Newsletter

Operational Research Society of New Zealand (Inc.)

March 1994

Editorial

Another issue ready - finally! This newsletter appears when time allows, but more importantly when material is supplied. ***And not enough is sent***...so Hans Daellenbach, at the Department of Management, Canterbury University, has agreed to bludgeon copy from members which I will assemble into a newsletter. ***So please submit something to Hans***...preferably typed, on a disc in some sensible format. The newsletter needs more articles, photos, puzzles (and solutions - any to the Glass Rod problem in the last issue?).

Simon Carr

Newsletter Editor

1993-94 ORSNZ Council

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Minutes	M Pickup

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ORSNZ News

New Members

Jason Laws	Marketing Information Officer	Auckland
Mikael Ronnqvist	Lecturer, Engineering Science	Auckland
Tim Robinson	Transport Analyst	Rotorua
Howard Silby	Student	Wellington
Maurice Bone	Systems Coordinator	Wellington
Graeme Basire	Student	Wellington
Andrew Kerr	Student	Christchurch

Reduced Subscription to NZMS for ORSNZ Members

At the NZ Mathematical Society's Council meeting in August it was decided that NZMS members who are concurrently members of the NZSA or ORSNZ could apply for exemption from subscription to that part of the NZMS membership fee related to the NZ Journal of Mathematics. Under the new ruling the subscription would be reduced from $52.90 to $36.00 (inc GST) for members who are concurrently members of the NZSA or ORSNZ and do not wish to receive the journal.

Professor Peter Whittle - Companion of Operational Research

From the OR Society January 1994 newsletter:

'The Operational Research Society is pleased to announce that Professor Peter Whittle, who has been Churchill Professor of the Mathematics of Operational Research at Cambridge University since the late 1960s, has been made a companion of Operational Research. The citation reads:

'Peter Whittle retires this year after 26 years as the first Churchill Professor of Mathematics of Operational Research at the University of Cambridge. During that time and during his previous appointments at Cambridge University and Uppsala University and a Professorship at the University of Manchester he has made major contributions to the mathematical theory underpinning optimisation of stochastic systems and optimal control. He was made a Fellow of the Royal Society in 1978 for his work, and was the first person in the UK to be awarded the Lanchester Prize by ORSA for work in his book "Systems in Stochastic Equilibrium" in 1983. A New Zealander by birth, he worked for six years for the DSIR. As well as being one of the major world figures in the development of the optimisation of dynamic stochastic systems, he has been interested in their application to real problems. His work on stochastic equilibrium is proving very useful in telecommunication networks while "restless bandits" (?-Ed) are finding practical solutions'.

1993 ORSNZ Conference Report

Jonathan Lermit

Arriving the night before, I was a little apprehensive. It had been the usual mad rush to get away, I nearly missed the plane, and I was wondering would it be worth it. Of course I need not have worried. It was a superbly organised conference, interesting and useful, and it ran very smoothly, even if one taxi driver couldn't find the conference dinner venue! Everybody was able to catch up with old friends and make new ones.

The joy of the conference proceedings is the large number of practical papers. Unlike the Journal, which is full of learned articles that I for one cannot understand, there is a wealth of practical ideas that can be applied. In many cases, the same ideas can be applied in a number of fields. It is good to see that many companies, although driven by profit and secrecy, are still willing to let people talk about their work at conferences.

The large number of papers meant that parallel sessions were needed. This can be a mixed blessing, as you inevitably miss something of interest. It is hard sometimes to choose between the practical and theoretical papers - so much is going on in OR, and NZ seems to be in the thick of it.

The conference got off to a good start with Bob Cavana talking about the wine industry. Unfortunately it was too early in the morning for free samples!

Some highlights for me - on the theoretical side, the paper by N Zhu and Tony Vignaux on the Constrained Knapsack Problem is a significant theoretical breakthrough (if I understood it correctly!). Similarly, John Roper-Lindsay's 'Optimising the Optimiser' shows that there is good work going on in basic LP techniques. On the practical front, the paper by John George et al on Electoral Districts was fascinating - it will be needed for MMP!

As always, our invited speakers from overseas were great value. In particular, Bruce Murtagh's latest optimisation work was of great interest. Keeping up with overseas work is always difficult, and a live presentation beats reading journal papers any day.

As is often the case, the student papers were a major highlight of the conference. The students seem to be getting brighter (and younger!) every year, and they are putting a lot of work into these projects. I'm sure that there is many an experienced practitioner who would be proud to present papers of this quality. A couple of my favourites were Jason Laws' paper on 'Optimal Expansion Strategies', and Curt Hjorring's on 'Vehicle Routing Problems'.

Hopefully, these students will be able to find useful and interesting employment in OR for at least part of their working lives. A lot of the credit must go to our fine band of lecturers who are providing the inspiration, and industry which is providing the problems and working with the students.

I was struck by the large number of people from outside the immediate OR circle. Many conferences have been pretty much 'closed shops' but in recent years we have been more outgoing, so that even though no specific group was invited to join us, there were a number of people willing to take an interest in our work. This bodes well for the future, as there are thousands of OR problems out there, just waiting for someone to recognise them as OR.

I went away with the feeling that OR in New Zealand is in good hands, both intellectually stimulating and contributing to the economy. Academics, practitioners, and students alike are doing excellent work and enjoying it. Long may this remain so.

1993 Young Practitioner Prize

Andrew Mason

The Young Practitioner Prize Competition for 1993 was held in conjunction with the 29th ORSNZ Conference. There were six entrants for this year's prize. Each entrant was required to submit a singly authored paper to be included in the Conference Proceedings and was also required to present their work during a special session of the conference.

The Young Practitioner Prize was developed to replace the Student Paper Prize in the hope that it will encourage young practitioners as well as students to attend the Conference and present their work to other members of the Society. The rules for the Young Practitioner Prize are based on the previous Student Paper Prize, but the conditions for entry were broadened to include young practitioners provided they were under 25 at the time of the Conference.

Unfortunately, our efforts to attract young practitioners as well as students were unsuccessful! All the entrants were able to claim student status (even though two of the entrants were no longer students).

The entries were judged by Professor Alastair MacCormick (University of Auckland), Ms Karen Garner (Industrial Research Ltd.) and Dr Grant Read (University of Canterbury). The standard of both the papers and the presentations was very high and the Judges' task was not easy.

Competition Results

First Prize

Curt Hjorring, Auckland University

Using Genetic Algorithms & the Petal Method to Solve Vehicle Routing Problems

Second Prize (Joint Award)

Mark Craddock, Auckland University

A Network Model for Optimal Power Generation in a Hydro-electric System

Geoff Gill, Auckland University

Optimal Container Packing to Fill Order Book

1993 Prize Winners

Curt Hjorring graduated with a BE(Hons) from the Department of Engineering Science in Auckland in 1990 and is currently a PhD student, working on the Vehicle Routing Problem (VRP). The approaches being investigated are based around the petal method, which solves a restricted version of the VRP. Curt has co-authored a paper in the Journal of the Operational Research Society detailing improvements to this method. In the paper submitted for the Young Practitioner Prize Curt described the use of a Genetic Algorithm and the petal method to solve VRPs. An initial population of solutions is generated and solutions are combined using a specially designed crossover operator. The operator takes a route from one solution and then adds the remaining deliveries from the other solution. Initial results are encouraging, and a basic version of the Genetic Algorithm competes well with the tabu search method.

Mark Craddock graduated in 1991 with a BE(Hons) from the Department of Engineering Science at Auckland University. Mark is currently studying towards a PhD in the same Department. Research interests include the development of algorithms for continuous-time network programs, an extension of conventional linear programming theory, and other aspects of linear programming theory. For the student paper, Mark presented an application of continuous-time Linear Programming algorithm for the hydro-electric scheduling problem. This problem seeks to find a schedule of water releases through a hydro-electric power scheme which will generate a required hourly demand of electricity.

Geoff Gill writes:

I have always been very interested in mathematical problems that are easily understood, but difficult to solve. My desire to solve logistic type problems motivated me to do a BE in Engineering Science at Auckland University. In 1992, my degree project was to generate suitable schedules for packing reels of paper into standard shipping containers for New Zealand Forest Products (NZFP). The computer program that I developed generated better schedules than those that NZFP generated. In 1993 I began my ME, and again I chose to specialise in Operations Research. My Master's project involved the same Container Packing problem, but now I am experimenting with a different way to find good schedules.

Operations Research at Massey University

Julie Falkner and John Giffin

Massey does not have a separate OR Department - Yet! Currently OR at Massey is centred in the Departments of Mathematics and Statistics, but there is also an umbrella grouping involving staff from Economics, Finance and Production Technology. Staff swearing primal allegiance to the OR flag are Julie Falkner, John Giffin and, due to arrive in early 1994, Mark Bebbington; those with dual allegiances are Chin Diew Lai, Gordon Smith and Adrian Swift; most confused of all is Jeff Hunter (that's why he's the Chairperson and a Professor!)

Majoring degrees in OR are available in Arts, Science, Technology, and the School of Mathematical and Information Sciences. While undergraduate student numbers are not large - although OR now graduates as many majors as does Mathematics - our post graduate program is enticing a consistently high-quality stream of Scholarship winners (mainly mathematicians who have seen the light). The post graduate options available include the new (extramural) Diploma in OR with ten enrolments, the MA/MSc (two completed, three in progress) and the PhD (one completed, five in progress).

Research interests of OR staff include applications of linear and integer programming, applied and computational probability, reliability, quality control, queuing theory, numerical analysis, heuristics, vehicle routing and scheduling, graph theoretic layout and location, and nonlinear optimisation. Opportunities are now also arising for consulting in the greater Palmerston North region (ie Wellington).

Massey will be hosting the 1994 OR conference, jointly with the NZ Statistical Association in the last week of August. We can't promise glORious weather, but we can promise infORmative seminars (hORrendous puns, gOuRmet cuisine, ORful spelling?) and/OR a memORable time.

International Transactions in Operational Research

A free sample of this new quarterly IFORS Journal is available from the publisher (see below). The journal aims to advance the understanding and practice of operational research on an international basis.

International Transactions in Operational Research
Pergamon Press (Journals)
PO Box 242, Northbridge, NSW 2063 Australia
Ph +61 02 958 4429 Fax +61 02 967 2126

Annual subscription	*$230 US*	*£150UK*
Personal subscription	*$83US*	*£54UK*

Soft Systems Methodologies:

New OR/MS Weapon or Soft-Way-Out?

H G Daellenbach

OR began as an interdisciplinary team-based approach to find better solutions to complex problems, such as the ones tackled by the teams attached to the staff of operations during WWII, or the groups that sprang up in public sector organisations, such as the Coal Board in England. With the advent of computers in the 50s and the great involvement of academics in this field in the 60s, particularly in the US, the emphasis shifted more and more towards the application of ever more sophisticated mathematical methods. This brought with it a shift away from interdisciplinary teams to single-person efforts, and a narrower focus to relatively well defined and well structured problems, rather than the less defined problems commonly found in the real world.

The operations researcher trained in the 60s and 70s mainly tackled problems where the objectives were clearly stated, the alternative courses of action and constraints on them fully known. The role of the operations researcher consisted largely of identifying which type of technique was most suitable to find the optimal solution. Some lip service to the systems approach was paid, but this was largely misinterpreted as the property of being systematic, ie logical with efficient procedures, rather than systemic in outlook, ie looking at the systems interactions and the effects of any intervention on the system as a whole. Some spectacular successes in solving highly complex and computationally difficult problems were recorded, as well as a large number of less publicised failures. By and large, the initial promises that OR would transform problem solving and would become indispensable have not materialised. A cynic would claim that the greatest success of OR has really been as an academic discipline, producing thousands of 'learned' papers, but becoming ever more remote from the real world.

There were some dissenting voices: C. West Churchman and a number of his disciples, notably Russel Ackoff in the US, but also people like Stafford Beer and Patrick Rivett in England. But they were largely ignored by the wider academic community, particularly in the US. I vividly remember West telling the OR class of 1960 at the University of California in Berkeley that, if we put our main effort in solving trivial problems for production managers, as the trend seemed to indicate, then somebody else would come along and tackle the really important executive type problem faced both by the private and public sectors. But they would not call it operations research. He was right!

These people came in the 70s and 80s, and they did not call it OR. They gave it all sorts of names and acronyms, such as Strategic Assumption Surfacing and Testing (SAST, 1969/81) by Mason and Mitroff, the Viable Systems Model (VSM) by Beer, the Soft Systems Methodology (SSM, 1972) by Checkland, Social System Science (S^3, 1974) by Ackoff, Strategic Options Development and Analysis (SODA, 1983) by Eden, Robustness Analysis (1980) by Rosenhead, and Total Systems

Intervention (TSI, 1991) by Jackson. What distinguishes them from traditional OR/MS? What can they do that OR/MS cannot? What is their place among the OR/MS methodologies?

'Hard' or structured problems are concerned with 'How' type questions. Some of the fundamental aspects are assumed to have already been settled, eg *What is/are the objective(s)? How are they measured?What are the alternative courses of action.*? If such problems lend themselves to quantification, in many instances they can be tackled by OR/MS techniques. In contrast, 'soft' or unstructured problems or rather problem situations, to use the more appropriate term, are concerned with both 'What' and 'How' questions, eg *What particular aspect of a problem situation should be addressed? What is the nature of the issue? What are its objectives? How is the change best brought about?*

Such problem situations are constantly faced by the private and public sector. They are often highly complex, both in terms of their systemic content, as well as from a human interaction point of view. Hence, the term 'wicked' problem! Soft systems methodologies, to use a potentially controversial catch-all name, tackle such 'wicked' problems. Some of the 'Hows' may well lend themselves to solution using OR/MS techniques. Viewed in this way, OR/MS is a sub-branch of these soft systems methodologies.

Most soft systems people would agree that there is no such thing as objectivity, truths, or even facts, but only subjectively perceived interpretations. The most that can be said about 'objectivity' is that at any given point in time it is a 'commonly accepted collective subjective consensus', open to be overturned at any time — one counter example is all that is needed! Soft systems people say that we see, interpret, and judge everything through a selective filter - our background, upbringing, education, and social interactions. They call it *Weltanschauung*, literally translated as *world view*. Two different people may interpret the same situation quite differently, through a personal selective filter. As a consequence, there is usually not one unique solution to a problem, but several. The solution to a given problem using a particular Weltanschauung may not be a solution for another Weltanschauung. This is one of the central tenets of soft systems methodologies. Few operations researchers explicitly recognise this concept, at their peril.

The third major difference between OR and soft systems methodologies is OR aims to find the optimal solution to the problem, while the latter seeks to create a climate or a vehicle for a dialogue which facilitates change or 'resolves' the issue considered to the satisfaction of the various stake holders. If in OR the emphasis is on identifying the optimal solution, in soft systems methodologies, the emphasis is on the process for change and resolution of the issue considered. For this reason, soft systems methodologies share many concepts and underlying theories with organisation theory and sociology, particularly the critical theories of Habermas.

Soft systems methodologies can be used for a much wider class of problem situations than OR/MS. They take a much more comprehensive view of the situation. They are particularly suitable for highly complex situations with many stakeholders who may have different world views and who may be in conflict with each other.

There is little doubt that these methodologies are here to stay. Some are still in their early childhood and will no doubt mature and develop further, as new insights are gained in their use. The typical example of this is Checkland's SSM which has undergone considerable reorientation and refinement over the last 20 years. In fact, it uses its own methodology to constantly gain more insights into itself.

There is not the space to say more on how these methodologies actually work. Numerous articles and books have been written and it too has become a mining ground for academics in the publish or perish business! A place to start would be the texts by Rosenhead or Jackson. You might also wish to attend Professor Rosenhead's one-day workshop in Wellington, April 15. People in Wellington could contact John Brocklesby, Management Group, Victoria University. His current research interests are largely in this area.

Selective Bibliography

Rosenhead J. *Rational Analysis for a Problematic World, Wiley, 1991*

Jackson M. C. *Systems Methodologies for the Management Sciences, Plenum, 1991*

Checkland P. *Systems Thinking, Systems Practice, Wiley, 1981*

Checkland P. and Scholes J. *Soft Systems Methodology in Action, Wiley, 1990*

Heuristic Decision Support Systems for Warehouses

Hamish Fraser

Warehousing involves highly repetitive functions, and many warehouses are now automated to the point where all paper transactions have been eliminated with respect to operations on the warehouse floor. Data input is often by bar code scan, and data communications by radio telephone. To gain further competitive advantage by reducing labour costs in this highly competitive, cost-minimising business, some companies automatically trigger, schedule and robotically perform item replenishments.

The activity of actually "picking" a customer order from various locations in a warehouse and accumulating items for shipping has become a major proportion of the labour cost. In all but a few situations, "load forming" has remained a manually planned and executed task. Manual planning has persisted because of the complicated, multi-objective nature of the picking task. Manual loading has remained because of the difficulty of robotically picking and stacking items with different characteristics.

A picker is faced with the task of building loads:

- As quickly as possible
- That will result in minimal product damage when the product is shipped
- That maximise utilisation of the shipment vehicle
- That closely meet customer unloading requirements

This list can be further broken into more than 20 specific objectives. Many of these specific objectives involve non-linear trade-offs against other objectives. For example, the minimisation of picker travel distance vs the maximisation of load stability. The decision variables are integer.

Core Management Systems has been working with a large U.S. company to develop a Decision Support System (DSS) for pickers. This is a step that must precede any advances for the company in robotic picking. The DSS is designed to assist the pickers in building consistently good loads. Our solution heuristic contains modules with similarities to the travelling salesman problem, the container packing problem, the bin packing problem, and the assignment problem.

The load forming problem is a good example of the use of a number of different OR techniques being put to use in the evolution of the automated warehouse.

Editor's Note:

Hamish Fraser is an OR Consultant with Core Management Systems, Auckland.

Solution to The Island of Modeller's Dread

James Corner

The island of Modeller's Dread is inhabited by 200 mathematical programmers, all desperate to escape. Of the 200 inhabitants, 100 have blue eyes and 100 have green eyes; however, the programmers do not know their own eye colour. In fact, people who can prove, by using their own logic, that they know their own eye colour to an obliging ferry owner will be transported away, 24 hours later, never to return. There is no reflecting material on Modeller's Dread and communication of any sort between inhabitants is punished by instant execution. However, any programmer may look into the eyes of any other programmer.

Now, there happens to be a 201st person on the island as well, whose eye colour is irrelevant. He is the Grand Poo-Bah who one day get sup to speak in front of the 200 island inhabitants (he is exempt from the instant death rule!). He says, "I see someone whose eyes are blue!"

The solution to this problem applies simple rules of deduction and logic to ever-increasing problem sizes until a solution is found. The problem size is measured in terms of the number of people on the island - minus the Grand Pooh-Bah - so the problem size above is 200. Begin by assuming:

- Inhabitants know there are 200 people on the island,some with blue and some with green eyes
- Inhabitants don't know the mix of those colours across all inhabitants
- Inhabitants use perfect logic and they are all strongly motivated to leave the island

The solution proceeds by assuming there are just two inhabitants who each hear the GP-B's statement. A solution to this problem is obtained, and the problem is then relaxed to include three inhabitants. A solution for the three person problem is obtained, the size of the problem is relaxed and so on. After about problem size 8, general solution rules are found.

The solution to the 200 person problem is found to be:

No one leaves the island until after day 50 and everyone leaves at once!

This solution is reached as follows: Assume a 2 person problem size. The total sample space for possible eye colour combinations includes the following single event (b = blue eyed, g = green eyed):

	Person	
Event	**A**	**B**
1	b	g

The events b - b and g - g are not possible given the first assumption stated above. The logic, which is used throughout the iterations shown below, proceeds as follows. Person A observes person B and sees green eyes. Having heard the GP-B state that there is a blue eyed person about, person A immediately realises it must be he (or she) and can leave the island in 24 hours. Meanwhile, person B sees person A's blue eyes and realises he/she must be green, given the same originally stated assumption of both colours on the island. They both leave after 24 hours.

Assume a 3 person problem size. The total sample space is now:

		Person	
Event	**A**	**B**	**C**
1	b	g	g
2	b	b	g

Again, events with just one colour are not possible under the assumption. Start with event 1. Person A sees two green eyed people and immediately deduces him/herself to be blue and leaves in 24 hours. B and C observe both a blue and green eyed person and can make no clear deduction as to what they themselves are. Thus, they wait. Upon seeing person A leave after 24 hours, they each conclude that person A must have seen two greens in order to make the deduction which he/she made. They thus then know their own eye colours and leave after 48 hours. Consider event 2. The logic here is the same as for event 1, with C leaving after 1 day and A and B leaving after 2 days.

Assume a 4 person problem size The total sample space is now:

	Person			
Event	**A**	**B**	**C**	**D**
1	b	g	g	g
2	b	b	g	g
3	b	b	b	g

The sample space grows by a single event with the addition of another person. The logic for events 1 and 3 repeats as in the previous problem. For events with a single person for a given eye colour, that person leaves after 24 hours and all the rest leave a day later. For event 2, additional logic is needed. Consider person A of blue eyes. A observes two green and one blue eyed people and can make no immediate decision as to his/her own eye colour. However, B would leave after 24 hours if person A was green eyed. Given that B does not leave after a day, A can deduce that he/she is blue eyed and can leave after day 2. The same reasoning is found for person B who also leaves after day 2. Consider either of the green eyed people (C or D). Their reasoning is the same as the blue eyed people, with colours reversed! Thus, all people leave after day 2.

Assume a 5 person problem size. The total sample space is now:

	Person				
Event	**A**	**B**	**C**	**D**	**E**
1	b	g	g	g	g
2	b	b	g	g	g
3	b	b	b	g	g
4	b	b	b	b	g

Using the logic of the previous problem, events 1 and 4 are fully described. The reasoning for event 2 is the same as for event 3 but with the colours switched, so concentrate on event 2. From the standpoint of either person A or B, not seeing the other person leave after 24 hours leads each to deduce their own proper eye colour and each can leave after 48 hours. No such deduction can be made by C, D or E. They must wait until A and B leave to deduce what those two must have seen in persons C, D and E (ie. green eyes). Thus, these three can not leave until after 72 hours (3 days).

Assume a 6 person problem size The total sample space is now:

	Person					
Event	**A**	**B**	**C**	**D**	**E**	**F**
1	b	g	g	g	g	g
2	b	b	g	g	g	g
3	b	b	b	g	g	g
4	b	b	b	b	g	g
5	b	b	b	b	b	g

Once again, all events except event 3 have been explained. If events 1 or 5 occur, then one person leaves after 1 day and all the rest leave a day later. If events 2 or 4 occur, then no one leaves for a day, A and B (E and F) leave after day 2, followed by the rest after day 3. For event 3, consider blue eyed person A (the reasoning also works if you consider this from the green eyed person's point of view). From person A's point of view, if he/she were green, then we would face the situation of problem size 5, event 2 (and 3!). That is, if A were green, then persons B and C would leave after day 2. Then, person A would know what he/she was and would leave after day 3, as would persons D through F. However, Person A would see persons B and C not leave on day two and deduce his/her proper eye colour to be blue and still leave after day 3. Using this same reasoning for all people, everyone leaves after day 3.

Assume an 8 person problem size. We omitted the 7 person problem size since the only new event there is b-b-b-b- g-g-g (along with its analogue b-b-b-g-g-g-g, but the reasoning is the same). This is merely an extension of event 3, problem size 6 and everyone is gone by day 4 (3 leave after day 3, the remaining 4 after day 4).

For the 8 person problem, the new sample space is b-b-b-b- g-g-g-g, similar in design to the originally stated 200 person problem composition of 100 each blue and green eyes. Using the balanced design logic of event 3, 6 person design, all people leave after 4 days. The reasoning is that from, say person A's point of view, if he/she were green eyed, then the design and reasoning would be similar to event 2 of the 6 person problem and persons B, C, and D would leave after 3 days. Since they don't, person A deduces that he/she is blue eyed and leaves after day 4 (along with everyone else!).

Assume an N person problem size. We need to consider only the three possible events as actually observed (deduced) by the inhabitants. That is, the N inhabitants look around and each observes N/2 of one eye colour and N/2 - 1 of another. That leaves open the possibility of either N/2 of each eye colour (the observer is part of the observed minority colour) or N/2 + 1 of one colour and N/2 - 1 of another (observer part of the observed majority colour). Thus, there are three events when one considers the symmetry similar to say events 2 and 4 of problem size 6 above. In order to then solve the original problem, we merely need to see what the behaviour of the inhabitants should be under each of these three events.

Using the logic of above, for balanced designs where there are an equal number of each colour eyed people (N/2), then everyone leaves after day N/4. Thus, for the original problem size of N = 200, there are N/2 = 100 each of blue and green eyes, and all 200 people leave after day N/4 = 50.

For the two unbalanced of the three relevant events (and the behaviour of these two is the same, so just consider one), look back at problem size 6 and events 2 and 4. The behaviour of these events relative to event 3 generalises to the N person problem size. In problem size 6, events 2 and 4 had the minority group leave after day N/4-1 and everyone else left after day N/4. This can be shown to hold for any N.

Thus, for the original problem where the design is balanced, inhabitants would keep their eyes out for everyone else's behaviour on day 49 to see if anyone leaves (and therefore deduce they were in one of the unbalanced designs). If anyone left after day 49, they would be in the minority group and the majority group would all then leave after day 50. However, since we have the balanced design event, inhabitants would observe no one leaving after day 49; everyone would realise the balanced design held and leave after day 50.

Local and International Events

Management Science Soft Systems Methodologies

One-Day Workshop in Wellington, 15 April

Conducted by

Jonathan Rosenhead

Professor of Operations Research, LSE

The workshop will cost approximately $100 plus food and text. It will cover:

- **Why conventional MS/OR methods fail for 'wicked' problems**
- **Overview of problem structuring methodologies for dealing with 'wicked' problems**
- **Hands-on coverage of one problem structuring method, such as Strategic Options Development and Analysis (SODA)**
- **Brief review of other soft systems methodologies**

Location **Ian Gordon Room, Victoria University Staff Club, Rankine Brown (Library) Building**

Enquires: **H.G. Daellenbach**

Dept. of Management, University of Canterbury, Private Bag 4800, Christchurch

Fax: **(03) 364 2020**

Email: **opre007@csc.canterbury.ac.nz**

NZSA/ORSNZ Joint Conference 1994

Massey University 25-26 August 1994

The program is: Wed Aug 24 - (Optional) Excursion and Registration

Thurs Aug 25 - Conference Day 1, including Registration and Dinner

Fri Aug 25 - Conference Day 2.

We plan to have several parallel session streams. Invited speakers include Bill Henderson from Adelaide. The first announcement and Call for Papers will be posted in March.

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TIMS XXXII

Anchorage, Alaska, 12-15 June 1994

Natural Resources, Economic Development, and the Environment: The Role of Management Science

Contact: TIMS XXXII - Anchorage

The Institute of Management Sciences

290 Westminster Street

Providence, RI 02903 USA

Ph: (401) 274-2525

Fax: (401) 274-3819

Local and International Events

TIMS/ORSA '94 Joint National Meeting

Detroit, USA, 23-26 October 1994

Global Manufacturing in the 21st Century

Contact: Kenneth Chelst, General Chair
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College of Engineering
Wayne State University
Detroit, MI 48202 USA
Ph: (313) 577-3857
Fax: (313) 577-8833
Email: chelst@mie.eng.wayne.edu

APORS '94

Fukuoka, Japan, 26-29 July 1994

Development in Diversity and Harmony

Contact: Operations Research Society of Japan
Gakkai Centre Bldg, 4-16, Yayoi 2-chrome
Bunkyo-ku,Tokyo 113 Japan

15th International Symposium on Mathematical Programming

Ann Arbour, Michigan, USA, 15-19 August 1994

Contact: 541 Thompson St, Room 112
University of Michigan
AnnArbour, MI 48109-1360, USA
Ph: (1) (313) 764-5305
Fax: (1) (313) 764-2990
Email: xvismp@um.cc.umich.edu

Senior Consultants/Practice Director

New Zealand's leading management science practice seeks senior practitioners in the fields of management science or applied economics. Positions are available in Auckland and Wellington.

Candidates will hold honours' degrees in management science (operations research) or economics, will have been active in either field for a minimum of five years and have had experience in managing commercial projects involving these disciplines.

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The Company uses an incentive-based remuneration scheme and is able to tailor individual employment packages.

Besides an obvious interest in the standard of a candidates' professional qualifications and work experience, regard will be had at time of interview for personal appearance, oral communication skills, and the ability to prepare written material.

All candidates will be required to produce material which, largely, they have been responsible for preparing.

Persons interested in these positions should apply in confidence by 15 April to:

The Managing Director

CORE Management Systems Limited

PO Box 3940 CPO AUCKLAND

WHAT IS OPERATIONAL RESEARCH?

Operational Research is the scientific approach to solving management problems. Using observation, data and analysis, the OR practitioner builds up quantitative relationships, called models. Models that take an overall system view help management make informed decisions.

The Secretary
Operational Research Society of New Zealand
PO. Box 904
WELLINGTON

Please enrol me as a member of the Operational Research Society of New Zealand, at the membership grade indicated below. I enclose the appropriate fees*.

I agree to be governed by the constitution of the ORSNZ, and to remain liable for subscriptions until I notify the Secretary in writing of my intent to withdraw from the Society.

Signature :____________________ Date :________________

Individual members in
Auckland, Wellington, Christchurch and overseas $35.00
Individual members in other areas $31.50
Student members † $15.00
Corporate members $100.00
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