CDMTCS: 1999 ANNUAL REPORT

The Centre for Discrete Mathematics and Theoretical Computer Science was founded in 1985 in order to a) support research between mathematics and computer science, b) increase local knowledge in these areas, and c) broaden research skills in New Zealand. The aim is build one of the world's best centres for research in Discrete Mathematics and Theoretical Computer Science. The Centre has already become a major force in fostering research and development in these areas within Australasia region and has created links with many research institutions in Asia, Europe and North America.

The Centre encourages and supports a wide range of research activity with an emphasis to:

1. Artificial Intelligence
2. Combinatorial Optimisation
3. Computability and Complexity
4. Constructive Algorithms
5. Quantum and Molecular Computations
6. Logic and Applications.

The Centre is financially supported by the department of Computer Science, Mathematics Department, and Pukekohe travel.

Director: Professor Cristian Calude. In 1999 the director has been on sabbatical leave.

Deputy Director: Dr. Bakhadyr Khoussainov. In 1999 Khoussainov has acted as an acting director of the Centre.

Research Reports Coordinator: Dr. Michael J. Dinneen

Management Committee consists of Professor Douglas Bridges (External Researchers Representative, The University of Canterburry), Professor Cristian Calude, Professor Ian Collins (The University of Auckland Research Committee representative), Associate professor Peter Gibbons, HOD, The department of Computer Science, Professor Ivan Relly, Dr. Bakhadyr Khoussainov.

Participating Members of the Centre are P. Bonnington (Mathematics, Tamaki), D.S. Bridges (Mathematics, The University of Canterburry), C. Calude (Computer Science, Auckland), M. Conder (Mathematics, Auckland), M. Dinneen (Computer Science, Auckland), R.W. Doran (Computer Science, Auckland), P. Gibbons (Computer Science, Auckland), H. Guesgen (Computer Science, Auckland), P. Hafner (Mathematics, Auckland), F. Kroon (Philosophy, Auckland), B. Khoussainov (Computer Science, Auckland), M. Morton (Mathematics, Auckland), R. Nicolescu (Computer Science, Tamaki), E. O'Brien (Mathematics, Auckland), B. Pavlov (Mathematics, Auckland), I. Reilly (Mathematics, Auckland), M. Titchener (Computer Science, Tamaki), C. Thomborson (Computer Science, Auckland).

The **international advisory board** of the CDMTCS consists of the following members:

M. Arslanov (Kazan University, Russia), R.C. Backhouse (Eindhoven University of Technology, Netherlands), J. Casti (Santa Fe Institute, USA, and Technische Universitet, Austria), G.J. Chaitin (IBM, USA), C.J. Colbourn (University of Vermont,USA), E.W. Dijkstra (University of Texas, USA), J.H. Dinitz (University of Vermont, USA), J.A. Goguen (UCSD, USA), R.L. Graham (UCSD, USA), J. Hartmanis (Cornell University, USA), H. Jurgensen (University of Western Ontario, Canada), C.C. Lindner (Auburn University, USA), R. Mathon (University of Toronto, Canada), B.D. Mackay (Australian National University, Australia), A. Nerode (Cornell University, USA), I. Prigogine (Solovey Institute, Belgium), G. Rozenberg (Leiden University, Netherlands), A. Salomaa (University of Turku, Finland), J. Seberry (University of Wollongong, Australia), D. Van Dalen (University of Utrecht, Netherlands).

External Researchers:

The Center has around 20 external researchers from other academic institutions from Japan, USA, Australia, New Zealand, Germany, Scotland, Taiwan, Finland Canada, and Austria. All of them actively contribute to the Centre's activities by refereeing papers, assisting with conference and workshop organizations, and by other means. Some of the external researchers are I. Antoniou (Solvay Institut, Bruxelles, Belgium), E. Calude (University of Massey at Albany, New Zealand), R. Downey (Victoria

University of Wellington, New Zealand), B. Everitt (University of Aberdeen, UK), 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), M. Lipponen (Turku University, Finland), C. Little (Massey University, New Zealand), J. McKay (Concordia University, Montreal, Canada), Gh. Paun (Institute of Mathematics, Romanian Academy), C. E. Praeger (University of Western Australia), K. Svozil (Vienna University of Technology, Austria), D. Stefanescu (Bucharest University, Romania), S. Yu (University of Western Ontario, Canada), I. Tomescu (Bucharest University, Romania)

Graduate Students whose work is related to the research program of the Centre are the following:

Peter Dobcsanyi (PhD student, "Combinatorial Computation using Distributed Processing"), Luminita Simona Dediu (PhD student, "Constructive Aspects of the Theory of Von Neumann Operators"), Matt Humphrey (PhD student, "Human-computer Interaction Using Relational Algebra"), Stuart Inglis (PhD student, "Textual Image Processing"), James Webb: (PhD student, "Computational Techniques for Solving Chessboard Problems"), S. Irvine (PhD student), John Pearson (PhD student, "Studies in Combinatorics and Group Theory"), Cameron Walker (PhD student, "Compact Presentations for the Symmetric Groups"), Craig Nevill-Manning (PhD student, "Programming by Example"), Tony Smith (PhD student, "Probability-based Grammar Induction"), Wang Yuchuan (PhD student, "Constructive aspects of the Dirichlet Problem"), Sasha Rubin (PhD student, “Finite Automata and Algebraic Systems”), Robyn Curtis (Masters student, "The Cycle Double Cover Problem"), Samantha Stephenson (Masters student, "Sharply Transitive Sets and Finite Projective Planes"), Brent Martin (Masters student, "Instance-based Learning: Nearest Neighbour with Generalisation"), James Littin (Masters student, "Learning Rules with Inter-attribute Dependencies").

Postdoctoral Fellows:

Dr. Richard Coles and Dr. Peter Hertling have finished their Postdoctoral research work in 1999. They have worked here under the supervision of Professor Cristian Calude.

Research Grants:

1. Marston Conder, Jianbei An, and Eamonn O'Brien..
Effective computational approaches to questions in group theory and its applications. Marsden Fund. $81875pa

2. Cristian Calude. Monbusho (Japan Ministry of Education, Science, Sports and Culture), Research and Travel Grant

3. Mike Fellows (of VUW) and Michael J. Dinneen. Systematic design of useful heuristic algorithms via parametric complexity methods $375,000

4. Bakhadyr Khoussainov, Rod Downey (of VUW). NSF Division of International Programs Grant for Cooperative Research between USA and New Zealand. Computability, Logic, and Complexity. 1997-2001.

In addition, the members of the Centre have secured a number of research grants awarded by the University of Auckland Research Committee.

Workshop and Conferences:

The Workshop CCF'99 (Computability, Complexity, and Fuzziness)}, organised by the University "Dunarea de Jos", Galatzi, Romania, was organized by the Centre, the Department of Mathematics and Statistics of University of Canterbury, Christchurch, and the University of Dunarea de Jos, Galatzi, Romania. The conference was held on 26--28 August, 1999.

Seminars:
Dr. Bakhadyr Khoussainov has began running Algebra, Logic, and Computer Science (ALCS) seminar series. There have already been 18 seminar presentations given by the academics from the computer science department, mathematics department, and philosophy department.
In addition, Professors Rod Downey (Victoria University in Wellington) and Sergey Goncharov (Novosibirsk University) have presented talks on recent developments in theoretical computer science and mathematical logic.
The seminar has also organized a series of talks in preparation for Kaikoura 2000 workshop "Computability and Complexity".

Affiliations: The Centre has affiliations with the following institutions:

1. Logic Group at Japan Advanced Institute of Science and Technology
2. Theoretical Computer Science Centre at Turku University, Finland.
3. Mindship International.

Publications and Technical Reports:

The Centre edits the Springer-Verlag books series in Discrete Mathematics and Theoretical Computer Science. CDMTCS also cooperates with Turku Theoretical Computer Science Centre and Graz University of Technology in producing Journal of Universal Theoretical Computer Science.

Books published in 1999:

1. C.S. Calude and M. Dinneen (eds). Combinatorics, Computation, Logic. Proceedings of the CATS99 and CDMTCS99, Springer—Verlag, Singapure,, 1999, 368pp

2. M. Mignotte, D. Stefanescu. Polynomials. Algorithmic Approach. Springer-Verlag, Singapure, 1999.

3. C. Ding, T. Helleseth, H. Niederreiter (eds.). *Sequences and Their Applications. Proceedings of SETA '98,* Springer-Verlag, Singapore, 550 pp.

4. G.J. Chaitin. *The Unknowable,* Springer-Verlag, Singapore, 1999, 122 pp.

The Journal of Universal Computer Science publishes on monthly basis.

Research Papers: Members of the Centre, faculty staff, and students have published more 100 research papers in refereed journals, proceedings, books, and workshop proceedings.

CDMTCS Research Reports:

1. C.S. Calude and E. Calude. Bisimulations and Behaviour of

Nondeterministic Automata. 02/1999
2. C.S. Calude.A Glimpse into Algorithmic Information Theory. 02/1999
3. C.S. Calude and R. Coles. On a Theorem of Solovay. 02/1999
4. C.S. Calude A Characterization of C.E.~Random Reals. 03/1999
5. L. Staiger. The Kolmogorov Complexity of Liouville Numbers. 03/1999
6. A.M. Kraegeloh. Unstable Dynamics on a Markov Background and Stability in Average. 03/1999
7. G. Paun. Computing with Membranes: A Variant. 03/1999
8. C.S. Calude, K. Salomaa and S. Yu. Metric Lexical Analysis. 03/1999
9. C.S. Calude, P. Hertling, H. Jurgensen and K. Weihrauch. Randomness on Full Shift Spaces. 04/1999
10. G. Paun and G. Thierrin Multiset Processing by means of Systems of Sequential Transducers. 04/1999
11. G. Paun P Systems with Active Membranes: Attacking NP Complete Problems. 05/1999
12. B. Assanovich and U. Gunther Variable-Length Codes for Sources with Equiprobable Symbols. 05/1999
13. C.S. Calude, E. Calude and K. Svozil. Quantum Correlations Conundrum: An Automaton-Theoretic Approach. 06/1999
14. M.J. Dinneen and B. Khoussainov.Update Games and Update Networks. 06/1999
15. C.S. Calude, E. Calude and K. Svozil. Quantum Correlations Conundrum: An Automaton-Theoretic Approach. 06/1999
16. C.S. Calude, M.J. Dinneen and K. Svozil. Counterfactual Effect, the Halting Problem, and the Busy Beaver Function. 07/1999
17. C. Grozea. Free-Extendible Prefix-Free Sets and an Extension of the Kraft-Chaitin Theorem. 07/1999
18. C.S. Calude, E. Calude, T. Chiou, M. Dumitrescu and R. Nicolescu. Testing Computational Complementarity for Mermin Automata. 07/1999
19. D.S. Bridges, C.S. Calude and L.S. Dediu (editors) Abstracts of Constructivity, Complexity, and Fuzziness (CCF '99). 07/1999
20. M.J. Dinneen and B. Khoussainov Automata with Equational Constraints. 08/1999
21. C.S. Calude, H. Jurgensen and S. Legg Solving Problems with Finite Test Sets. 09/1999
22. C.S. Calude, E. Calude and K. Svozil Computational Complementarity for Probabilistic Automata. 09/1999

23. C.S. Calude Chaitin Ω Numbers, Solovay Machines, and Incompleteness. 10/1999
24. G. KapoulasComputable p-adic Numbers.11/1999
25. C.S. Calude, H. Ishihara and T. Yamaguchi Minimal Programs Are Almost Optimal. 11/1999

Honours:

1. Marston Conder, Doctor of Science, University of Oxford, January, 1999.
2. Cristian Calude, External Researcher, University of Canterburry, 1999.

Financial Statement for 1999:

INCOME:

Carry on from 98:	22,061.39
Computer Science Dept:	5,000.00
Maths Department	3,000.00
SMIS	2,500.00
For Visitors	10,000.00
Total	42.561.39

EXPENDITURE:

Travel:	9,637.07
Visitors Travel:	4,068.80
Communication:	774.24
Hospitality:	436.36
Other:	2,254.85
Total Expenditure:	17,171.32

Carried to the 2000 Budget: $22,000

Deputy Director:
Dr. Bakhadyr Khoussainov