steps to on-going improvement, and the identification of the need to answer three questions essential to any process of on-going improvement:

- what to change?
- what to change to?
- how to effect that change?

This has been published in *Theory of Constraints* (1990), and the second edition of *The Goal*, which contains some 9 extra chapters from the first and revised editions.

The most recent material is a set of "Thinking Processes" to help people answer those essential questions in a logical and systematic way. These tools are based on representations of situations, actions and outcomes in tree structures, and will appear logical and understandable to most OR people - some of you may find parallels with Senge's work. However the methods are introduced with their own unfamiliar terminology, and are fairly complex in their most rigorous definition, which is a challenge. However, I think the effort is worth it, as the tools are different from what I've done before, and definitely useful.

The best way to get an idea of these latest tools is to read *It's Not Luck* (1994), the sequel to *The Goal*. Like *The Goal*, *It's Not Luck* is in novel form, and features anti-hero Alex Rogo - this time in the elevated role of executive VP in charge of a diversified group of companies. As with its predecessor, *It's Not Luck* intertwines Alex's personal and business dilemmas, and introduces the reader to the Thinking Processes indirectly as Alex grapples with the problems.

I'd then recommend a book *called The Theory of Constraints and its Implications for Management Accounting*, by Eric Noreen, Debra Smith and James T. Mackey, the result of an independent research project sponsored by the Institute of Management Accountants (USA) and Price Waterhouse (Paris, France), published by North River Press, 1995. This book summarizes TOC and critiques its use in a number of companies in a series of case studies. As expected, it particularly focuses on the accounting aspects (which haven't been fully treated before), but provides excellent all round coverage.

Another useful introductory booklet is available from the Avraham Y Goldratt Institute office in Auckland. This is the Institute that Eli Goldratt set up and named after his father, to develop and disseminate common sense approaches to solving increasingly more difficult problems. The AGI offers training courses and trainer licensing programmes. Their Auckland office address is PO Box 1639, Auckland, ph 262 0944, fax 262 2904, and it services Australia and NZ. Most of the books referred in this article, as well as the general introductory booklet, are available from the institute. They are also available at some bookstores, such as VUW's Victoria Book Centre. Those wanting an even fuller treatment, can refer to Bill Dettmer's book, or go to the AGI for training courses.

I have been on one of the AGI courses here in NZ and, while I am still getting to know the latest tools, I have found them to be very effective so far. AGI's management skills workshop is of very general interest, and is a good way to start learning tools that can be used every day, such as resolving day-to-day conflicts, chronic conflicts, dealing with half-baked ideas, achieving ambitious targets, giving clear instructions, etc.

Finally, you can access a couple of web-sites or join a newsgroup/mailing list to get more info:

- Constraint Management: *http://vancouver.wsu.edu/fac/holt/em596cm.html*
- Crazy About Constraints *http://www.lm.com/~dshu/toc/cac.html*
- and the newsgroup/mailing list you can subscribe to by sending the following command in email:

"subscribe toc-1 emailname@address" to *LISTSERV@NETCOM.COM*

Have fun!

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MORE ON MILK TANKER SCHEDULING

Chuda Basnet and Les Foulds, University of Waikato, and John Wilson, Loughborough University Business School, a recent visitor to Waikato, have worked on various issues, applying their FleetManager milk tanker routing DSS in the NZ dairy industry. Here are the abstracts of a couple of their recent papers on two of these issues.

A Decision Aid for Milk Tanker Pump Scheduling

We report on a decision support system (DSS) that recommends solutions to a particular vehicle allocation problem occurring in the New Zealand dairy industry. The DSS has been developed for use by New Zealand milk tanker schedulers. It is designed to aid them in the allocation of tankers to milk collection routes in order to alleviate pumping bay congestion, which occurs when the tankers return to unload milk at a processing plant. The DSS enables its users to remain in control of the tanker allocation process, while usingtheir own experience and preferences. We describe the issues involved and the type of help that the schedulers need. We introduce a typical allocation problem and describe some heuristics for its solution, which are incorporated in the DSS.

Key words : Vehicle allocation, milk tanker scheduling, decision support systems, microcomputer applications, New Zealand, pumping bay.

A Heuristic for Vehicle Routing Over Tree-like Networks

We describe a new heuristic for the collection of milk by road tankers in rural New Zealand . Typically the road system encountered in this environment comprises a network of farm roads, leading off a major highway which forms the spine of a tree-like network. Farms must be allocated to tanker collection routes, with tanker capacity and driving time being major limitations. The heuristic developed attempts to minimize the total collection costs incurred by the fleet in transporting the milk to a central processing facility. The approach takes advantage of the tree-like stucture of the network. Implementation issues are discussed.

Key words : milk collection, vehicle routing, tree network

WORLD WIDE WEB NEWS: How you can search for papers in OR online

Dr David Smith, the editor of *IAOR*, says:

An experimental version of the Annual Comprehensive Index (ACI) is now online at INFORMS. It can be accessed through *http://www.informs.org/Biblio/ACI.html*

The ACI is a collection of bibliographic references going back to 1982. It includes references to all papers in ORSA/TIMS journals for 1982-87, and references about 150 research journals from 1988 through 1993. The papers are indexed to reviews in the *IAOR*. However, the ACI does not contain the abstracts. If a paper is found, either using author search or keyword search, it will only identify the source journal. For an abstract, you still need to consult the *IAOR* journal directly.

Once the bugs are our of the system, it will be updated to make it current. References for 1976-1981 will be added. The Endnote compatible files for downloading will be reoffered. He urges us to check it out and write comments to:

Michael Trick, Editor INFORMS Online,
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TREASURY TALK

Andrew Mason, Department of Engineering Science, University of Auckland, Auckland, NZ
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Following the move of Council to Auckland, the past few months have been spent developing a new database system to assist in the financial management of our society. The input from Matthew Hobbs, our previous treasurer, has been invaluable in getting these systems up and running. Thanks, Matthew.

Subscriptions to the society are now due. All members (except those who joined during this financial year, July 1995-June 1996) should have received a subscriptions form. Please return this to me as soon as possible. Even if you do not have any subscription fees owing to the society, please return your form to confirm that we have your correct mailing address and other details. Note that a discount rate of $40.50 was available to standard members only for payments made **before 22/03/96**. Hopefully, most of you took advantage of the discount.

ORSNZ COUNCIL NEWS

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The Council grappled with the following issues at its February 22, 1996, meeting:

1. The ORSNZ survey results:

The most important findings were:

- APJOR did not have much to offer (rating 1.2 out of 5.0) and it should contain less theory (rating 4.3 out of 5.0).
- The Newsletter was very important (rating 4.3 out of 5.0).
- ORSNZ should provide a mentoring service(rating 3.6 out of 5.0). However, there was not much interest from the members to become a mentor (rating 2.6 out of 5.0).
- There was overwhelming support for the WWW-page initiative.

2. WWW page

The WWW page is located at *http://www.esc.auckland.ac.nz/Organisations/ORSNZ/* and is connected to other home pages, such as IFORS and ASOR, the Royal Society of New Zealand It also lists all current ORSNZ council members and their e-mail addresses, and has a directory of individual ORSNZ members. We are seeking to establish links from this directory to all ORSNZ members.

If you already have a Home Page on your local computer, and would like this linked to your name in the ORSNZ directory then please email your full name and title, and the address of your home page to *a.philpott@auckland.ac.nz*

(Members belonging to university OR/MS groups might like to link the ORSNZ page to their group home page.)

If you currently do not have a Home Page, or a computer, and would like to be included in the directory then please write to *Dr M. Ronnqvist, Secretary, ORSNZ, Dept. of Engineering Science, University of Auckland, Private Bag 92019, Auckland, NZ*, giving your full name and title. We shall construct a Home Page for you on our Web site. Any information you want included on this page should be supplied, preferably in some computer readable form.

3. The APORS97 Conference

The APORS97 Conference is co-sponsored by ORSNZ and is in Melbourne, November/December 1997. It was also noted that there is no ORSNZ Conference during 1997. Anyone interested in planning a special session should contact Vicky Mabin who is the ASOR representative.

4. Mathematical Sciences Review

The Australian Academy of Science has completed a review of the Mathematical Sciences in Australia. One finding was that the athematical Sciences were critical to Australia's economic competitiveness and quality of life. In general, Australia possesses a sound research base but certain sub-disciplines, among them Operations Research, need to be strengthened. Copies of the Australian review can be obtained by writing to the Manager, Commonwealth Information services, Australian Government Publishing Service, GPO Box 84, Canberra ACT 2601, Australia. A similar review is to be carried out in New Zealand in 1997. Submissions will be sought from ORSNZ.

5. APJOR

There has been much discussion on whether APJOR should be bundled with ORSNZ subscriptions. It was agreed to debundle the subscription and replace it with a free copy of the conference proceedings volume. This change will come into effect after the APORS 97 meeting. There was a discussion of the possible impact of Conference attendence if the ORSNZ Proceedings were also available for non-attendees. It was decided to advertise the Proceedings volume with registration information for the 1996 Conference.

6. The ORSNZ Newsletter

The Newsletter suffers from a lack of material submitted by its readers. It is proposed to elect Newsletter correspondents from each Branch with the responsibility of co-ordinating and supplying submissions from the Branches to the Editor.

NEW MEMBERS

The following members have joined the Society during the last few months. We extend a warm welcome to Mark, Mahyar, and John, and hope to see them at the OR Conference in Christchurch:

Mr Mark Smith, Auckland
Dr Mahyar Amousegar, Massey University
Dr John Rendel, Hamilton

CURRENT ORSNZ COUNCIL MEMBERSHIP

Andrew Philpott (President) *a.philpott@auckland.ac.nz*
David Ryan (Vice President, student affairs) *d.ryan@auckland.ac.nz*
Andrew Mason (Treasurer) *a.mason@auckland.ac.nz*
Mikael Ronnqvist (Secretary) *m.ronnqvist@auckland.ac.nz*
David Robb (Council member) *d.robb@auckland*
Naomi Quirke (Council member, membership) *naomi@eymsl.co.nz*
Vicky Mabin (Council member, APORS representative) *vicky.mabin@vuw.ac.nz*
Bob Cavana (Council member) *bob.cavana@vuw.ac.nz*
John Buchanan (Council member) *jtb@waikato.ac.nz*
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This list is also contained in the WWW homepage.

GRiF PROJECT ADVERTISEMENT

Description:	ME/MPhil Project
Project Title:	Development of Optimisation-based Staff Rostering System
Corporate Partner:	Mantrack Decision Group Ltd, Auckland
Supervisor:	Dr Andrew Mason, Department of Engineering Science, University of Auckland
Funding:	Total funding of approximately $30,000 is available for this project.
Commencement:	This project must be commenced by 30 June 1996

Based in Auckland, Mantrack is one of the leading developers of employee information management systems. Mantrack have developed an information system based on the Paradox database engine that includes Human Resource Management, Payroll, Labour Costing and Time and Attendance. Mantrack have the ability in their package to record and manually manipulate staff roster patterns that have been developed elsewhere, but they currently have no optimisation system for generating such rosters.

The Department of Engineering Science has for many years been involved with roster generation, with larger projects including roster construction for Air New Zealand and New Zealand Customs. Typically these roster problems have been formulated as set partitioning problems and solved using the linear programming package 'ZIP'. While this approach will be the first examined for Mantrack's rostering system, it is likely that heuristic techniques will also have to be developed to reduce the rostering problem to one of manageable size. Column generation will also be considered as a means of handling very large problems. The exact mix of linear programming, column generation and heuristic techniques required for this problem is an open research question.

This project is being offered as the research component of a Master of Engineering (ME or M.Phil)

degree. Therefore, the student contemplating this work should have completed an undergraduate degree in either Engineering Science or Operations Research with expertise in optimisation methods. In addition to the research topic, the student will be required to enrol in 3 Masters level papers; it is expected that these will be selected from the advanced Operational Research and Information Engineering papers available at the University. The code developed during this project will be written in C, Fortran and/or Pascal, and so the interested student should have experience in at least one of these languages.

Interested students should contact::
Andrew J. Mason, Dept of Engineering Science, School of Engineering,
University of Auckland, Private Bag 92019, Auckland, New Zealand
Phone +64 9 3737599 x7909 Fax +64 9 3737468
e-mail: *a.mason@auckland.ac.nz*

MEETINGS CALENDAR

ORSNZ 32nd Annual Conference
Thursday/Friday 29-30 August 1996
SEE CALL FOR PAPERS ON PAGE 12

INFORMS Washington Spring 1996 Meeting
5 - 8 May 1996
Washington D.C.: Washington Hilton and Towers
Registration: INFORMS Washington, DC, P.O.Box 6827, Providence, RI 02940 USA
(Fee before 8 April US$160, payment by VISA or MasterCard possible)
Fax: 401-274 3189
WWW: *http://www.informs.org*

1996 Asia Pacific Decision Sciences Institute Conference
21-22 June 1996
Hong Kong: The Hong Kong University of Science and Technology, East Kowloon
Information: Kar Yan Tam, Information and Systems Management, HKUST, Hong Kong
e-mail: *apdsi@usthk.ust.hk*

4th European Conference on Information Systems
2-4 July 1996
Lisbon, Portugal
Complete papers: in the style of European J. of Information Systems of no more than 5000 words, by 30 November 1995
Information: Prof. J. Dias Coelho, ISEGI, New University of Lisbon,
Tv. Estevao Pinto, 1070 Lisboa, Portugal
Fax: 351 1 387 2140
e-mail: *ECIS96@EPSYLON.ISEGI.UNL.PT*

1996 IFORS Conference in Vancouver, B.C.
8 – 12 July 1996
Venue: Hyatt Regency, Vancouver
Conference theme: OR bridging the theory and practice of decision making
Conference Secretariat, IFORS 96, Venue West Conference Services Ltd., 645 - 375 Water Street,
Vancouver, BC, Canada V6B 5C6, FAX (604) 681 2503
Chairman program Committee: Prof. Theo Stewart, Dept. of Math. Statistics, University of Cape Town
Rondebosch 7700 South Africa
FAX +27 21 650 3918/3726
e-mail: *TJSTEW@maths.uct.ac.za*

OR 38, Warwick
3 – 5 September 1996
Warwick Business School, University of Warwick, Coventry CV4 7AL
Contact: Prof. Robert Dyson or Dr Emmanuel Thanassoulis
e-mail: *orsrd@warwick.ac.uk*

Payment

Payment may be made by cheque (made out to "ORSNZ") or by credit card. All prices are in $NZ and include GST.

Total Payment Enclosed: $_____

Credit card payments

(Mastercard / VISA)

Cardholder name _____

Card Number: _____

Expiry Date: _____

Signature: _____

Student Travel Grants:

There will be some travel grants-in-aid made to ORSNZ student members attending the conference from centres other than Christchurch. The size of the travel grants have not yet been determined, but it will be proportional to travelling distance. If you wish to be considered for a grant, you must complete the student declaration below and return this by 1 August 1995.

❑ I have completed the declaration below and wish to receive a student travel grant.

Student Declaration

To be eligible for student conference fees, student membership or student travel grants, you must complete the following declaration.

I, _____ declare that I am currently a student enrolled at:

Department: _____
Institution: _____

Signed: _____
Date: _____

Signature of Head of Department or Supervisor:

Signed: _____
Date: _____

Skiing Opportunities

Christchurch has several ski fields within two hours drive of the city.

For those who wish to take the opportunity to do some skiing. Trips to the ski field can be made using the Mount Cook Line's ski bus service to Mount Hutt.

❑ Yes I'm interested in more information on skiing opportunities in the Canterbury Region either before or after the conference.

OPERATIONAL RESEARCH SOCIETY OF NEW ZEALAND

32nd ANNUAL CONFERENCE

29th - 30th AUGUST 1996

UNIVERSITY OF CANTERBURY
CHRISTCHURCH
NEW ZEALAND

ORSNZ 1996 REGISTRATION

Tax Invoice (all fees include GST) 30/6/96
Operational Research Society of
New Zealand (Inc.),
GST No.: 55-449-481

**Please return
completed
form to:**

ORSNZ Conference 96
c/o Ross James
Department of Management
Private Bag 4800
Christchurch
New Zealand

Name _____

Title _____

Address _____

_____

_____

Wording for Name Tag:

Name: _____

Affiliation: _____

May we include this information on a   Yes ❑
list of conference participants?   No ❑

Arrival Time

Will you be able to register on the   Yes ❑
Wednesday night? (and join us in a   No ❑
pre-conference social)?

Will you be arriving in time for   Yes ❑
breakfast on Thursday?   No ❑

Conference and Dinner fees:
The conference fee includes a copy of the
proceedings, breakfasts, lunches.

Member†	❑	$180
Non member†	❑	$210
Student member*	❑	$70
Student non-member*	❑	$80
Late Fee (payable after 1 August)	❑	$20

Dinner Tickets**
_____ guests @ $50 = $ _____

Young Practitioner Prize Entrant§   ❑   -

Extra Copies of the Proceedings
_____ copies @ $20 = $ _____
(Add $2 postage and packing if not
attending the conference)

Annual Membership Fee (1995/96)	❑	$45
Student Annual Membership Fee* (1995/96)	❑	$15

Total $ _____

†   Includes the Conference Dinner
§   The cost of the conference dinner will be
     subsidised for YPP entrants. Entrants are asked
     to pay the appropriate conference fee and dinner
     fees (if applicable). Refunds will be made at the
     conference.
*   Please complete the student declaration on back
     of this form.
**   Guests and students not presenting papers are
     welcome to purchase tickets for the dinner.

Accommodation
Accommodation is available in the Rochester and
Rutherford Halls or local motels.

Motels
* Academy Motor Lodge, 62 Creyke Rd,
  Fendalton, Ph 03-351 9347
* Ascot Vale Motor Lodge, 296 Riccarton Rd,
  Upper Riccarton, Ph 03-348 0207 Fax 348 1636
* Ilam Motel, 250 Riccarton Rd, Upper Riccarton,
  Ph 03-348 5983

Hostel Accommodation:
The full amount is payable with registration form and
must be received by 30th June.

Wednesday Night   ❑
Thursday Night   ❑
Friday Night   ❑

_____ nights @ $38.25 per night = $_____

These rates include breakfast. Guests at the hostel
may choose to have breakfast at the hostel or join
the rest of the conference participants at the
conference venue. For catering, please indicate
whether you wish to have breakfast at the
conference venue.

I will be requiring breakfast at the   Yes ❑
conference venue   No ❑

Guidelines for Papers presented for the 1996 ORSNZ Conference

Joe J. Bloggs
Department of Operational Research
University of Anywhere
New Zealand
j.bloggs@anywhere.ac.nz

Abstract

This document provides style guidelines for authors submitting papers to the 1996 New Zealand Operations Research Society conference being held at University of Canterbury, Christchurch, New Zealand in August 1996.

1   Layout Guidelines

Papers submitted for inclusion in the proceedings of the 1996 conference of the New Zealand Operations Research Society should conform to the following guidelines as closely as possible. Authors are responsible for preparing their documents in "camera-ready" form; laser-printer or similar quality is expected. All submissions are expected to be on paper. We will only accept documents electronically if they are Word Perfect or MS Word files which are likely to print out correctly first time.

This document specifies the font sizes and spacings required.

Your paper should use A4 paper with a 2.5cm margin at the top, a 1.5cm margin at the bottom, and 3cm margins left and right; this leaves 15cm of text per line. Do not put page numbers on your paper, but instead write the page numbers using a light pencil on the reverse of each page. Papers (including abstracts, tables, figures and references) are restricted to no more than 6 pages. Papers longer than this will be returned to the authors for editing.

The title should be centred in 24 point Times. Author names and information should also be centred, in 12pt Times, and separated from the title by one line.

A solid line should be placed above and below the abstract, with the word "Abstract" centred in 14 point bold Times. The abstract body should be justified in 12 point Times using a line spacing of 15 points. (If you can't get 15 point line-spacing, please use single line spacing.)

1.1 Section Headings

Each section should be numbered and named, with section titles in 14 point bold Times and sub-section titles in 12 point bold Times. There should be a 20 point space above and an 8 point space below each section title (or 1 line above and below if you can't achieve this).

The body text should be justified 12 point Times on a line of 15 points. (As before, use single line spacing if you can't get 15 point spacing.) Paragraphs following a heading should not be indented.

Subsequent paragraphs should have a 6mm indent with no spacing above or below the paragraph. Footnotes[1] should be numbered consecutively through the document.

Diagrams and tables should be included in-line with the text as near to the first point of reference as possible, as illustrated by Figure 1. They should be centred and have consecutively numbered and centred captions in 12 point Times.

Test Figure
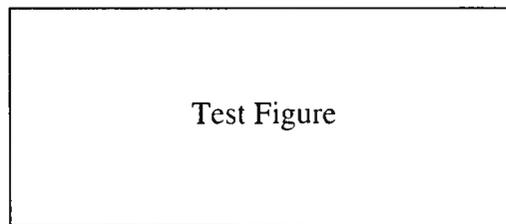
1. Figures and their captions should be centred.

References should be numbered in the text [1], and appear alphabetically ordered at the end of the article in the style shown.

To aid legibility and consistency, all text should be in Times; the use of multiple fonts is distracting. The use of all capitals slows reader comprehension and should be avoided. Do not use underlining - italics should be used if emphasis is required in the text. And please remember to use a spelling checker.

Acknowledgments

Acknowledgments can appear in an un-numbered section preceding the references.

References

[1] J.J. Bloggs, T. Smith, *Typography*, Pitman (1967)

[2] D. Teddy, *Strategy for the Purchase of Cars for a Rail Network*, Transport Displanning (U.K.), 12 (1983), pp 39--44.

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[1] Footnotes should appear in 10 point Times, with a short line separating them from the text.

INFORMS Atlanta Fall 1996 Meeting
3 – 5 November 1996
Atlanta Hilton & Towers, Atlanta GA
General Chair: Faiz A. Al Khayyal, Georgia Institute of Technology
School of Industrial and Systems Engineering, Atlanta, GA 30332-0205
e-mail: *FALKHAYY@GTRI01.gatech.edu* (note: it is gtri zero one)

INTERNATIONAL CONFERENCE ON OPERATIONS AND QUANTITATIVE MANAGEMENT
5 – 8 January 1997
Jaipur, India
Call for papers: abstract of max. 100 words with US$20 submission fee by 25 June 1996.
General chair: Omprakash K. Gupta, Indiana University Northwest,
3400 Broadway, Gary IN 46408-1197, USA
FAX: 001 219 980 6579; *e-mail: ogupta@ucs.indiana.edu*

THE INTERNATIONAL INSTITUTE FOR GENERAL SYSTEMS STUDIES
9 – 11 Jan. 1997
Southwest Texas State University, San Marcos, Texas USA
Main speakers: George J. Klir, Tuncer Oren, Lofti A. Zadeh
Call for papers: Two copies of abstracts of at least 800 words plus a one page summary by 10 June 1996. For more details contact
Dr Yonghao Ma, Co-chair
Dept. of Math., Southwest Texas State University, San Marco, TX 78666 USA
e-mail: *ma@iigss.math.swt.edu*

INFORMS San Diego Spring 1997 Meeting
4 – 7 May 1997
Town and Country Hotel, San Diego CA
General Chair: Fred Raafat, San Diego State University, College of Bus. Adm.
San Diego, CA 92182

INFORMS Barcelona 1997 International Meeting
7 - 10 July 1997
Barcelona, Spain
Organizing Chair: Jaime Barcelo, Navarro Reverter 33, Barcelona 08017, Spain
e-mail: *BARCELO@EIO.UPC.ES*

APORS' 97 – 4th Conference – PRELIMINARY ANNOUNCEMENT
30 Nov. 1997 – 4 Dec. 1997
Melbourne, Australia
Invitation to be added to mailing list, contact: APORS' 97, c/o ASOR Melbourne Chapter
GPO Box 1048H, Melbourne, Australia 3001
e-mail: *P.Lochert@sci.monash.edu.au*
FAX (61) 3 903 2227
If you intend to give a paper or organize a session, contact P. Lochert

INFORMS/CORS Montreal Spring 1998 Meeting
26 – 29 April 1998
Queen Elizabeth Bonaventura Hilton, Montreal, Canada
General Chair: Paul Mireault, École des Hautes Études Commerciales,
5255 Avenue Decelles, Montreal, Quebec
e-mail: *Paul.Mireault@HEC.CA*

29th – 30th AUGUST 1996
University of Canterbury
Christchurch, New Zealand

Keynote Speakers
1. Professor Clay Whybark, University of North Carolina, Director of the Global Manu
facturing Research Center.
2. A Prominent Australian OR professional will address the conference on OR in Australia.

Call for Papers
Deadline for abstracts (maximum of one page A4 12pt) - 1 May 1996
Deadline for Summary Papers (For format see "Guidelines for Papers") - 1 July 1996
All papers should be sent to:
ORSNZ Conference 96, C/- Dr Ross James
Department of Management,University of Canterbury
Private Bag 4800,Christchurch, N.Z.

Important Dates

1 May	Deadline for Abstracts
30 June	Deadline for Halls Accommodation
1 July	Deadline for Papers
1 August	Last day for Conference Registration before late fee imposed
29 August	The 32nd ORSNZ Conference

Student Project Prize and Young Practitioner Prize
    ORSNZ wishes to promote and encourage excellence in student project work in OR. The Council
invites students, who completed a practical project in 1995 as part of their undergraduate or first graduate
degree at a NZ university or technical institute, to submit their work as an entry into the 1996 Student
Project Prize. The deadline for submission is Friday, 10 May 1995. The Prize is about $300. For detailed
information and a copy of the entry form, please contact:
    Prof. David Ryan, Dept. of Engineering Science, University of Auckland
    Private Bag 92019, Auckland, N.Z.
    FAX (09) 373 7468   e-mail: d.ryan@auckland.ac.nz

    ORSNZ also wishes to encourage young practitioners to submit papers for the Young Practitioner's
Prize. To qualify, the paper must be presented at the conference, be singly authored, and the author must be
under 25. Two full copies of the paper must be in the hands of the conference secretary, clearly labelled as
submission for the prize, by 1 July 1996. Up to three awards will be made from a total prize pool of $1000.