The 29th PNU-POSTECH Algebraic Combinatorics Workshop

Organized by M.Hirasaka and J.Koolen

January 9, 2009

Date

January 9, 2009

Place

Room 404, Department of Mathematics in POSTECH

Program

11:00-11:50, Yasuhisa Saito (Pusan National University)
Lotka-Volterra equations and qualitative permanence

14:00-14:50, Sunghyu Han (Ewha Womans University)
Higher Weights and Generalized MDS codes

15:00-15:50, Eun Ju Cheon (Gyeongsang National University)
Extension theorems of linear codes over finite fields

16:10-17:00, Sung-Soon Choi (Yonsei University)
Optimal Query Complexity Bounds for Finding Graphs

17:10-18:00, Jang Soo Kim (KAIST)
A combinatorial approach to the power of 2 in the number of involutions

18:30-21:00, Dinner (free of charge)

Available Devices for Presentation

We strongly encourage speakers to give a classical styled talk with chalk and blackboard. However, a beam projector is equipped at room 404.

Speaker: Yasuhisa Saito (Pusan National University)
Title: Lotka−Volterra equations and qualitative permanence
Abstract: Lotka−Volterra equations are well known as a most widely used model in Mathematical Biology. While global stability analysis on the model is interesting and important mathematically as well as biologically, a more basic and important biological question to ask is whether or not all species in a multispecies community will be alive and well in the long run. Permanence is a useful concept for answering the question, which is a weaker concept exhibiting every possible type of species coexistence dynamics (besides global stability on a positive equilibrium) including periodic and chaotic oscillations. In this lecture, we introduce the qualitative permanence of the interaction matrix which has the sign structure that guarantees permanence for a Lotka−Volterra equation whenever it has a positive equilibrium point, and provide both necessary and suÿcient conditions for qualitative permanence.

Speaker: Sunghyu Han (Ewha Womans University)
Title : Higher Weights and Generalized MDS codes
Abstract : We study codes meeting a generalized version of the Singleton bound for higher weights. We show that some of the higher weight enumerators of these codes are uniquely determined. We give the higher weight enumerators for MDS codes, the Simplex codes, the Hamming codes, the first order Reed−Muller codes and their dual codes. For the putative [72, 36, 16] code we find the i−th higher weight enumerators for i = 12 to 36. Additionally, we give a version of the generalized Singleton bound for non−linear codes. This is joint work with Steven T. Dougherty.

Speaker: Eun Ju Cheon (Gyeongsang National University)
Title: Extension theorems of linear codes over ?nite ?elds
Abstract: Let F_n^q be the n−dimensional vector space over the finite field F_q of order q, where q is a prime power. A q−ary [n, k, d] linear code C, simply $[n, k, d]_q$ code means a k−dimensional linear subspace of F_q^n with minimum Hamming distance d. An $[n, k, d]_q$ code C with a generator matrix G is called extendable (to C) if there exists a vector h F_k such that $[G, h^T]$ generates an $[n + 1, k, d + 1]_q$ code C. Here C is called an extension of C. The aim of this talk is to give a geometric aspect to investigate the extendability of linear codes and a new extension theorem for 3−weight (mod q) codes, more precisely, for $[n, k, d]_q$ codes with d ?1 (mod q) whose weights are congruent to 0, −1 or −2 modulo q.

Speaker: Sung-Soon Choi (Yonsei University)
Title : Optimal Query Complexity Bounds for Finding Graphs
Abstract :
We consider the problem of finding an unknown graph by using two types of queries with an additive property. Given a graph, an additive query asks the number of edges in a set of vertices while a cross-additive query asks the number of edges crossing between two disjoint sets of vertices. The queries ask sum of weights for the weighted graphs. These types of queries were partially motivated by DNA shotgun sequencing and linkage discovery problems of artificial intelligence.
For an unknown weighted graph G with n vertices, m edges, and a certain mild condition on weights, we prove that there exists a non-adaptive algorithm to find the edges of G using O(m log n/ log m) queries of both types provided m (log n) for a suffciently large constant . The bound is best possible up to a constant factor if m n^2? for any postive constant . For an unweighted graph, it is shown thatO(m log(n^2/m)/ log(m + 1)) queries are enough for 1 m $\binom{n}{2}$/2, which is best possible up to a
constant factor for all range of m.
This settles a conjecture of Grebinski [V. Grebinski. On the power of additive combinatorial search model. In Proceedings of the 4th Annual International Conference on Computing and Combinatorics (COCOON 1998), Taipei, Taiwan, pages 194-203, 1998] for ?nding an unweighted graph using additive queries. We also consider the problem of ?nding the Fourier coeffcients of a certain class of pseudo-Boolean functions. A similar
coin weighing problem is also considered.

Speaker: Jang Soo Kim (KAIST)
Title: A combinatorial approach to the power of 2 in the number of involutions
Abstract: We prove combinatorially that the largest power of 2 in the number of involutions of length n is equal to [n/2] - 2[n/4] + [(n + 1)/4]. We show that the smallest period of the sequence of odd factors in the number of involutions modulo 2^s is 2^{s+1} for s > 2. We also consider the largest power of 2 in the number of even and odd involutions.