Title: Bent p-ary functions and strongly regular graph decompositions

Abstract: Bent functions over a finite field can be thought of as maximally non-linear functions. They can be defined using Fourier transforms, but can also be described by the combinatorics of their level sets, by the parameters of certain associated Cayley graphs, and by the algebra of the adjacency matrices of these graphs. For the Boolean ($p = 2$) case, Dillon discovered a simple combinatorial condition for a function to be bent. In graph-theoretic terms, a Boolean function is bent if and only if its Cayley graph is strongly regular with feasible Latin square or negative Latin square type parameters. Dillon's theorem does not generalize in an obvious way to primes $p > 2$. The Cayley graphs associated with a bent p-ary function are not necessarily strongly regular. We prove a generalized Dillon-type theorem in the other direction, giving graph-theoretic conditions which guarantee that a p-ary function is bent. We also show how to construct such bent functions from orthogonal arrays. These results are joint work with David Joyner.