Newsletter
Mathematics & Statistics

UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

ISSUE 7/06 **September 2006**

THIS ISSUE

RBNZ – NZESG AWARD

Congratulations to **William Rea**, **Marco Reale,** and **Jennifer Brown,** whose paper on long memory time series won a Reserve Bank of New Zealand – NZ Econometric Study Group award for econometric research at the NZESG meeting in Dunedin from 4-5 August. The title of the paper was *Do Long Memory Time Series Have Amnesia?*

CONFERENCES

In June, **Mike Steel** gave a talk at *Evolution Conference 2006* at the University of Stony Brook, New York. He also presented a seminar and a research talk at the meeting on *Phylogenetic Trees and Rapidly Growing Pathogens* at Rutgers University, New Brunswick.

Also in June, **Mike Steel** attended a conference at the University of East Anglia and gave two talks as part of a European Union workshop on biogeography and biodiversity.

Josef Berger was one of the organisers of the workshop *Trends in Constructive Mathematics* held from 19-23 June 2006 in Frauenwörth, Germany. He also gave talks at *Computability in Europe 2006 - Logical Approaches to Computational Barriers,* (University of Wales, Swansea, 30 June – 5 July 2006), and *Logic Colloquium 2006* (Nijmegen, The Netherlands, 27 July – 2 August 2006).

Alex James presented a paper entitled *A Dynamical Model of Honeydew Production* at the NZ Ecology Society's conference, *Ecology Across the Tasman,* held at Victoria University, Wellington, from 28 August – 1 September 2006.

ETON SENIOR MATHEMATICS COMPETITION

The Department hosted the finalists from the Eton Senior Mathematics Competition on Friday, 18 August. The 15 school pupils sat a two-hour exam in the morning followed by a whistle-stop tour of several College of Engineering departments. We entertained them with food, posters, and an impressive display of surface-fitting software. The gory shot of a titanium plate being grafted to the surface of a skull was a particular crowd-pleaser! Thanks to Rick and Paul for the computer display; to Ryoko**,** Scott, and Kathryn, who talked about their experiences as students; to Sarah and Justine for the food; and to Liz**,** Alex, and Mike, for mingling with the visitors.

Ben Martin

PAPERS ACCEPTED

D S Lee, J Roscoe & G Russell: *Developing hidden Markov models for aiding the assessment of preterm babies' health (*International Conference on Biomedical and Pharmaceutical Engineering, 11-14 December, Singapore). Dominic gave a talk with the same title to the Quantitative Journal Club, Christchurch School of Medicine & Health Sciences, on 26 June.

J G Chase, J Lin, D S Lee, J Wong, C E Hann & G M Shaw: *Stochastic insulin sensitivity models for tight glycaemic control* (6th IFAC Symposium on Modelling and Control in Biomedical Systems, Reims, France, 19-22 September 2006.)

A D Rudge, J G Chase, G M Shaw, D S Lee & C E Hann: *Parameter identification and sedative sensitivity analysis of an agitation-sedation model.* (Computer Methods and Programs in Biomedicine.)

PAPERS PUBLISHED

K Hartmann & M Steel: *Maximizing phylogenetic diversity in biodiversity conservation: greedy solutions to the Noah's Ark problem* (Systematic Biology 55 (4),644-651, 2006.

A D Rudge, J G Chase, G M Shaw & D S Lee: *Physiological modelling of agitation-sedation dynamics including endogenous agitation reduction* (Medical Engineering and Physics, Vol 28 (7) pp 629-638, ISSN: 1350-4533, 2006).

T Lotz, J G Chase, K A McAuley, D S Lee, J Lin, C E Hann & J I Mann: *Transient and steady state euglycemic clamp validation of a model for glycemic control and insulin sensitivity testing.* (Diabetes Technology & Therapeutics, Vol.8 (3), pp 338-346, ISSN: 1520-9156, 2006).

A D Rudge, J G Chase, G M Shaw & D S Lee: *Physiological modelling of agitation-sedation dynamics* (Medical Engineering and Physics 28 (1), pp 49-59, ISSN: 1350-4533, 2006.)

J G Chase, J Lin, D S Lee, G M Shaw, T Lotz, C E Hann & X W Wong: *Modelling stochastic insulin sensitivity variability in critical care.* (Technical Note, NZ Medical Journal, Vol. 119 (1231), p 11, ISSN: 0028-8446, 2006.)

J Berger: *The logical strength of the uniform continuity theorem* (Logical Approaches to Computational Barriers, Lecture Notes in Computer Sciences 3988, Springer-Verlag 35-39, 2006.

J Berger & P Schuster: *Classifying Dini's Theorem* (Notre Dame J. Formal Logic 47, no.2 (2006) 253-262.

VISITS

In June, **Mike Steel** visited Oxford University where he talked to the statistics department and gave an informal seminar. He also met with administrators of the Isaac Newton Institute for Mathematical Sciences at the University of Cambridge to discuss arrangements for a Phylogenetics Workshop in 2007. In July, Mike visited the Universities of Hamburg and Bielefeld in Germany. He then went on to meetings in Vienna at the Centre for Integrative Bioinformatics and to Tübingen University, Germany, to meet with recent Erskine Fellow Daniel Huson.

Douglas Bridges spent three weeks in Germany in August. He was working in the Mathematisches Institut of the University of Munich in the first and third week, and participated in the meeting on *Computational Structures for Modelling Space, Time, and Causality* at Schloss Dagstuhl in the second. (Dagstuhl is the German Computer Science Society's equivalent of Oberwohlfach.) In contrast to his June visit, the weather on this occasion was cool and wet, but then, the beer also had those characteristics…

WHAT IS ... CHURCH'S THESIS?

(Douglas Bridges)

What is ...

... **Church's thesis?**

Those of you who are versed in logic please forgive me for using this column to talk about something as elementary, if fundamental, as Church's thesis—or, as some of us prefer to call it, the Church–Markov–Turing thesis. But since this year is the seventieth anniversary of the thesis [2], it seems appropriate to give it some recognition in the way one does to the elderly.

In 1936 there were produced a number of different mathematical descriptions of what it might mean to be a computable partial function $f : \mathbb{N} \to \mathbb{N}$; that is, a computable function whose domain is a set of natural numbers (note: I include 0 as an element of $\mathbb{N}$) and whose values belong to $\mathbb{N}$. Among these, perhaps the most famous is the Turing machine approach, in which a computer is modelled by an abstraction of the idea of a read-write head moving along a tape divided into cells which contain symbols from the alphabet $\{0, 1, \mathbf{B}\}$, where $\mathbf{B}$ signifies a "blank" (empty) cell. At around the same time, Church produced his "lambda calculus", an approach to computability theory that eventually led to the programming language LISP. Then Gödel, Herbrand and Kleene used the partial recursive functions for their notion of computability; the class of partial recursive functions is built up from a base class, consisting of functions such as "successor" that are indisputably computable, by finitely many applications of certain rules which, at least intuitively, produce new computable functions from old. Subsequently there were produced several other, quite different approaches to a theory of computation, including that of "Markov algorithm", introduced by Markov in the late 1940s.

Remarkably, all those apparently very different ways of introducing notions of "computable partial function" led to the same class of such functions. As a result, the Church-Markov-Turing thesis, formulated by Church in 1936, seemed more and more reasonable. The thesis states that

> **CMT:** The computable partial functions from $\mathbb{N}$ to $\mathbb{N}$ are precisely those partial functions that can be computed by a Turing machine.

To date, no-one has produced a universally agreed counterexample to this thesis (although Kalmár [1] would have begged to differ on this). The beauty of CMT is that if, as almost all logicians do, you accept it, then every time you come across a partial function $f : \mathbb{N} \to \mathbb{N}$ that is clearly computable in an informal sense, you can invoke the thesis to justify a belief that it is formally computable by a Turing machine; this enables you to avoid presenting the tiresome details of the construction of a Turing machine that computes f.

Note that CMT is a thesis, not a theorem. To identify "computable" with "Turing-machine computable" is akin to identifying the informal notion of "continuous function" with the formal ε-δ one that is given to undergraduates. However, analysts normally require proof that their functions are indeed continuous, whereas computability theorists are happy to rely on their intuition of the computable and to apply CMT wherever possible. Analysts are fussy; computability theorists are lazy!

References

[1] L. Kalmár, "An argument against the plausibility of Church's thesis", in *Constructivity in Mathematics* (A. Heyting, ed.), 72–80, North-Holland, Amsterdam, 1959.

[2] A. Olszewski, J. Woleński, R. Janusz (eds), *Church's Thesis After 70 Years*, Ontos Verlag, Frankfurt, 2006.

DEPARTMENTAL VISITORS

Visitors	Name of Organization	From	To	Room	Extn
Dr John Holt	Massey University	15 Mar 2005	10 Apr 2007	502	7663
Dr Bhalchandra Thatte	Massey University	1 Apr 2006	15 Nov 2006	616	8876
Ms Simone Linz	University of Dusseldorf, Germany	29 Sep 2006	31 Aug 2007	605	8028
Dr Beata Faller	Eotvos University, Hungary	14 Oct 2006	20 Dec 2006	616	8876
Dr Michael Bate	University of Oxford, England	30 Nov 2006	16 Dec 2006	605	8028
Prof Rainer Loewen	University of Braunschweig	30 Nov 2006	6 Jan 2006	607	8875

BE VERY AFRAID!

Welcome back to **Julie Daly**, who returns to the Department on Monday, 18 September! Our thanks and best wishes go to **Justine Willett** as she moves on to a permanent position at Princess Margaret Hospital.