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Seminar

Speaker: **Professor Frederick K.H. Phoa**
Institute of Statistical Science
Academia Sinica

Title: **Circulant Orthogonal Array: Construction via GDS and Application to fMRI Experiments**

Time: **3:20 – 4:20pm, *Wednesday*, March 11, 2015**

Place: **552 Hill Center**

Abstract

Circulant matrix is a useful class of experimental plan that are commonly used in functional magnetic resonance imaging (fMRI) experiments. By definition, a n x n matrix $Ab = (a_{i,j})$ is circulant if $a_{i+1,j+1} = a_{i,j}$ where the subscripts are reduced modulo n. A question arising in stream cypher cryptanalysis is reframed as follows: For given n, what is the maximum value of m for which there exists a circulant m x n (± 1) - matrix Ab such that $AbAb^T = nIb_m$. In 2013, Craigen et al. (2013) compiled a table of maximum values of m for small n and proved some important theoretical bounds. However, the constructions of all these bounds were not mentioned. In this talk, we introduced a new idea called general difference sets (GDS), and derived an important theorem that construct circulant partial Hadamard designs via GDS. We also proposed an algorithm, called difference variance algorithm (DVA), to search GDS. The resulting design tables and their comparisons to the results in Craigen et al. (2013) are given. Then we extend our results to the construction of circulant orthogonal arrays, a broader class of designs than the circulant partial Hadamard matrices.

***** Refreshments will be served @2:50pm in Room 502 Hill Center *****