Draft Timetable for CMA Hadamard Maximal Determinant Workshop
Thursday 13th May – Monday 17th May, 2010

ORGANIZERS: Richard Brent and Judy-anne Osborn
VENUE: Bernhard Neumann Seminar Room (G35),
John Dedman Building (Building 27), MSI, ANU

Thursday 13th May

15:30 – 16:00 MSI Afternoon Tea

16:00 – 17:00 MSI Colloquium
Professor Jennifer Seberry, University of Wollongong
Progress in Hadamard Matrices via Computers

Friday 14th May

09:30 – 10:30 Professor Jennifer Seberry, University of Wollongong
How Progress in Orthogonal Designs and Sequences have led to Progress in Hadamard Matrices via Computers

10:30 – 10:45 break

10:45 – 11:45 Dr Paul Zimmermann, INRIA, Nancy
An Implementation of Orrick's Algorithm

11:45 – 12:00 break

12:00 – 13:00 Professor Richard Brent, ANU
Decomposing Gram Matrices

13:00 – 14:30 Lunch

14:30 – 15:30 Dr Judy-anne Osborn, ANU
Visualizing searches for Maximal Determinant Matrices

15:30 – 17:30 Afternoon Tea and Workshop

18:30 Dinner

Saturday 15th May

09:30 – 10:30 Professor Kathryn Horadam, RMIT University, Melbourne
Hadamard Matrices and Their Applications: an update

10:30 – 10:45 break

10:45 – 11:45 Dr William Orrick, Indiana University, Bloomington
Codes and the structure of Hadamard matrices

11:45 – 12:00 break

12:00 – 13:00 Professor Charles Little, Massey University
A possible approach to the Hadamard Conjecture using Coding Theory

13:00 – 14:30 Lunch

14:30 – 15:30 Dr Paul Leopardi, ANU
Amicability graphs and Clifford algebras

15:30 – 17:30 Afternoon Tea and Workshop

18:30 Dinner

Sunday 16th May

Free day

Monday 17th May

09:00 – 12:30 POSSIBLE FURTHER TALKS

12:30 – 14:00 Lunch

14:00 – 16:00 Workshop and Afternoon Tea

16:00 – 17:00 MSI Computational Mathematics Seminar Series
Dr William Orrick, Indiana University, Bloomington
Range and distribution of determinants of binary matrices

Abstracts

Speaker: Professor Richard Brent, ANU
Title: Decomposing Gram matrices
Abstract: When searching for maximal or large-determinant $\{-1, +1\}$ matrices R we construct putative Gram matrices G and try to decompose them — either find R such that $G = RR^T$ or show that no such decomposition exists. We may also know another matrix H such that (possibly) $H = R^T R$; this extra information can be used to speed up the search for R. In this talk we outline a backtracking search algorithm to find R or prove that it does not exist. The algorithm is similar to one used by Orrick to find a maximal matrix of order 15, but has some significant differences. We describe our C implementation, its current limitations, and mention possible future improvements. (Joint work with Will Orrick, Judy-anne Osborn and Paul Zimmermann.)

Speaker: Professor Kathryn Horadam, RMIT University
Title: Hadamard Matrices and Their Applications: An Update
Abstract: I will survey research progress in Hadamard matrices, especially cocyclic Hadamard matrices, their generalisations and applications, made over the past three years.
Advances in (up to) 20 specific problems and several new research directions will be outlined and some new problems presented.

Speaker: Dr Paul Leopardi, ANU
Title: Amicability graphs and Clifford algebras
Abstract: It is known that the Williamson construction for Hadamard matrices can be generalized to constructions using sums of tensor products. This talk will discuss a specific construction using a basis for the real representation of Clifford algebras, and its connection with graphs of amicability and anti-amicability. Results will be given for small dimensions. How much of the theory underlying these results is folklore in the Hadamard community? Is it worthwhile to search for higher-dimensional cases?

Speaker: Professor Charles Little, Massey University
Title: A possible approach to the Hadamard Conjecture using Coding Theory
Abstract: In 1981, D. Thuente and I showed that the Hadamard conjecture is equivalent to a problem concerning circuits of length 4 in the complete bipartite graph $K_{4n,4n}$. In more recent and unpublished work, I have related this problem in turn to coding theory and tried to use MacWilliams's identity. In this talk I will describe the current state of play and appeal for assistance.

Speaker Dr William Orrick
Title: Codes and the structure of Hadamard matrices
Abstract: TBA

Speaker Dr William Orrick
Title for MSI Computational Mathematics Seminar Series: Range and distribution of determinants of binary matrices
Abstract: TBA

Speaker Dr Judy-anne Osborn
Title: Visualizing searches for Maximal Determinant Matrices
Abstract: TBA

Speaker Professor Jennifer Seberry, formerly Jennifer Seberry Wallis
Title for Colloquium Talk: Hadamard matrices and computing: the early days
Abstract for Colloquium Talk:
The first results on Hadamard matrices were all theorems. It is in 1944 that J. Williamson in his effort to find the first 200 matrices pioneered computing techniques.
It was the gaps in his table that led to further results also inspired by computing.
My honours thesis (1965) led me to look at special kinds of Hadamard matrices which could be used to construct others.
My early efforts to compute skew Hadamard matricess used thousands of hours on early commputers
I shall talk about Willliamson matrices, Williamson type matrices, Goethals-Seidel Matrices (and their group generalization Wallis- Whiteman Matrices) and special sequences which have been used to construct Hadamard matrices. I shall talk about the computing effort involved.
I shall mention the early attempts as searching for equivalent Hadamard matrices and the Smith Normal Form.

Speaker Professor Jennifer Seberry
Title: How Progress in Orthogonal Designs and Sequences have led to Progress in Hadamard Matrices via Computers
Abstract: TBA

Speaker: Dr Paul Zimmermann, INRIA, Nancy
Title: An Implementation of Orrick's Algorithm
Abstract: We have implemented in C the algorithm described by Will Orrick to search for candidate matrices with maximal$\{-1, 1\}$-determinant of given dimension n (for n odd). The talk will describe some results obtained with this implementation, and possible ideas to improve the search (common work with Judy-anne Osborn, Richard Brent and Will Orrick).