First Announcement

The 16th Korea-Japan Workshop on Algebra and Combinatorics will take place at Yeungnam University, Gyeongsan City, Korea, from 8-10, February 2018. The workshop is held once a year, alternatively in Korea and in Japan. It is intended to provide researchers of both countries, especially young researchers including graduate students, with opportunities to exchange rather informal information of ongoing studies in the area.

Further information is available from the organizers below.

Local Organizers (alphabetical order):
Sejeong Bang (Yeungnam University)
Young Soo Kwon (Yeungnam University)
Jaeun Lee (Yeungnam University)

Supporting organizers (alphabetical order):
Eiichi Bannai (Shanghai Jiao Tong University)
Jung Rae Cho (Pusan National University)
Mitsugu Hirasaka (Pusan National University)
Andreas Holmsen (KAIST)
Tatsuro Ito (Anhui University)
Hyun Kwang Kim (POSTECH)
Younjin Kim (Ewha Womans University)
Jack Koolen (The University of Science and Technology of China)
Hirotake Kurihara (Kitakyushu National College of Technology)
Yoshihiro Mizoguchi (Kyushu University)
Koji Momihara (Kumamoto University)
Akihiro Munemasa (Tohoku University)
Sang-il Oum (KAIST)
Makoto Tagami (Kyushu Institute of Technology)

Speakers (alphabetical order):
Eiichi Bannai (Shanghai Jiao Tong University)
Trinh Khanh Duy (Tohoku University)
Yasuhiko Ikematsu (Kyushu University)
Yuhei Inoue (Tohoku University)
Keiji Ito (Tohoku University)
Ringi Kim (KAIST)
Seog-Jin Kim (Konkuk University)
Takefumi Kondo (Kagoshima University)
Natalia Maslova (Ural Federal University)
Suil O (The State University of New York, Korea)
Andrey Vasilev (Sobolev Institute of Mathematics and Novosibirsk State University)
Yuta Watanabe (Tohoku University)
Jae young Yang (Anhui University)

Place
Building A02 (International Center), Room 207, Yeungnam University
280 Daehak-Ro, Gyeongsan city, Gyeongbuk 38541, Republic of Korea

Accommodation
- Dormitory on campus: For reservation, please email to kj2018@yu.ac.kr by January 20(Wed) 2018.
- Hotel in Daegu city: There is KJ2018 group rate. Participants are kindly asked to reserve their own hotel rooms individually. For reservation, please visit http://yu.ac.kr/~kj2018/accomodation.html

Welcome Reception
Date: February 8 (Thursday) 18:00-20:00
Cost: 25,000 KRW per person (Korean food Buffet)
Place: Naturekitchen (6 bus stops(20 mins) from the workshop place.)
Reservation: please email to kj2018@yu.ac.kr by January 20(Sat)

Banquet
Date: February 9 (Friday) 18:00-20:00
Cost: 40,000 KRW per person (Korean barbeque)
Place: tteuran (Within 1km from the workshop place)
Reservation: please email to kj2018@yu.ac.kr by January 20(Sat)

Home Page and E-mail
All information about this workshop will be updated via this home page.
- If you have any questions, then please email to kj2018@yu.ac.kr
Program

February 8 (Thursday)

10:00 – 10:15 Opening

10:15 – 11:00 Andrey Vasil’ev (Sobolev Institute of Mathematics and Novosibirsk State University)
Coherent configurations associated with groups and isomorphism problem

11:15 – 12:00 Yuta Watanabe (Tohoku University)
Association schemes on the Schubert cells of a Grassmannian

12:00 – 14:00 Lunch

14:00 – 14:15 Photo

14:15 – 15:00 Yuhei Inoue (Tohoku University)
On self-duality of association schemes whose class is at most 7

15:15 – 16:00 Keiji Ito (Tohoku University)
Characters of transitive permutation groups and Krein parameters

16:15 – 17:00 Seog-Jin Kim (Konkuk University)
DP-coloring

18:00 – 20:00 Welcome Reception
February 9 (Friday)

9:30 – 10:15 Eiichi Bannai (Shanghai Jiao Tong University)
Spherical designs, complex spherical designs, and unitary designs

10:30 – 11:15 Natalia V. Maslova (Krasovskii Institute of Mathematics and Mechanics UB RAS; Ural Federal University)
On pronormal subgroups of odd index in finite groups

11:30 – 12:15 Trinh Khanh Duy (Tohoku University)
On infinite Jacobi matrices related to beta ensembles

12:15 – 14:15 Lunch

14:15 – 15:00 Yasuhiko Ikematsu (Institute of Mathematics for Industry, Kyushu University)
The description of local theta lift for U(2)U(3)

15:15 – 16:00 Jae Young Yang (Anhui University)
On lattices from graphs with smallest eigenvalue $-3$ and large minimal valency

16:15 – 17:00 Suil O (The State University of New York, Korea)
The Saturation Number, Spectral Radius, and family of k-edge-connected graphs

17:30 – 19:30 Banquet
February 10 (Saturday)

9:30 – 10:15 Takefumi Kondo (Kagoshima University)
Distortion of some finite graphs

10:30 – 11:15 Ringi Kim (KAIST)
Variations of Woodall’s conjecture

11:30 – 12:00 Problem Session

12:00–12:10 Closing
Abstracts
February 8 (Thursday)

Speaker: Andrey Vasil’ev (Sobolev Institute of Mathematics and Novosibirsk State University)
Title: Coherent configurations associated with groups and isomorphism problem
Abstract: The coherent configuration $\mathcal{X} = (\Omega, S)$ on a set $\Omega$ is said to be schurian, if the set $S$ of its basis relations is precisely the set $\text{Orb}_2(G, \Omega)$ of 2-orbits of some permutation group $G \leq \text{Sym}(\Omega)$, that is the set of the orbits of the naturally induced action of $G$ on $\Omega \times \Omega$. Clearly, in the case of a schurian configuration $\mathcal{X}$, this group $G$ is a subgroup of the automorphism group $\text{Aut}(\mathcal{X})$. So starting with $G$ and trying to find $\text{Aut}(\mathcal{X})$ or the set $\text{Iso}(\mathcal{X}, \mathcal{X}')$ of all isomorphisms from $\mathcal{X}$ to an arbitrary coherent configuration $\mathcal{X}'$, we have an advantage knowing some predetermined information about $\text{Aut}(\mathcal{X})$. The same picture arises in the case of Cayley graphs (or Cayley schemes, which are coherent configurations as well). Indeed, if $\Gamma = \text{Cay}(G, X)$ is the Cayley graph for a group $G$ with a connection set $X$, then $G$ is included as a regular subgroup in $\text{Aut}(\Gamma)$. We are going to discuss some new results and techniques on the isomorphism problem for combinatorial objects associated with a group $G$ in the described way, concentrating on the cases when $G$ is a nonsolvable group.

Speaker: Yuta Watanabe (Tohoku University)
Title: Association schemes on the Schubert cells of a Grassmannian
Abstract: Let $\mathbb{F}$ be any field. The Grassmannian $\text{Gr}(m, n)$ is the set of $m$-dimensional subspaces in $\mathbb{F}^n$, and the general linear group $\text{GL}_n(\mathbb{F})$ acts transitively on it. The Schubert cells of $\text{Gr}(m, n)$ are the orbits of the Borel subgroup $B \subset \text{GL}_n(\mathbb{F})$ on $\text{Gr}(m, n)$. We consider the association scheme on each Schubert cell defined by the $B$-action and show it is symmetric and it is the generalized wreath product of one-class association schemes, which was introduced by R. A. Bailey in European Journal of Combinatorics 27 (2006) 428–435.

Speaker: Yuhei Inoue (Tohoku University)
Title: On self-duality of association schemes whose class is at most 7
Abstract: If the first eigen matrix $P$ and second eigen matrix $Q$ of a commutative association scheme $\mathcal{A}$ meet $P = \overline{Q}$, we say $\mathcal{A}$ is self-dual. In
self-dual association scheme, for any $i, j, k$, the intersection number $p_{i,j}^k$ equals the Krein number $q_{i,j}^k$. However, it is unknown whether the converse holds or not. We obtained a result that the converse holds if the class is at most 7 and talk about the proof.

Speaker: Keiji Ito (Tohoku University)
Title: Characters of transitive permutation groups and Krein parameters
Abstract: Some association schemes are constructed from transitive permutation groups. For a transitive permutation group, the association scheme constructed from the permutation group becomes commutative, if the permutation character satisfies a condition called multiplicity-free. Scott’s Theorem holds for such commutative association schemes. Scott’s Theorem mentions to a relation between Krein parameters of the commutative association scheme and inner product of characters of the transitive permutation group and the converse of Scott’s Theorem is not always true. In my talk, we prove that the converse of Scott’s Theorem holds for some transitive permutation groups.

Speaker: Seog-Jin Kim (Konkuk University)
Title: DP-coloring
Abstract: DP-coloring was introduced by Dvořák and Postle (2015) to study list coloring. DP-coloring of a graph is a generalization of list coloring, and also a generalization of signed coloring of signed graphs. In this talk, we will give an overview of DP-coloring, and present recent results in DP-coloring. This talk is based on joint work with Kenta Ozeki (Yokohama National University).

February 9 (Friday)

Speaker: Eiichi Bannai (Shanghai Jiao Tong University)
Title: Spherical designs, complex spherical designs, and unitary designs
Abstract: We first give a survey on these concepts, following the three basic papers: Spherical codes and designs (Delsarte-Goethals-Seidel, 1977); Complex spherical designs and codes (Roy-Suda, 2014); Unitary designs and codes (Roy-Scott, 2009). Then we comment on the paper of Roy-Suda (2014), and discuss the existence and the classification problems of “good” tight complex spherical T-designs (for certain $T$) coming from tight real
spherical t-designs. Here, ”good” means either the number of distances
$s = |A(X)|$ is small, or an association scheme is naturally attached to it.
The last part of this talk is based on the ongoing joint work with Takayuki
Okuda (Hiroshima University), Da Zhao (Shanghai Jiao Tong University)
and Yan Zhu (Shanghai University).

Speaker: Natalia V. Maslova (Krasovskii Institute of Mathematics and
Mechanics UB RAS; Ural Federal University)
Title: On pronominal subgroups of odd index in finite groups
Abstract: According to Ph. Hall, a subgroup $H$ of a group $G$ is said to be
pronominal in $G$ if $H$ and $H^g$ are conjugate in $\langle H, H^g \rangle$ for every $g \in G$. It is
well known that a subgroup $H$ is pronominal in a group $G$ if and only if, for
any permutation representation of $G$, $N_G(H)$ acts transitively on $fix(H)$.
Some problems in combinatorics and in permutation group theory were
solved in terms of the pronominalty. Consider a finite group $G$ acting
transitively on a set of odd order. The question of pronominality of
subgroups of odd index in finite groups naturally arises. In the given talk
we discuss a solution of this question for some families of finite groups. In
particular, we discuss a recent progress in the classification of finite simple
groups in which the subgroups of odd index are pronominal.

Speaker: Trinh Khanh Duy (Tohoku University)
Title: On infinite Jacobi matrices related to beta ensembles
Abstract: Jacobi matrices are symmetric tridiagonal matrices. To a finite
or an infinite Jacobi matrix $J$, there is a probability measure $\mu$ on the real
line satisfying $\int x^k d\mu = J^k(1,1), k = 0, 1, \ldots$. A measure $\mu$ is unique if it is
determined by moments. In this case, we call it the spectral measure of $J$,
or call $J$ the Jacobi matrix of $\mu$. In fact, spectral measures and Jacobi
matrices are close related via the theory of orthogonal polynomials. This
talk introduces some Jacobi matrices with explicit spectral measures. They
include the Jacobi matrices of the semicircle distribution,
Marchenko-Pastur distributions and Kesten-Mckey distributions, which are
naturally appeared in the study of Gaussian, Wishart and MANOVA beta
ensembles via tridiagonal random matrix models.

Speaker: Yasuhiko Ikematsu (Institute of Mathematics for Industry,
Kyushu University)
Title: The description of local theta lift for U(2)U(3)
Abstract: I will talk about the description of the local theta lift for a p-adic unitary dual pair $U(2) \times U(3)$. This is a complement to a result of Gelbart-Rogawski-Soudry. Also Gan-Ichino described the local theta lifts for unitary groups in the almost equal rank case. I provide another proof of their result in the case $U(2) \times U(3)$. If time permits, I also talk about the description of the local theta lift for a p-adic quaternionic dual pair of rank one.

Speaker: Jae Young Yang (Anhui University)
Title: On lattices from graphs with smallest eigenvalue $-3$ and large minimal valency
Abstract: Conway and Sloane defined the concept of $s$-integrable lattice. An integral lattice $\Lambda$ is called $s$-integrable if $\sqrt{s} \Lambda$ can be embedded in the standard lattice $\mathbb{Z}^r$. For a graph $G$ with the adjacency matrix $A(G)$ and smallest eigenvalue at least $-3$, the matrix $B = A(G) + 3I$ is positive semidefinite hence $B$ is a Gram matrix of some vectors of norm $\sqrt{3}$. In this talk, we will prove that if the minimal valency of $G$ is very large, then such vectors of norm $\sqrt{3}$ form a 2-integrable lattices. This result is a generalization of a theorem of Hoffman in 1977, which is about generalized line graphs. This is joint work with Jack H. Koolen and Qianqian Yang.

Speaker: Suil O (The State University of New York, Korea)
Title: The Saturation Number, Spectral Radius, and family of $k$-edge-connected graphs
Abstract: Given a family of graphs $\mathcal{F}$, a graph $G$ is $\mathcal{F}$-saturated if no member of $\mathcal{F}$ is a subgraph of $G$, but for any $e \in E(G)$, some member of $\mathcal{F}$ is a subgraph of $G + e$. The saturation number of $\mathcal{F}$, denoted $\text{sat}(n, \mathcal{F})$, is the minimum number of edges in an $n$-vertex $\mathcal{F}$-saturated graph. For a given positive integer $k$, let $\mathcal{F}_k = \{H | H$ is a $k$-vertex connected graph}$ and $\mathcal{F}'_k = \{H | H$ is a $k$-edge connected graph}$). Wenger showed that $\text{sat}(n, \mathcal{F}_k) = (k - 1)n - \binom{k}{2}$. In this talk, we give the saturation number of $\mathcal{F}_k$ and also a necessary condition related to the spectral radius for $\mathcal{F}_k$-saturated and $\mathcal{F}'_k$-saturated graphs.

February 10 (Saturday)

Speaker: Takefumi Kondo (Kagoshima University)
Title: Distortion of some finite graphs
Abstract: Using duality theory of semidefinite programming, Linial, London and Rabinovich obtained a characterization of the least possible distortion of embeddings of finite metric spaces into Euclidean space. We will describe how this result is applied to determine the Euclidean distortion of finite generalized polygons in joint work with Toshimasa Kobayashi and discuss another method based on generalizations of Wirtinger inequality by Gromov for some class of polytopes.

Speaker: Ringi Kim (KAIST)
Title: Variations of Woodall’s conjecture
Abstract: A dijoin in a digraph is a set of edges meeting every directed cut. Woodall’s conjecture is a min-max conjecture stating that if $G$ is a digraph, and every directed cut of $G$ has at least $k$ edges, then there are $k$ pairwise disjoint dijoins. This conjecture remains open but its weighted version is known to be false by three examples due to Schrijver, Cornuejols and Guenin. We observed that all these counterexamples have some common property, say $P$, and we raised a question if the property $P$ is a crucial factor causing the weighted version of Woodall’s conjecture to be false. In this talk, I will propose conjectures regarding this question, and talk about our results about the conjectures.