
Generalized Hadamard Matrices and Applications
(Org: **Aidan Roy and Ada Chan** (University of Waterloo and York University))

ROBERT CRAIGEN, University of Manitoba
Some Circulant Generalized Weighing matrices

An elementary construction produces new classes of circulant generalized weighing matrices of so-called "Butson type" (i.e., whose entries are complex roots of unity) with parameters $GW(nN, n^2)$ for all positive integers n, N such that $n \leq N$. We also discuss some generalizations and context. This was work done with Warwick de Launey before his recent death.

HADI KHARAGHANI, University of Lethbridge
Mutually unbiased complex weighing matrices

A k -complex weighing matrix of order n and weight p is a matrix $CW(n, p)$ of order n with entries consisting of the k -th root of unity and $WW^* = pI_n$. Two k -complex $CW(n, p)$, H, K are called *unbiased* if the absolute value of the entries of HK^* equal \sqrt{p} . The class of mutually unbiased k -complex $CW(n, p)$ s for small values of n and p will be discussed. This is a joint work with D. Best and H. Ramp.

AIDAN ROY, University of Waterloo
Generalized Hadamard matrices and quantum measurements

The columns of a unitary matrix M may be thought of as a von Neumann measurement in quantum mechanics. When the entries of M are highly structured, such as in a generalized Hadamard matrix, the measurement may prove particularly useful in quantum computing. I will give three instances of this phenomenon and describe the combinatorics involved in each: mutually unbiased bases, weighted complex 2-designs, and the entanglement-assisted capacity of a graph.

ALYSSA SANKEY, University of New Brunswick
Type-II matrices associated with 2-graphs and weighted strongly regular graphs

The class of type-II matrices includes Hadamard matrices and spin models. The Nomura algebra of a type-II matrix is the Bose-Mesner algebra of an association scheme. Since spin models are contained in their Nomura algebras, we consider type-II matrices associated with known schemes. Indeed, they exist in connection with strongly regular graphs, certain distance-regular graphs, and other combinatorial objects.

In this talk we investigate type-II matrices, 2-graphs and weighted strongly regular graphs.