The 23rd PNU-POSTECH Algebraic Combinatorics Workshop

Organized by M.Hirasaka and J.Koolen

January 10, 2008

Date

January 10, 2008

Place

Mathematics Science Building Room 404, POSTECH

Program

11:00–11:50, Masashi Shinohara (Kyushu University)
On locally distance sets

13:40–14:30, Kyoung-tark Kim (Pusan National University)
A survey of some papers on quantum algebras by P.Terwilliger

14:40–15:30, Takayuki Okuda (Kyushu University)
Riemann hypothesis analogue for invariant rings

16:00–16:50, Sejeong Bang (Pusan National University)
The Bannai-Ito Conjecture (I)

17:00–17:50, Jack Koolen (POSTECH)
The Bannai-Ito Conjecture (II)

Available Devices for Presentation

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

Speaker: Masashi Shinohara (Kyushu University)
Title: On locally distance sets
Abstract: Let X be a finite subset of the d–dimensional Euclidean space $\mathbb{R}^d$. We define $A(X) = \{PQ : P, Q \in X, P \neq Q\}$ and $A(P) = \{PQ : Q \in X, P \neq Q\}$ for $P \in X$ where PQ is the Euclidean distance between P and Q. X is called a k–distance set if $|A(X)| = k$. Moreover X is called a locally k–distance set if $|A(X)| \leq k$ for any $P \in X$. Clearly every k–distance set is a locally k–distance set. For fixed d and k, it is easy to see that the cardinalities of k–distance sets (resp. locally k–distance sets) in $\mathbb{R}^d$ are bounded. One of our interests is to determine the maximum cardinality for distance sets (resp. locally distance sets). We denote the maximum cardinality by $DS_k(d)$ (resp. $LDS_k(d)$).
In this talk, we will determine the maximum $LDS_2(d)$ for $d \leq 8$ and classify two–distance sets in $\mathbb{R}^d$ with $LDS_2(d)$ points for $d \leq 7$. Moreover, we will give a necessary condition to satisfy $DS_2(d) < L_2(d)$.

Speaker: Kyoung-tark Kim (Pusan National University)
Title: A survey of some papers on quantum algebras by P.Terwilliger
Abstract: The quantum algebra $U_q(\mathfrak{sl}_2)$ has a presentation which is called the equitable presentation by T.Ito, P.Terwilliger and C.Weng. In this presentation, the generators are on an equal footing, more or less. We can generalize this process. Let $\mathfrak{g}$ be a symmetrizable Kac-Moody algebra. We can also give an analogous presentation for the quantum group $U_q(\mathfrak{g})$.

Speaker: Takayuki Okuda (Kyushu University)
Title : Riemann hypothesis analogue for invariant rings
Abstract: Let C be an $[n, k, d]$ code over a finite field of q elements,and $W_C(x, y)$ be a weight enumerator of C. If C is a self-dual code, $W_C(x, y)$ have the following property.

$$W_C(x, y) = \frac{1}{\sqrt{q}^n} W_C(x + (q-1)y, x - y)$$

In general, for a homogeneous polynomial $F(x, y)$ that satisfies the equation above, we define the zeta polynomial $P_F(T)$ of $F(x, y)$.
When $F(x, y)$ have some properties, we can observe that zeros of the zeta polynomial $P_F(T)$ is arranged on the same circle. Such a phenomenon is called Riemann hypothesis analogue.
In this presentation, I want to introduce this topic and some results of my investigation.

Speaker: Sejeong Bang (Pusan National University)
Title: The Bannai-Ito Conjecture (I)
Abstract: In their book "Algebraic Combinatorics I: Association Schemes (1984)", Bannai and Ito conjectured that there are finitely many distance-regular graphs with fixed valency at least three. In these two talks, we will show that the Bannai-Ito conjecture holds.

Speaker: Jack Koolen (POSTECH)
Title: The Bannai-Ito Conjecture (II)
Abstract: In their book "Algebraic Combinatorics I: Association Schemes (1984)", Bannai and Ito conjectured that there are finitely many distance-regular graphs with fixed valency at least three. In these two talks, we will show that the Bannai-Ito conjecture holds.