NEWSLETTER

Operational Research Society of New Zealand (Inc.)

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Jonathan Lermit — ✍ Electricorp, Box 930, Wellington
Editor — ☎ (04) 723-550

September 1989

Conference Issue

Our 25th Annual Conference was a great success, generating plenty of nostalgia, as well as looking forward to the next 25 years. We have held this issue to allow for conference reports (which is why its late!). The after dinner entertainment, recorded here for posterity, brought out considerable hitherto hidden talent among out members. That this talent has been channelled into OR, when it could have so easily have been absorbed into the music and drama departments of our universities, is indeed a credit to our academic members!

New Members

A warm welcome to new members since the last newsletter.

Graeme Britton	Lecturer	Christchurch
Mark Bryne	Student	Christchurch
Owen Christian		Christchurch
Andrew Clark	Student	Auckland
Delwyn Clark	Junior Lecturer	Hamilton
Wayne Epson	Student	Christchurch
Hamish Fraser	Student	Christchurch
Patrick Harnett	Student	Christchurch
Kieron Horide	Production O.R.	Hastings
Malo Ioane	Chemical Analyst	Christchurch
Michael Keehan	Student	Massey
Naiomi Larsen	Student	Auckland
Mark Loone	Financial Advisor	Wellington
Ian MacDonald	Student	Auckland
Bradley McMaster		Sydney
John Moodie	Student	Auckland
Scott Murray	New Zealand Railways	Wellington
Steven Pedder	Student	Auckland
Mark Rogers	Information Systems Manager	Wellington
Yang Miao	Student	Christchurch

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Professor Fred Hillier, *Stanford University.*

The Application of Queueing Theory to the Design of Production Line Systems

A traditional aim has been to balance work across a production line as evenly as possible. This is optimal if process time at each workstation is constant. The question posed by Professor Hillier is "Is it a optimal strategy if process time is variable?" Professor Hillier's work considers a sequential production line as a continuous time Markov Chain, assuming that process times are identically distributed at each station. A general result is that it is optimal to unbalance the line - the "bowl" phenomenon. greater efficiency gains are made by allocating more resources to central stations in the production line. Intuitively this makes sense, as a hold up in the centre of a line could delay production by blocking progress of those behind (can't get past the bottle-neck) and by starving work for those ahead. Deliberately unbalancing a line like this achieves gains of 1-2% in production rate with considerable robustness.

Much of this work has been carried out the last few decades, but the strategy of unbalancing work *per se* is less viable in today's labour market. More recently Professor Hillier has addressed the problem of what other resources can be unbalanced to achieve a similar result. Allocating extra storage space is not as simple as it would seem, for storage can only be allocated in whole units of a product leading to an Integer Programming problem. With this integer limitation it is hard to replicate the "bowl" phenomenon. nevertheless, efficiency gains are found for increasing storage on nearly every station except the end two, and particularly in the stations towards the centre (but not adjoining ones). A similar situation is found for allocating additional workers.

Professor Hillier's recent work considered the joint optimal allocation of workers, storage and work to stations. Here the optimal allocation was to to place most work or resources at the end of the line, producing what was described as the "L" phenomenon. Such an allocation, however, may not be realistic in a production setting and has only been produced for small test problems. In particular, Professor Hillier's algorithms have proven under his test problems to be more efficient (in CPU time and in closeness to the optimal solution) than other algorithms tested, including the integer programming algorithms from GAMS. Curiously though, the newly developed algorithm was found to perform badly on randomly created problems, compared to the "real situation" test problems. This phenomenon is still under investigation.

Mark Pickup

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Erratum

Terri Green, reported in the last issue as 'finally' finishing her Ph.D., points out that she finished in May 1987! Humble apologies, we will try to be more up to date in future!

Letter to the Editor

From *Dr Robert Davies*

Dear Editor,

I was interested to read the news item in the April newsletter from Graeme Wake of Massey University. In this item he describes his quantitative problem-solving consultancy at Massey as the first of its type in New Zealand.

This is a slight exaggeration; our organisation has been in the quantitative advisory business for half a century. More recently the Auckland University Department of Theoretical and Applied Mechanics, the Waikato Centre for Applied Statistics, the Victoria University Institute of Statistics and Operations Research and Massey's very own Department of Production Technology have been providing quantitative advice to commercial clients.

But it is better late than never, so can we welcome Graeme and his band to the excitement of using real mathematics to get real answers to real problems.

Seriously though - I think there is a huge untapped opportunity for the application of mathematics in New Zealand. We all have to work together to open this up. So I really do welcome Graeme's initiative.

Robert B Davies
Director
Applied Mathematics Division, DSIR

Professor Wake replies

Dear Editor

We are grateful for this opportunity to respond to the sentiments expressed above by Dr Robert Davies, Director of the Applied mathematics Division, DSIR. We concede that his organisation has the breadth of ours but we have the extra opportunity of senior student involvement for post-graduate degree work. This makes us a different type of organisation than the Applied Mathematics Division. It is hoped that we will collaborate with them (and similar agencies). Indeed Robert's colleagues are joining us for the Consultancy workshop at Massey University on 14th and 15th August.

Other Universities, as Robert mentions, are involved in consulting (the more the merrier); what we have tried to do at Massey is too gather in the expertise spread widely across the University.

We heartily endorse Robert's closing remark and thank him for his support!!

Yours sincerely
G C Wake
on behalf of the QPSC Executive Group

Advertisements

Ashley Software, P.O. Box 13651, Christchurch have recently announced the introduction of Beeline, a Linear Programming package for spreadsheet optimisation. This is based on LP algorithms previously used in TurboLP, a stand-alone LP code, but being based round a spreadsheet package provides full modelling and reporting facilities. The price of Beeline (excluding GST and $5.00 postage and packing) is:

$420 for a commercial license
$230 for an educational license

Large discounts are available for multiple/net work licenses, and for educational institutions, provision is made for special undergraduate student versions, at $40 each.

We hope to have a review of this package in a future issue.

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Executive Sciences Institute has recently an individual rate for its journal *Operations Research / Management Science* (OR/MS). This journal has served the OR/MS community for over 27 years. The Institute is offering OR/MS to NZOR members for $US40.00 per annum, plus $US12.00 postage (the normal rate is $US 138.00). It is a monthly journal, and runs to over 800 pages annually.

Send your order to:
Executive Sciences Institute
1005 Mississippi Avenue,
Davenport
Iowa 52803, USA.

The editor is always pleased to receive information on commercial OR activities in New Zealand for (discrete) inclusion in the newsletter.

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❝ Quotable Quotes ❞

From Robert Watson-Watt, the inventor of radar:

Definition of an OR worker: 'the court jester who is paid to be irreverent so long, and only so long, as he is wise'!

The task of OR: to determine 'what the user wants; what he ought to want; what he gets; what he ought to get; and what he ought to have and do in order to get what he ought to want out of what he gets'!

Expert Systems Workshop

23-24 November 1989
Contact: Department of Production Technology
Massey University
Palmerston North

12th Triennial Conference on Operations Research

25-29 June, 1990
IFORS 90
Athens, Greece

Second International Workshop on Project Management and Scheduling
Compiegne, 20-22 June 1990
Contact: Jaques Carlier
Université de Technologie de Compiegne
URA HEUDIASYC Département Génie Informatique
Centre de Researches
BP 649 60206 COMPIEGNE CEDEX

OPERATIONS RESEARCH 1990

International Conference on Operations Research
Vienna, Austria
28-31 August 1990
Contact: Prof G. Feichtinger
Institut für Ökonometrie
OR und Systemtheorie
Technische Universität Wien
A-1040 Wein, Argentinierstraße 8

Sixth International Working Seminar on Production Economics

19-23 February 1990
Innsbruck
Austria
Contact: Janerik Lundquist
International Working Seminar on Production Economics
Department of Production Economics
Linköping Institute of Technology
S-581 83 LINKÖPING
Sweden

(I hope I've got all these ös, ßs, and és right!)

Call for Abstracts -

19th Annual Franz Edelman Award for Implemented Work in the best Tradition of Management Science

Send an Abstract of your paper by October 2, 1989 to:
1990 TIMS/CPMS Prize Competition
c/o Arthur H. Schneyman
Mobil Corporation
150 East 42nd Street
New York, NY 10017, USA **$US6,000 First Prize!**

The 25th ORSNZ Conference - a Truly Memorable Event!

I always enjoy ORSNZ conferences, usually more so when they are out of Wellington, because of the chance to visit friends and family in Auckland and Christchurch. But this home grown, hand-knitted conference takes the cake for fun and laughs. Certainly the minister's opening speech on the Labour Government's past and future successes was a bit of a giggle, but really I'm refering to the humour of those presenting the papers and the entertainment at the conference dinner itself.

I'll talk about the evening's entertainment first, as it was this that set the conference apart from other such get-togethers and generated a strong feeling of camaraderie among those present.

Grant Read presented Canterbury's contribution to the festivities, starting with reminiscences of previous conferences. There was the chap who criticized the quality of everyone's slides and put up his own exemplary ones, only to find they had all gone dark and couldn't be read! And the student with the temerity to ask Fred if the 150,000 variables in his forestry model were meant to represent every single tree? Some delightful pseudo-OR journal articles followed, the details of which escape me now (nothing to do with the wine consumed at the time of course).

Cheryl MacDonald, fresh from the Burnham assault course, presented Wellington's contribution, with Donald Reinken and Mark Pickup. As Helen Clark, Geoffrey Palmer and David Lange, they gave us some useful insight to the OR 'Cabinet Makers' Problem. Censored reproduction can be found elsewhere in the newsletter.

Auckland's laudably audible (or should that be audibly laudable?) contribution can also be found further on, and was obviously as much fun for the Auckland group singing it as it was to those of us listening. Merv Rosser would like to stress it was written by Anon and definitely not Amerve. Andy Philpott then proved himself OR's answer to John Denver. (Actually that's not a fair comparison as Andy has to be better than JD). His songs had little to do with OR, try as he might to pretend they did, and were warmly received.

For me the polished Council's performance (no, I don't mean Council's polished performance - they glowed!) of 'An OR's Job is not an Easy One' sung to the tune of Gilbert and Sullivan's 'A Policeman's Lot' was the highlight of a high evening. This too is reprinted in the newsletter - unfortunately we can't include the props that added so much hilarity to the performance!

Before finishing I had better make mention of the papers, which is after all what conferences are about? The milestone nature of the conference necessitated several navel-gazing papers on the direction of OR, that had both positive and negative comments on OR in NZ. John Boshier sounded the strongest note of doom and gloom, with his belief that OR models should not be used in policy decision making. In his experience, policy makers pay too much attention to the results from an analytic

model and not enough to the effects of changes in model assumptions, or the volatility of the economic climate in which the decision is being made.

Hans Daellenbach considers OR teaching still focuses too much on the mathematical techniques involved in problem solving. He advocates Checklands soft systems methodology for dealing with ill-defined problems, and more consideration of the problem 'medium'. His new word is 'Weltenschauung', I think means its the view of the world you have that makes you focus on some aspects of a problem and not others. Its major attraction as a word is its unpronouncability and its large number of vowels.

On the positive side, John felt OR was good for building yachts, Hugh said OR people won WWII, Brian Easton said at least OR is now more practical than Economics which has gone more theoretical. Selwyn Gallot confirmed that planes won't drop out of the sky more often than they used to - in any case it didn't matter (unless you're under one) as they were freight planes, and John Giffin provided everyone with the answer to 2D in the conference crossword (THEOREM, if like me you're still trying to complete it).

The student papers were most impressive and obviously represented a lot of hard work. (In between the soul searching of the jubilee papers, the comment was made that it was 'nice to hear a good technical paper'.)

Last, but by no means least, were the keynote addresses. Ren Potts has a delightful sense of humour. His papers held everyone's attention and were readily understandable. In his first talk on 'Sheep Shearing Robots', the audience warmed up with elbow bending exercises - no doubt as practice for the evening's imbibing - which helped counteract the chilling effects of the initially vicious air conditioning. His second talk on 'The Mathematics of Preferences' showed how there is no good voting system - under different rules about how to account for voters' preferences, different people get elected. His contribution to the conference, which strengthened its light hearted nature, is much appreciated.

Thank you Rona and Cheryl for all your efforts in organising the conference.

Thanks too to all the participants, both speakers and entertainers, who made the two days so enjoyable.

Karen Garner

1990 Conference

University of Waikato

Tentative dates: 20-21 August 1990

See you there!

Conference Dinner Entertainment

Note: the following significant contributions were presented at the 25th Annual Conference but, for some obscure reason, did not appear in the *Proceedings*. The Editor would like to stress that these items have not been refereed, and that the opinions expressed are not necessarily condoned, or even understood, by anyone other than the writers.

Disclaimer: The names used in these sketches are not necessarily fictitious, and any resemblance to any OR personalities is far from coincidental.

The team from the land of the Auks presents:

Ham-Network
The Prince of Benchmark

Scene: *The Castle Ramparts, Elsin OR.*
Hamnetwork soliquizes, as a messenger approaches.

H: OR or not OR? That is the question.
Whether it is . . . . . .

M: My Lord, Hugh Barr my entry!

H: What Ho, varlet!

M: My liege, your objective stands without.

H: Without what, knave?

M: Without an upper bound, my lord!

H: Abort, before he diverges.
But prithee, why so late, drudge?

M: A small Transportation Problem sirrah, as we left the workstation!

H: Didst not choose the critical path? Avast!

M: M'lord, my condition is weak; and my carriage will be towed from castle parking, as I have no Karmarker.

H: Enough! You may join our OR dinner. There will be singing and Dantzig (*aside* - by George!). You can sing for your supper - in your condition we call it "Tuhn - Tucker".

M: Good my lord, I shall. It is a bad salad - whoops - sad ballad, with a happy ending:

Enter CHORUS in a state, variable.

CHORUS

Oh what an optimal programme,
Oh what a minimal cost;
I've got a convergent feeling
more has been gained than was lost.

M: 1. First in Christchurch they tried optimising,
Don McNickle, Grant Read, hackles rising.
Hans Daellenbach tried, John George swallowed his pride,
But even Fred Baird had too much on the side.

CHORUS

M: 2. Next in Wellington they simulated,
Tony Vignaux revised and updated.
Tapas formed constraints, and they all worked like saints,
But divergence foiled them - just hear their complaints.

CHORUS

M: 3. John Buchanan at Waikato foundered,
And at Palmerston John Giffin floundered.
This corn is so high, it makes Gary Eng cry,
and Barr, Mabin, Benseman give up and die!

CHORUS

M: 4. Then at last the tough problem was Auckland's,
And they beat it, as Brits did the Falklands.
Dave Ryan partitioned, and Andy networked,
With Sue, Steve and Julie, Merv, Rachel - none shirked.

Final CHORUS

Oh what an optimal programme,
Oh what a minimal cost!
Where would we be without Auckland,
When all the others were lost?
- Auckland, the team with the most!

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A comment on large, all-embracing models

He who would do good to another must do it in Minute Particulars.
General Good is the plea of the scoundrel, hypocrite, and flatterer.
For Art and Science cannot exist but in minutely organised particulars.

William Blake, *Jerusalem*

An OR Job is not an Easy One

Lyrics by M Civil, B Benseman & V Mabin
Music by Sir A Sullivan
with a Chorus of Council Members

	CHORUS
When the manager of ACME called in panic	called in panic
The answers to her ills she did not know	did not know
she had found that this assignment was no picnic	was no picnic
would the OR people like to have a go	have a go!
When the management is so much in a panic	in a panic
and need answers to the problems they've not done	they've not done
then the OR person's always optimistic	optimistic
Solving real-life problems can be so much fun	So much fun
All we need to do is find the right solution	right solution
An OR problem can be so much fun	So much fun!
So Matthew tried to fit least squares regressions	squares regressions
and Jonathan forecast stochastically	'chastically
But when Tony Vignaux checked out the dimensions	the dimensions
t'was a physical impossibility	billy tea!
Oh take one high correlation with an other	with an other
We find drowning causes people to drink Coke™	in the sun
When analysing lots of facts and numbers	facts and numbers
An OR job is not an easy one	easy one
When we've got a real-life problem to be done	to be done
An OR job is not an easy one	easy one
Then Dave Whitaker used OR on the PC	on the PC
And Julie's set parti'ning ran amuck	ran amuck
So while Sue Byrne redesigned it as a QP	as a QP
Dave Ryan used his ZIP and got it stuck	got it stuck
By now the manager was drinking whisky	drinking whisky
So Vicky found the major bottle-necks	bottle-necks
While Hugh maintained the problem was so risky	was so risky
And Bruce LP'd in terms of y and x	y and x
Oh if only we could find a quick and dirty	quick and dirty
The OR job would be a happy one	happy one
Then Don McNickle did his simulating	simulating
Grant and Gary got out PRISM to fortell	to fortell
But when Fred's LP was fully decomposing	decomposing
The machine went phut and made an awful smell	awful smell!
Now management was getting really shirty	really shirty
Wanted answers on the desk by half past one	half past one
So Bob grabbed Dynamo and took a squirty	took a squirty
And Hans worked on his students one by one	one by one
And suddenly they found the quick and dirty	quick and dirty
So the OR job became a nappy one	nappy one

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The Cabinet Assignment Problem

Written and performed by
Cheryl McDonald, Donald Reinken & Mark Pickup

Scene: Geoffrey Palmer and Helen Clark deciding on the new cabinet. David Lange is to one side interjecting unheard by GP & HC. He is cheerful, they are fairly serious but crack the occasional joke. They leaf through Daellenbach *as required.*

HC: Our first cabinet selection Geoffrey. We must get it right.

GP: Yes Helen, we must select the RIGHT criteria.

HC: Assign the RIGHT people to the RIGHT jobs

DL: **Labour used to be a party of the left. How far the party has strayed !**

GP: There appears to be a chill in these proceedings

HC: The ghost of cabinet past ?

DL: **Rogered !**

GP: Now Brian Easton sent me this book on .. Operations Research by some blokes called Daellenbach, George and McNickle.

DL: **The Lawyers for Equity corp.**

HC: Operations Research - We're selecting a cabinet not operating on them.

GP: Some of the caucus could do with an operation - take Bill Sutton ha ha!

DL: **I wish someone would**

HC: Don't be wet Geoffrey, I'm not.

DL: **You were !**

HC: Now how can this book help us

GP: It's got all these techniques for getting the best solution. The Americans have been using it for years

DL: **and they elected Reagan - Twice !**

GP: It's a bit mathematical

HC: We can always call in Caygill if we cant do the sums

GP: Just as long as we can do without Roger. We have to keep him under control.

DL: **Make him minister of gangs**

HC: I'm sure we can manage without Roger

DL: **Best of luck**

HC: Let's get started

GP: Right, Dynamic Programming

HC: The National Party could do with a bit of that

DL: **Mike Moore overdoes it**

GP: The problem is decomposed!

DL: **Like the Social Democrats**

GP: ... and the subproblems optimised ?

DL: the ANZAC frigates will be subs' problems

HC: Lets try another technique, what about this one, - Linear Programming

GP: Yes allocating limited resources to known activities - sounds hopeful

HC: yes we have a few lightweights in cabinet which limits our resources

GP: One thing about David - he was never a lightweight ha ha

HC: and the known activities are the portfolios

DL: Or inactivities

HC: We have a list of our variables and some will be slack

DL: Jonathon Hunt's your slack variable

HC: and some will be surplus

DL: Roger and Rebel Prebble should be surplus

HC: And a list of constraints some of which will be artificial

DL: Trevor de Cleene or part of him

HC: and according to the L & P method

DL: Perrier please, L&P gets up my nose

HC: or the simplex method

DL: one for Jimbo

HC: We try to achieve equality. Well I'll be fighting for pay equity

GP: You're getting off the subject Helen. Feasibility studies

HC: Pay equity is feasible

DL: Twitter Twitter Helen

GP: It's in this book. The transportation problem with a degenerate solution - sounds like Bob Tizard and the Anzac frigates.

HC: All frigates are good for are cocktail parties and showing the flag.

GP: There's also the Poisson distribution

HC: Hao to get to Paris from Hao and not come back

DL: Don't mention french frogmen to me - Sacre Bleu !

GP: the z transform

DL: Jim Bolger's speeches transform the house - everyone falls asleep

HC: the z transform - Ruth Richardson's perm Ha Ha ! I'm not changing my hairstyle.

GP: I know we stand for substance, but we do have to consider our image.

HC: You do Geoffrey. I don't look petrified on television.

DL: No .....

GP: Margaret's got me talking to myself in the mirror every night. If only all my audiences were so intelligent I'd be alright ha ha

HC: Let's get on. Game theory

GP: That would have appealed to David but we're more responsible

DL: *(looking hurt)* **Responsible for Unbridled Power and Harold Twitter**

GP: Sensitivity and post optimal analysis

HC: We have to be sensitive to the aspirations of the tangata whenua and the women of New Zealand

GP: We have to choose our cabinet and we haven't got anywhere so far.

HC: Well I want to keep Health and a woman should have Labour

GP: Lets give up on this new technology and go for the good old heuristic trial and error. You put the blindfold on and I'll stick the pins in the back of this envelope.

DL: **The quick and dirty. I shouldn't have quit !**

GP: Now what have we ended up with - Finance : Roger Douglas

DL: *(Stands, clutches his heart and reels away muttering)*

HC & GP: *(stand scratching their heads & muttering)*

Lights down.

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Conference Proceedings

Copies of the proceedings from the 1989 conference (and previous years) are available for $5.00 per copy from the Treasurer, Rona Bailey (✍ P.O. Box 1335, Wellington, ☎ (04) 727-855 x 862). Postage outside New Zealand is additional.

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Situation Wanted

We have received a letter from David Noble, currently a Senior Lecturer in Operational Research at Silsoe College, Cranfield Institute of Technology. He and his family desire to emigrate to New Zealand. He is seeking a position, preferably as a practitioner.

His educational qualifications are:
B.Sc. (1st class honours in Maths), University of St. Andrews
M.A. in Operational Research, University of Lancaster

He has had some 19 years experience, mainly in teaching, but also as an OR consultant.

The Editor has his complete C.V. for anyone who would be interested, or you can write to him directly at:

42 Howard Close,
Haynes
Bedford MK45 3QH
United Kingdom.

Advance Notice

The Operational Research Society of New Zealand and the Centre for Continuing Education at Victoria University of Wellington are proud to announce a:

Workshop for quantitative analysts on problem formulation in operational research

Course objective:
To provide participants with the ability to formulate a variety of quantitative problems in an Operational Research framework for which solution technology already exists.

Relevant for:
Quantitative analysts with little formal knowledge of OR techniques, but who are keen to expand their repertoire.

Time & place:
The workshop is now planned for February 1990, and will be held at the Centre for Continuing Education, Victoria University of Wellington.

Cost:
Not yet finalised, but expected to be about $250 per person, this includes notes, lunchs, teas, and GST.

Numbers:
In order to give all participants personal attention, attendance will be limited to about 25 people.

Topics to be covered:

Optimisation
Inventory & production scheduling
Decision analysis
Queueing theory

This will be an excellent opportunity to expand your knowledge and skills.

Please complete the form below if you are interested in attending.

For further information: Frances Sutton ☎ (04) 727-627
or Jonathan Lermit ☎ (04) 742-370

To: Frances Sutton, Continuing Education Officer, NZOR Soc,
P.O. Box 904, Wellington ☎ (04) 727-627

Yes, I am interested in the Quantitative Analysis Workshop.
Name..... ☎.....
Address.....