

# The 25th PNU–POSTECH Algebraic Combinatorics Workshop

Organized by M.Hirasaka and J.Koolen

May 3, 2008

Date

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Place

Room 404, Department of Mathematics in POSTECH

Program

11:00–11:50, Tetsuji Taniguchi (Kyushu University)

On graphs whose smallest eigenvalue is at least  $-3$

14:00–14:50, Andreas Bender (KIAS)

Connections between information–theoretic inequalities and algebra

15:00–15:50, Akifumi Kira (Kyushu University)

The Fibonacci frame of inverse matrices in quadratic programming

16:10–17:00, Gul Zaman (Pusan National University)

The Non–Newtonian Blood Flow in Vessel with the Configuration of Brownian Force

17:10–18:00, Hyeong–Kwan Ju (Chonnam National University)

Generalized Stirling Permutations

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: Tetsuji Taniguchi (Kyushu University)

Title: On graphs whose smallest eigenvalue is at least  $-3$

Abstract: There are many results on graphs with the smallest eigenvalue at least  $-2$ . As a next step, A. J. Hoffman proposed to study graphs with the smallest eigenvalue at least  $-1 - 2$ . In order to deal with such graphs, in [3], R. Woo and A. Neumaier introduced the concept of a Hoffman graph, and defined a new generalization of line graphs which depends on a family of Hoffman graphs. They proved a theorem analogous to Hoffman's, using a particular family consisting of four isomorphism classes.

In [1] and [2], we deal with a generalization based on a family  $\mathcal{h}$  smaller than the one which they dealt with, yet including generalized line graphs in the sense of Hoffman. The main result of [1] is that the cover of an  $\mathcal{h}$ -line graph with at least 8 vertices is unique. The main result of [2] is that a minimal graph which is not an  $\mathcal{h}$ -line graph, is just isomorphic to one of the 38 graphs found by computer.

Next we study graphs with the smallest eigenvalue at least  $-3$ . For some (fixed) family  $\mathcal{h}$ , we found 10 minimal graph which is not an  $\mathcal{h}$ -line graph by computer. We believe that this result is analogous to the result of [2].

## References

- [1] T. Taniguchi, On graphs with the smallest eigenvalue at least  $-1 - 2$ , part I, submitted.
- [2] T. Taniguchi, On graphs with the smallest eigenvalue at least  $-1 - 2$ , part II, in preparation.
- [3] R. Woo and A. Neumaier, On graphs whose smallest eigenvalue is at least  $-1 - 2$ , Linear Algebra Appl. 226-228:577-591 (1995).

Speaker: Andreas Bender (KIAS)

Title: Connections between information-theoretic inequalities and algebra

Abstract: In this purely expository lecture, we shall define some basic information-theoretic notions like entropy and then consider what kind of inequalities are valid between them. In particular, it will turn out that there is a duality between certain such inequalities and inequalities in group theory. This duality can be used to prove statements in one field by methods from the other. Some of these results are already known, some are new?

Speaker: Akifumi Kira (Kyushu University)

Title: The Fibonacci frame of inverse matrices in quadratic programming

Abstract: Tridiagonal matrices often appear in the field of applied

mathematics. It is also known that the matrices play a vital role in many eigenvalue algorithms. In this paper, we introduce four tridiagonal matrices with the concept of Fibonacci frame property of inverse. The matrices yield typical quadratic criteria of control problems. We show that the property characterizes their optimal solutions.

Speaker: Gul Zaman (Pusan National University)

The Non-Newtonian Blood Flow in Vessel with the Configuration of Brownian Force

Abstract: In this talk we will present the blood flow in vessel which is based on the Brownian configuration fields using Hookean's dumbbells. The influence of orientation stress tensor and an Oldroyd-B fluid in the vessel will be investigated. During the mathematical analysis it is found that governing differential equation for steady flow in an Oldroyd-B fluid is identical to that of viscous fluid. Some numerical results will also present to show that the effect of the orientation stress tensor in blood vessel is considerable, although the Brownian force is sufficiently small.

Speaker: Hyeong-Kwan Ju (Chonnam National University)

Title: Generalized Stirling Permutations

Abstract: Let  $Q_n$  be the set of all permutations of the multiset

$\{1, 1, 2, 2, \dots, n, n\}$  in which for all  $i$ , all entries between the two occurrences of  $i$  are not smaller than  $i$ . Obviously  $|Q_n| = n!!$  ( $r = 2$ ). We describe the

generalized Stirling permutations which generalize permutations ( $r = 1$ ) and Stirling permutations ( $r = 2$ ). We give recursion formulas for combinatorial statistics, like descents, ascents, and plateaux. We also introduce several interesting properties for GSPs and bijective proof between the descents and the plateaux, which conjectured in Bona (2007 preprint, available at arXiv or his homepage), and Gessel and Stanley (1978). This is a joint work by M. Bona (U. of Florida), S. Seo (Chungju University) and myself.