RESEARCH UNITS, CENTRES AND INSTITUTES

Annual Report 2011

Section 1a - IDENTIFICATION INFORMATION:

<table>
<thead>
<tr>
<th>Title of Unit, Centre or Institute</th>
<th>Centre for Discrete Mathematics and Theoretical Computer Science</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name of Director</td>
<td>Prof. CS Calude</td>
</tr>
<tr>
<td>Name of Deputy Director</td>
<td>Dr. MJ Dinneen</td>
</tr>
</tbody>
</table>

Section 1b – ENDORSEMENT OF REPORT:

<table>
<thead>
<tr>
<th>Signatures:</th>
<th>Please sign in appropriate space below</th>
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<tbody>
<tr>
<td>Director</td>
<td>C. Calude</td>
</tr>
<tr>
<td>(Required for all Units/Centres/Institutes)</td>
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<tr>
<td>Head of Department</td>
<td>G. C Dobie</td>
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<tr>
<td>(Required only for Department Units/Centres)</td>
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<tr>
<td>Dean</td>
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<tr>
<td>(Required for Faculty/University Centres/Institutes)</td>
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Section 2 – ADVISORY BOARDS AND MEETING DATES:

Management Committee

- Professor Douglas Bridges (External Researchers Representative, Canterbury University),
- Professor Cristian Calude (Director),
- Dr. Michael J. Dinneen (Deputy Director),
- Professor Gill Dobie (HOD, Computer Science).

International Advisory Board

Appendix 2

Hartmanis (Cornell University, US), H. Jurgensen (University of Western Ontario, Canada and Potsdam University, Germany), C.C. Lindner (Auburn University, Alabama, US), R. Mathon (University of Toronto, Canada), B.D. Mackay (Australian National University, Australia), A. Nerode (Cornell University, US), I. Prigogine (1995–2003), G. Rozenberg (Leiden University, Netherlands), A. Salomaa (University of Turku, Finland), J. Seberry (University of Wollongong, Australia), D. van Dalen (University of Utrecht, Netherlands).

Section 3 – PARTICIPATING MEMBERS AND EMPLOYEES /STUDENTS:

Participating departments

Computer Science, Mathematics, Philosophy

Staff

Douglas S. Bridges (Mathematics, University of Canterbury),
John C. Butcher (Mathematics),
Cristian S. Calude (Computer Science),
Marston D. E. Conder (Mathematics),
Michael J. Dinneen (Computer Science),
Steven Galbraith (Mathematics),
Fred Kroon (Philosophy),
Bakh Khoussainov (Computer Science),
Radu Nicolescu (Computer Science)
Andre Nies (Computer Science),
Eamonn O’Brien (Mathematics),
Alexander Raichev (Computer Science),
Jeremy Seligman (Philosophy),
Ulrich Speidel (Computer Science),
Clark Thomborson (Computer Science),
Mark C. Wilson (Computer Science),
Xinfeng Ye (Computer Science).

External Researchers

Antoniou (Solvay Institute, Belgium), E. Calude (Massey University at Albany, New Zealand),
R. Downey (Victoria University of Wellington, New Zealand), B. Everitt (University of Aberdeen, Scotland), R. Goldblatt (Victoria University of Wellington, New Zealand), P. Hertling (FernUniversitat Hagen, Germany), D. Holton (University of Otago, New Zealand), K.W. Lih
(Institute of Mathematics, Academia Sinica, Taiwan), C. Little (Massey University, New Zealand), M. Lipponen (Turku University, Finland), J. McKay (Concordia University, Canada),
Gh. Paun (Institute of Mathematics, Romanian Academy, Romania), C.E. Praeger (University of Western Australia), L. Staiger (MartinLuther Universitat Halle-Wittenberg, Germany), K. Svozil
(technische Universitat, Vienna), D. Stefanescu (Bucharest University, Romania), S. Yu
(University of Western Ontario, Canada), I. Tomescu (Bucharest University, Ontario).

Graduate students

Appendix 2

International Affiliations

- Logic Group at JAIST,
- Turku Centre for Computer Science (TUCS),
- Valparaiso Institute of Complex Systems,
- Research Reports at Martin-Luther-Universitat Halle-Wittenberg, Germany.

Section 4 – INTRODUCTION:

The aim of the Management Committee to build one of the world’s best centres for research in Discrete Mathematics and Theoretical Computer Science is coming true. The Centre has become a major force in fostering research and development in those areas within the South Pacific Region and creating productive links between that region’s researchers and their counterparts in the rest of the world.

Section 5 – AIMS, GOALS AND FUTURE PLANS:

a. General Aims:

Although the Centre encourages and supports a wide range of research activity, its primary research foci are the following:
- Combinatorial Algorithms and Optimization
- Computability and Complexity
- Unconventional Computation
- The Runge-Kutta Club
- Programming Contests

b. Goals for Reporting Year:

- To stimulate and encourage the interest of undergraduate students in theoretical computer science and discrete mathematics (including ACM and regional programming contests),
- To foster research, development and cooperation in theoretical computer science and discrete mathematics (participating members, graduate students),
- To fund short and long term visitors, post-doctoral researchers, and doctoral students,
- To organize international conferences, workshops and seminars.

c. Plans for Upcoming Year:

To continue the achievement of the goals for the reporting year.

Section 6 – MAJOR ACHIEVEMENTS AND OTHER NOTABLE ACTIVITIES:

Starting with 2005, International Conference Unconventional Computation has become an annual event, organised by the following Steering Committee (see https://www.cs.auckland.ac.nz/uc):

Leiden, co-chair, Holland, A. Salomaa, Turku, Finland.

The 10th International Conference on Unconventional Computation (UC 2011) took place in Turku, Finland, on June 6-10, 2011. It was organized by the FUNDIM laboratory of the Mathematics Department, University of Turku and the CDMTCS, under the auspices of EATCS and Academia Europaea. The proceedings was published as:


The 4th Workshop on Physics and Computation and the 4th Workshop on Hypercomputation were held in Turku, Finland June 6-10, 2011 in conjunction with UC’11.

The Workshop Analysis and Randomness in Auckland was held in December 12-13.

International Programming Contest

CDMTSC staff helped organize several programming contests. The [ANZAC league](http://anzac-eatcs.org) of six rounds was offered during the first part of the year. Michael Dinneen prepared the problem set for the 2nd round and had about 5 regular competing teams throughout.

Radu Nicolescu organized an Auckland Site for the New Zealand Programming Contest. We had a few strong teams with the Intermediate category winners (University of Auckland team Rexes: Felix Fei Mann, Roy Lin and Kwun Hung Cheung). Unfortunately the University of Canterbury took the Junior and Tertiary Open categories.

For the main ACM South-Pacific Regional Contest we again took the Auckland Site with repeat winners for the Auckland Site (7th in region)—Ronald Chan, Tapio Saarinen and Ralph Versteegen. Michael Dinneen acted as coach and site judge (and assisted in the problem set preparation). The regional representatives to the ACM Finals will be by teams from the University of New South Wales and University of Canterbury.

Members of the CDMTCS in the editorial boards of the following international journals:


Educational Activities

The CDMTCS supports the following activities:
The group of courses “Logic and computation” leading to BA, BSc, MA, MSc degrees organized in cooperation with the departments of computer science, mathematics, philosophy and linguistics.

The CDMTCS is the major contributor to the undergraduate core courses CompSci 220 (Algorithms and Data Structures), CompSci 225 (Discrete Structures in Mathematics and Computer Science), CompSci 350 (Mathematical Foundations of Computer Science), CompSci 314 (Data Communications Fundamentals), CompSci 320 (Applied Algorithmics), CompSci 369 (Computational Science).

Two theoretical graduate courses CompSci 720 (Advanced Design and Analysis of Algorithms), CompSci 750 (Computational Complexity) were taught by CDMTCS staff.

CDMTCS members actively participate in organizing, judging ANZAC, NZ and ACM programming contests.

Miranda Jane Emery is recipient of the J.C. Butcher Award in Theoretical Computer Science for 2011.

International Activities

The members of the CDMTCS have been actively involved in more than 30 Program Committees for international conferences and workshops, in the activity of the Informatics Section of the Academia Europaea and in the ICT, Call : FP7-ICT-2011-8 (Brussels).

Section 7 – Reviews

a. Date of last review:

b. Review Recommendations:

No review in 2011.

Section 8 – FINANCIAL REPORT

See attached.

Section 9 – RESEARCH OUTPUTS

More than 180 research papers have been published by faculty members and graduate students.

CDMTCS Research Reports

The Series is very well cited; the reports are announced in the column “News from NZ” published three times a year in the EATCS Bulletin.

The following reports were published in 2011:

<table>
<thead>
<tr>
<th>Year</th>
<th>Author(s)</th>
<th>Title</th>
<th>Date</th>
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<tbody>
<tr>
<td>2011</td>
<td>G.J. Chaitin</td>
<td>A Mathematical Theory of Evolution and Biological Creativity</td>
<td>01/2 011</td>
</tr>
<tr>
<td>2011</td>
<td>Y. Bugeaud</td>
<td>Continued Fractions of Transcendental Numbers</td>
<td>02/2 011</td>
</tr>
<tr>
<td>2011</td>
<td>R. Nicolescu and H. Wu</td>
<td>BFS Solution for Disjoint Paths in P Systems</td>
<td>03/2 011</td>
</tr>
<tr>
<td>No.</td>
<td>Authors</td>
<td>Title</td>
<td>Date</td>
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<tr>
<td>2</td>
<td>L. Staiger</td>
<td>Constructive Dimension and Hausdorff Dimension: The Case of Exact Dimension</td>
<td>04/2011</td>
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<tr>
<td>3</td>
<td>U. Speidel</td>
<td>A Forward-Parsing Randomness Test Based on the Expected Codeword Length of T-codes</td>
<td>05/2011</td>
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<tr>
<td>4</td>
<td>M.J. Dinneen, Y.-B. Kim and R. Nicolescu</td>
<td>An Adaptive Algorithm for P System Synchronization</td>
<td>05/2011</td>
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<tr>
<td>5</td>
<td>A.A. Abbott, M. Bechmann, C.S. Calude, and A. Sebald</td>
<td>A Nuclear Magnetic Resonance Implementation of a Classical Deutsch-Jozsa Algorithm</td>
<td>05/2011</td>
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<tr>
<td>6</td>
<td>K. Tadaki</td>
<td>A Computational Complexity-Theoretic Elaboration of Weak Truth-Table Reducibility</td>
<td>07/2011</td>
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<tr>
<td>7</td>
<td>K. Svozil</td>
<td>Neutrino Dispersion Relation Changes Due to Radiative Corrections as the Origin of Faster-than-Light-in-Vacuum Propagation in a Medium</td>
<td>09/2011</td>
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<tr>
<td>9</td>
<td>C.S. Calude and E. Calude</td>
<td>The Complexity of Euler's Integer Partition Theorem</td>
<td>11/2011</td>
</tr>
<tr>
<td>10</td>
<td>C.S. Calude and E. Calude</td>
<td>The Complexity of Mathematical Problems: An Overview of Results and Open Problems</td>
<td>11/2011</td>
</tr>
<tr>
<td>11</td>
<td>L. Staiger</td>
<td>On Oscillation-free Chaitin h-random Sequences</td>
<td>11/2011</td>
</tr>
<tr>
<td>12</td>
<td>L. Staiger</td>
<td>Asymptotic Subword Complexity</td>
<td>11/2011</td>
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