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GCT Mini workshop

Date: 2019 8/21-23 Mathematical Science Institute, University of Tokyo (Komaba campus)   Room 056 (tentative)

Organizers: Takeshi Tokuyama(Kwansei Gakuen U.), Hisayoshi Matsumoto(U. Tokyo)

August 21(Wednesday)

13:00-13:15
Opening (Takeshi Tokuyama)

13:15-14:30
Kyo Nishiyama
RSK correspondence and geometry

We will explain a variant of the RSK correspondence for partial permutations, which is related to the geometry of certain flag varieties. We noticed that our results are closely related to the mirabolic RSK correspondence by Travkin, orbit structures of enhanced and/or exotic nullcones, and Zelevinsky's classical theory on the irreducible representations of GL_n over finite fields. We still do not know exactly how these different theories are so closely related, but will try to pursue the reason(s) behind the scene.

15:00-16:15
Christian Ikenmeyer
TBA

August 22(Thursday)

10:00-11:00
Takeshi Tokuyama
Abstract:
The generalized determinant is a one-parameter deformation of the determinant defined by Robbins and Rumsey based on Dodgson (known as Lewis Carroll)'s algorithm.
We discuss some recent observations on generalized determinant from mathematical and computational aspects.

11:00-12:00
Nick Fisher (Max Planck Institute fur Informatics)
Deciding Positivity of Plethysm Coefficients is NP-Hard".

Abstract:

Plethysm coefficients are the multiplicities of irreducible representations of the general linear group in the coordinate rings of vector spaces of homogeneous polynomials. These numbers play a fundamental role in geometric complexity theory. Finding a combinatorial description for them is problem 9 in R. Stanley's list from 2000 on positivity problems in algebraic combinatorics. In this talk we prove that deciding the positivity of a plethysm coefficient is NP-hard, which implies that no polynomial time algorithm can decide the positivity of a plethysm coefficient, provided P is not equal to NP. This is similar to the situation for the infamous Kronecker coefficient, but in stark contrast to the well-known Littlewood-Richardson coefficient, whose positivity can be decided in polynomial time.
This is joint work with Christian Ikenmeyer.

12:00-13:00 Lunch break

13:00-14:00
Christian Ikenmeyer (U. Liverpool)
Multiplicity obstructions are stronger than occurrence obstructions.
Abstract:
In 2016 Bürgisser, Ikenmeyer and Panova proved that occurrence obstructions in geometric complexity theory (as advocated by Mulmuley and Sohoni) cannot be used to prove Valiant's famous determinant vs permanent conjecture. This talk gives hope that the more general method of multiplicity obstructions is a viable way instead. Indeed, we present a very simple setting in which two group varieties can be separated via multiplicity obstructions, but provably not via occurrence obstructions. This is joint work with Dörfler and Panova.

14:30 -15:00
Suguru Tamaki (Hyogo Prefecture U.)
Stabilizer rank: Sparse representation for classical simulation of
quantum circuits
Abstract:
We consider a question of the following form: Given a vector v, a set of vectors S and a positive integer t, can we represent v as a linear combination of at most t vectors in S? In this talk, we focus on v and S related to classical simulation of quantum circuits, where the minimum t is called "stabilizer rank". I will give a brief overview on known results, including joint work with Tomoyuki Morimae.

15:10-15:40
Katsuyukii Takashima (Mitsubishi Electonic)

Post-quantum cryptography from supersingular elliptic curve isogenies

Abstract:
The goal of post-quantum cryptography is to develop cryptographic primitives that resist cryptanalysis by both classical and quantum computers. One such candidate is constructed by using isogenies between supersingular elliptic curves. The security and efficiency are closely related to the underlying graphs consisting of supersingular isogenies of fixed small degrees. I will explain some mathematical features of the graphs including their Ramanujan property, and two basic key exchange protocols called SIDH and CSIDH as well as our related results.

16:00 --17:00
Kyo Nishiyama(Aoyama Gakuin U,)
Continuant, Rotundus and Conway-Coxter Frieze

Abstract:
The continuant is a simple object which appears as a determinant of a tridiagonal matrix. In spite of the simplicity, it is related to many interesting mathematics, including (1) continued fractions, (2) discrete difference equations of Sturm-Liouville type (Toda lattice?), (3) triangulation of n-gons and Conway-Coxeter frieze related to cluster algebras, (4) Lagrangian configulations and their moduli spaces. This is an expository talk based on the papers of Conley, Ovsienko, Hiraku Nakajima and others.

August 23 (Friday)
10：00 – 12:00
Open problems and discussions

13:00 --   TBD

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