itms **School of Information Technology and Mathematical Sciences**

Research Newsletter

<u>**Inside this Edition:**</u>

A Few Words from the School Research Coordinator.....

The Research Newsletter has moved to being a bimonthly publication. As you will see there have been many events over the last two months.

Congratulations

In recognition of his work and standing in the School and University Alex Rubinov has been appointed "Professor". Alex in his time at the University has been prolific in his publications and very successful with large research grants. He has been very active in bringing visitors of high academic standing to the University and contributing to the academic and research life of this school. The appointment was approved by Council on the 12th May, 1999. All staff in the School congratulate Alex on this well earned appointment. Pozdravlyaem!

Projects in Progress.....

Research into the teaching of statistics
The concepts of sampling variability and the central limit theorem are acknowledged by statistical educators to be amongst the most difficult to teach. Several computer simulation based demonstrations have been presented at recent conferences. However there has been little if any evaluation of learning outcomes of these in comparison with traditional teaching methods.

Lyn Roberts and Robyn Pierce are conducting a research project to investigate the differences in learning outcomes for groups of students taught using different lesson styles.

The experiment is being conducted in the large MS501 Statistical Methods class.

During the core lecture in week three, students were given a pre-test and asked to sign a form giving consent for their results to be included in the research project. The seven tutorial groups were each then allocated to a special teaching programme for the three tutorial classes of that week. Two groups had only traditional "chalk, talk and textbook" teaching. Two groups did a series of "hands-on" sampling exercises involving things like numbers in the telephone book, digits on number plates in the car park, and colours of M&M's. The third experimental condition for two groups was to have only computer based instruction: Minitab simulations, web surfing of some statistics sites which include Java applets demonstrating sampling, and two multimedia computer based teaching packages. The seventh tutorial group did one of each type of activity: text book examples, a computer simulation exercise, and a hands-on sampling activity.

A post test will be administered in week 4, and the material will also be examined again in the end of semester exam. Qualitative information in the form of observations and impressions from researchers, tutors and students is also being collected.

Week three has been full of logistical problems, making sure students, tutors, and materials are all in the right place at the right time. Once the busy organisational work is completed, there will be a large amount of both quantitative and qualitative data to analyse. It is anticipated that several papers and conference presentations will come out of this work, and that it may lead to ongoing research into this aspect of the teaching of statistics.

Research Profile…..

DEVELOPMENTS – Refugee Law and SPIRT

Who says SPIRT's are easy ?
The warning signs are clear. The trend toward increased teaching loads and reduced Australian Research Council funding for research projects is a sure sign of a transition from the current state of play where research is predominantly funded by governments to a not too futuristic scenario where research is predominantly funded by industry.

As it is, success rates for ARC funding are hardly worth the considerable effort required to craft a competitive application. About 19% of Australian Post Doctoral Fellowship (APD) applications are successful. For ARC large grants the figure is, I believe, around 30%. Success rates for ARC Small grants depend heavily on circumstances within each University but these grants are relatively small in any event.

ARC applications are culled ruthlessly, often for technicalities. For example, last year my own APD application, that would have totally funded my salary at Ballarat, and raised the School's research quantum was rejected in the first round. The reason given: 'insufficient evidence of support from the institution [ie. School]. The APD guidelines stipulate that basic office, library and computing resources are to be supplied by the institution. The School committed itself to supplying those, but that was not, apparently, good enough. I was able to see an APD application that was not culled and noticed that, although no more was promised by that School, praise for the APD applicant was effusive.

While it is still certainly the case that ideas in themselves do not cost money, developing the ideas requires time and often equipment. Disseminating ideas also costs money, especially in a country so far away from research centres in other parts of the world.

So what alternatives to funding research are there ?

Strategic Partnerships with Industry, Research and Training (SPIRT) is a relatively new DETYA initiative that aims to encourage research institutions to collaborate with industry. There are three types of SPIRT

grants, Research Collaboration, Australian Post Doctoral Research Fellowships (APDI), and Australian Post graduate Award (APAI). APDI funds a post doctoral researcher salary for 3 years and an APAI funds a PhD's scholarship for 3 years.

In essence, most of the cash for SPIRT grants comes from DETYA but a small portion comes from an industry partner associated with the grant. The industry partner is also expected to supply a non-cash contribution. The partner benefits from research directed to their needs and in intellectual property rights. How easy are these grants to get? In the following paragraphs I'll outline some experiences I have had in my involvement in two successful SPIRT grants.

In October of 1996 John Yearwood and I commenced a new project aimed at combining information retrieval and reasoning to model refugee law. We approached members of the Refugee Review Tribunal (RRT) who informally guided the project in many meetings by supplying expert knowledge of reasoning in refugee law. After two failed attempts at securing ARC funding in 1997, we won a Small ARC grant. The main objective of this grant was to strengthen the relationship with Tribunal members so that we could apply for a SPIRT APAI in 1998. This occurred and while the Melbourne office of the RRT were enthusiastic the Sydney and head office were reluctant. They did however furnish a letter of agreement. By December 1998, when our SPIRT application was successful, some of the members we worked with had left, and more critically, new members assumed the executive role in Sydney.

The new executives immediately tried to distance themselves from the letter of agreement. Although the letter of agreement was not legally binding, our Melbourne partners put considerable pressure on the new executive to honour the agreement. In late December they,

agreed to do this however, currently, in late March, we are still negotiating a comprehensive agreement that covers publication and intellectual property rights. We are happy though that the University has taken the punt that agreement will be reached before June 30 by allowing Tunde Meikle to commence research as the APAI recipient. We are very fortunate to have Tunde's considerable skills on the project.

The second example is a successful SPIRT administered by LaTrobe University that involved an APDI and APAI. Dr John Zeleznikow and I initiated this application in January 1998 by presenting a proposal to executives of Victoria Legal Aid who were enthusiastic and willing to supply in-kind help in the form of time with their lawyers but could not supply cash. We approached a major legal publisher in Sydney who agreed to supply the cash. However, changes in middle management priorities and the discovery that the company does not pay tax in Australia, so would not benefit from generous concession, led two days before the SPIRT deadlines, to a withdrawal. We were rescued by a small Melbourne firm.

That grant was successful but, to our dismay, the small but enthusiastic Melbourne firm has hit unexpectedly with Year 2K expenses that must assume higher priority than funding the grant. They are still involved but cannot supply sufficient cash alone. Since March I have approached a number of firms and individuals. All are very interested in the research direction. All would buy software if it was ready to sell but none have agreed to help develop it.

MLA Victor Perton heads the Premier's Parliamentary Committee on Law Reform is not surprised by this reaction. It is consistent with the OECD figures that demonstrate that this country has one of the lowest R&D investment rates among developed nations. The sad reality is R&D is not part of the culture of Australian industry.

Mr Perton has been very active in securing contacts that I will see in the near future. I am hopeful that one of the firms he suggests is sufficiently adventurous, especially considering that, in accordance with the conditions of the SPIRT, I have agreed to resign from my SITMS position. If the SPIRT grant is not successful I will be out of a full time position here, sessional lecturing within this School cannot be made available and I will be one of the first of many SPIRT casualties. Who says SPIRT's are easy ? Not I !

Accepted papers....

A.M. Rubinov and **A.J. Zaslavski**, "Existence and uniqueness of a solution for a minimization problem with a generic increasing function" has been accepted for publication in Journal of Australian Mathematical. Society (Series A). The first version of this paper was published as Research Report 98/7. The main ideas of the paper was developed by the authors during a short visit of Alex Zaslavski in Ballarat in the autumn of 1977.

David Stratton has had an article accepted for the June issue of the SIGCSE Bulletin. (Special Interest Group Computer Science Education - an ACM SIG). The article is entitled "Teaching Network Fundamentals with a Simulated Network" and describes the NetSim program that he wrote and used in the Network Protocols and Services Unit (CP582).

Lyn Roberts has had a paper "Using Concept maps to measure statistical understanding" accepted by international Journal of Mathematical Education in Science and Technology.

Robyn Pierce's refereed paper for the Mathematics Education Research Groups of Australasia conference in Adelaide in July has been accepted with a positive response from all three Reviewers.

Published papers

The following papers have recently been published:
H. Xu, A.M. Rubinov and B.M. Glover, "Strict Lower Subdifferentiability and Applications", Journal of the Australian Mathematical Society, Series B, vol. 40, 1999, pp 379-391.

The paper is published in the special issue of JAMS (B) dedicated to Bruce Craven and Bert Mond. The first version of this old paper was published as Research Report 96/27 in December 1996. It was a large paper, and contained many results. Unfortunately the authors were forced to shorten it, as only short papers are published in this special issue

B. M. Glover, V. Jeyakumar and A.M. Rubinov, "Dual Conditions Characterizing Optimality for Convex Multi-objective Programs", Mathematical Programming, vol 84(1), 1999, pp 201-217.

"Mathematical Programming" is a leading journal in the field and there is a long queue of papers to this journal. This old paper was prepared in December 1995! By the way the paper "Cutting angle method" by Andramonv, Rubinov and Glover was submitted to this journal in May 1997, to date there has not been a reply.

"The integration of retrieval, reasoning and drafting for refugee law: a third generation legal knowledge based system." by John Yearwood and Andrew Stranieri as well as
"The evaluation of legal knowledge based systems" by Andrew Stranieri and John Zeleznikow will appear in the *Proceedings on the Seventh International Conference on Artificial Intelligence and Law.*

Quasidifferentiability and related topics

This is a title of the volume which Kluwer Academic Publishers intend to publish next year. Quasidifferentiability is a special

substitute of differentiability which can be used for a large class of nonsmooth (that is nondifferentiable) functions of n variables. Quasidifferentiable Calculus was invented by V.F. Demyanov and A. M. Rubinov twenty years ago. Both Vladimir Demyanov and Alex Rubinov will act as co-editors for this volume. More than fifteen researchers from Italy, Russia, China, Australia, Germany, Poland will present their papers to this volume.

Seminars and Workshops.....

Seminars
Jack Harvey presented 'A New Approach to Population Estimation From Satellite Imagery' on 24th March, 1999.

Assoc Professor Paul Kelly presented 'Using Technology to Change the Way We Teach' on Monday 29th March at 3.30p.m. 1999.

Dora Pearce presented 'Progress in Modelling the Association Between Ambient Air Pollution and Respiratory Illness In Children' on 26th April 1999.
Ross Brown presented 'Review of psychological HVS models' on 17th May 1999.

Forthcoming Seminars
Andrew Stranieri will present "Discretionary Legal Domains" on the 14th June, at 3.30 p.m. in the School ITMS Meeting Room.

Conferences.....

Professor Binh Pham attended **SPIE International Symposium on Medical Imaging 1999,** 20-26 February 1999, in San Diego.

This major International Symposium on Medical Imaging was attended by over 800 participants from diverse background (medical specialists, physicists, engineers, computer scientists, psychologists and people from industry). The one-week intensive program covers the following seven specialist conferences, each lasted between 2-4 days:

- Image Display
- Physics of Medical Imaging
- Physiology and Function from Multi-dimensional Images
- Image Processing
- PACS Design and Evaluation: Engineering and Clinical Issues
- Image Perception and Performance
- Ultrasound Transducer Engineering

The phenomenon of big inter-disciplinary teams working on complex problems has been a definite trend in the last few years, hence the progress has been rapid and significant. Furthermore, the government and medical specialists in the US seemed to be very responsive to adopting technology to further medical gains. It was rather unnerving to see how computer graphics and image processing techniques have been deployed extensively to capture, identify, construct, explore, manipulate and animate every single part of the human body, and to guide instruments and surgeons during surgery. On the other hand, the progress on telemedicine and PACS (Picture Archive Communication System) has been slow. There are currently only about 10 filmless hospitals within the US and probably 10 more around the world. Intelligent systems for archiving and medical diagnosis are still at infancy. I presented a paper on a collaborative project John Yearwood, Andrew Stranieri and I have with the Western Hospital on a diagnosis support system for cervical spine trauma. It attracted the attention of representatives from two companies (Siemens in US and Advanced Imaging Systems in Canada) because they were pursuing related problems.

This Symposium has also given me the opportunity to renew contacts with researchers from the National Library of Medicine in Washington, DC. Their Centre currently holds a collection of 17,000 X-rays of cervical and lumbar spines which were captured for a National Health Survey. One

of their current research projects is to construct an appropriate database of these images to allow them to be retrieved, according to their information content. We have exchanged ideas and planned to set up research collaboration in the near future.

Dr. Paul Lauterbur, the inventor of the method of using magnetic resonance to capture and reconstruct images (MRI), gave a two-hour inspiring address. He described step-by-step the motivation, efforts, failures and triumphs of MRI technology during the last twenty five years, through the development of nuclear magnetic resonance instruments which were only suitable for tiny objects of 5mm in size to the stage when they could cater for the whole human body.

Ewan Barker attended the Australasian Computer Science Week conference held in Auckland, January 18-21 1999. This was a large conference with four parallel strands. He mostly attended the sessions of the Discrete Mathematics and Theoretical Computer Science strand. There was a wide variety of interesting papers on such areas as Complexity Theory, Graph Theory, Semantics for proving program correctness and Cryptography.

On the day after the conference he attended a Java Teaching Day, which consisted of presentations and extensive discussions about issues in the teaching of Java, especially as the first language of a computing degree program. The choice of Java as first language is increasingly common, with many universities having made or contemplating this change. There are two schools of thought as to whether it is better to initially emphasise procedural algorithms and structures and introduce object features later, or conversely to highlight object oriented features and ideas from the start. A programming environment which may prove ideal for the latter approach is JavaBlue, which is being developed at Monash University and will be freely available to educational institutions.

Post Graduate News.....

Tunde Meikle commenced her PhD research on March 12 as the APAI recipient under the supervision of Andrew Stranieri and John Yearwood.

Glenn Auld arrived from the Northern Territory and is feeling the cold. Glenn is doing a PhD degree under the supervision of Paul Kelly, Philip Smith and Phil Candy. His project is on 'Computer Assisted Language Learning for Aboriginal Children'.

Jinglan Zhang arrived from China via Sydney. She will do a PhD degree under the supervision of Binh Pham and John Yearwood. Her project will be on techniques for supporting design for aesthetics.

Scholarships/Awards

IBM Scholarships 1999
This year two major IBM Global Services (Australia) scholarships of $24,000 each were awarded to David Andrews and Amy Turnbull. IBM Scholarships to the value of $12,000 were awarded to Adam Arnell, Heather Brice, Daniel Conway, Andrew Pobjoy, Wendy Rodgers and Rebekah Stasse.

Aspect Computing Scholarship
An Aspect Computing Scholarship to the value of $1,000 was awarded to Andrew Richter and Brendan Keyhoe jointly.

Research Reports

99/1	An Algorithm for Monotonic Global Optimization Problems	Alex Rubinov, Hoang Tuy and Heather Mays	January 1999
99/2	Stochastic Differential Delay Equations and Stochastic Stability: A Survey of Some Results	A.F. Ivanov and A.V. Swishchuk	January 1999
99/3	Dynamics of positive multiconvex relations	A. Vladimirov and A. Rubinov	February 1999
99/4	Differences of convex compacta and metric spaces of convex compacta with applications	A.M. Rubinov and A.A. Vladimirov	February 1999
99/5	*P*-functions, quasiconvex functions and Hadamard-type inequalities	C.E.M. Pearce and A.M. Rubinov	February 1999
99/6	Difference inclusions with delay of economic growth[1]	Z.A. Dzalilov[2], A.F. Ivanov[2,3], A.M. Rubinov[2]	February 1999
99/7	Mining Association Rules in Economic Databases for Forecasting	Raouf Veliev, Alex Rubinov and Andrew Stranierie	March 1999
99/8	Exploring the use of genetic algorithms for reflection line correction	Z. Zhang and B. Pham	March 1999
99/9	Design for aesthetics: interactions of design variables and aesthetic properties	B. Pham	March 1999
99/10	Can knowledge discovery from databases enhance case-based reasoning for medical diagnosis support systems?	Binh Pham, John Yearwood & Andrew Stranieri	March 1999
99/11	A fuzzy model for scene decomposition based on preattentive visual features	Ross Brown [a], Binh Pham[a] and Anthony Maeder[b]	March 1999
99/12	Evaluation of a Low-Level Program Visualisation Tool	Philip A. smith & Geoffrey I. Webb	March 1999
99/13	Contextual classification of multisource geoscientific data using a fuzzy/genetic learner	Andrew Skabar[1], Kousick Biswas[2], Binh Pham[3] Anthony Maeder[4]	April 1999
99/14	Inductive concept learning based on limited class information using evolutionary search	Andrew Skabar[1], Binh Pham[2], Kousick Biswas[3], Anthony Maeder[4]	April 1999
99/15	Some conditions of convergence of tabu search[1]	Mikhail Andramonov	April 1999
99/16	Review of Research into Aspects of Novice Programming and Programming Assistants	Philip A Smith & Geoffrey I Webb	April 1999

All IT&MS staff members and postgraduate students are encouraged to contribute to the next edition of the monthly ITMS Research Newsletter. Examples of newsletter items staff should consider are: projects in process, papers accepted, research in process, publications, grants, seminars, visitors, visits by ITMS staff and Post graduates, scholarships, reports from school research groups / centres, events, conferences, new discoveries, general items of interest, etc. All items should be received by Maxine Kingston no later than the 20th June 1999.

School of Information Technology & Mathematical Sciences, University of Ballarat.