The 58th KPPY Combinatorics Seminar

Organized by S.Bang, M.Hirasaka, T.Jensen, and M.Siggers

August 21 2013

Science Building 1, Room 319

Department of Mathematics, Yeungnam University

Program

11:00 - 11:50 **Saieed Akbari** IPM, Tehran, Iran
Generalization of c-Sum Flows in Graphs and Hypergraphs

1:30 -2:20 **Suyoung Choi** Ajou University
Combinatorial description of Betti numbers of toric varieties

2:30 -3:20 **Edgardo Roldán-Pensado** KAIST
A non-dual version of the Erds-Szekeres Theorem

3:40 - 4:30 **Meesue Yoo** KIAS
The combinatorics of HMZ operators applied to Schur functions

4:40 - 5:30 **Dongseok Kim** Kyonggi University
Westbury diagram by combinatorial webs of invariants vectors of Lie alebras

6:00–8:00 **Banquet**

Abstracts

Saieed Akbari

Generalization of c-Sum Flows in Graphs and Hypergraphs

Let G be a graph. For a real number c, a *c-sum flow* of G is an assignment of non-zero real numbers to the edges of G such that the sum of values of all edges incident with each vertex is c. Let k be a natural number. A *c-sum k-flow* is a c-sum flow with values from the set $\{\pm 1, \ldots, \pm(k-1)\}$. In this talk, we present known results on c-sum k-flows of graphs and propose several conjectures. For a hypergraph H, a *0-sum flow*, means a nowhere-zero real vector in the null space of the incidence matrix of H. Here, we state some results on 0-sum flows of hypergraphs.

In this talk we use some linear algebraic tools and graph factorization methods to obtain some results in zero-sum flows and their generalizations. Let A be an abelian group and $A^* = A \setminus \{0\}$. For a subset $S \subseteq A$, a map $\phi : E(G) \to S$ is called an *S-flow*. For a given S-flow of G, and every $v \in V(G)$, define $s(v) = \sum_{uv \in E(G)} \phi(uv)$. It is shown that if G is a 2-edge connected bipartite graph with two parts $X = \{x_1, \ldots, x_r\}$ and $Y = \{y_1, \ldots, y_s\}$ and $c_1, \ldots, c_r, d_1, \ldots, d_s$ are arbitrary integers, then there exists a $\mathbb{Z}^*$-flow of G such that $s(x_i) = c_i$ and $s(y_j) = d_j$, for $1 \leq i \leq r$, $1 \leq j \leq s$ if and only if $\sum_{i=1}^{r} c_i = \sum_{j=1}^{s} d_j$.

Suyoung Choi

Combinatorial description of Betti numbers of toric varieties

Recently, I and Dr. Hanchul Park have computed the i-th (rational) Betti number of the real toric variety associated to a graph G. It can be calculated by a purely combinatorial method and is called the i-th a-number of G. In the talk, I am willing to introduce recent works on the topic from the viewpoint of combinatorics and poset theory.

Edgardo Roldán-Pensado

A non-dual version of the Erdős-Szekeres Theorem

The Erdős-Szekeres Theorem states that in any sufficiently large set of points in the plane, there exists a subset consisting of n points in convex position.

We analyse what happens when we replace points by lines in this statement.

Meesue Yoo

The combinatorics of HMZ operators applied to Schur functions

We study the symmetric operators introduced by Haglund, Morse and Zabrocki which generate Hall-Littlewood polynomials indexed by compositions. They considered these operators to study the combinatorics of the characters of the space of diagonal harmonics. We construct a combinatorial way of applying these symmetric operators to various symmetric bases and use them to prove theorems of Haglund, Morse and Zabrocki combinatorially. Also, using the combinatorial construction of applying the symmetric operators to Schur functions, we can derive a new recursion of charge statistic.

Dongseok Kim

Westbury diagram by combinatorial webs of invariants vectors of Lie alebras

For Lie algebra sl(2), the invariants vectors are known as Temperley Lieb algebras. Since the dimension of these invariants spaces is Catalan number, it endows with some combinatorial descriptions. We will explain how the Westbury diagram can be constructed for other Lie algebras including sl(3), sl(4) and more.