南開大學
Nankai University

图论与组合优化前沿研讨会

秩序册

南开大学数学交叉科学中心

图论与组合优化团队

南开大学数学交叉科学中心

中国-天津

南開大學
Nankai University

图论与组合优化前沿研讨会

（线上）

会议时间：2022 年 10 月 3 日（周一）

腾讯会议：310 956 539（密码：1003）

会议举办方

南开大学数学交叉科学中心

图论与组合优化团队

会议组织委员会主席：李学良

会议组织委员会成员：蔡庆琼，郭强辉，黄申为，雷辉，李佳傲，宁博， 史永堂

会议联系人：李佳傲

邮箱：lijiaao@nankai.edu.cn

电话：13965054320

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会议日程

10 月 3 日	上　午	腾讯会议：310 956 539 （密码：1003）
8:30-8:40	开幕式	
主持人	**王维凡**	
8:40-9:10	叶永南	Eulerian polynomials, Stirling permutations and perfect matchings
9:10-9:40	李相文	Decomposing graphs of nonnegative characteristic into subgraphs with some forbidden subgraphs
9:40-9:50	茶　歇	
主持人	**李雨生**	
9:50-10:20	张　昭	Approximation algorithms for minimum weight connected dominating set
10:20-10:50	张华军	Some results and problems on cross intersecting families
10:50-11:00	茶　歇	
主持人	**高锁刚**	
11:00-11:30	于广龙	Some results on spectral radius of hypergraphs
11:30-12:00	卢福良	Removable edges in near-bipartite bricks
12:00-13:30	午　休	
10 月 3 日	下　午	腾讯会议：310 956 539 （密码：1003）
主持人	**陆　玫**	
13:30-14:00	陈旭瑾	当组合优化遇到博弈论
14:00-14:30	张　霞	Edge coloring of linear hypergraphs
14:30-15:00	张　欣	Counting cliques in 1-planar graphs

15:00-15:10	茶　歇	
主持人	**范益政**	
15:10-15:40	刘瑞芳	Spectral Turán-type problems on friendship graphs and triangle-free graphs
15:40-16:10	刘文忠	Minimal quadrangulations of surfaces
16:10-16:40	张闫博	The game of cops and robbers on grids
16:40-16:50	茶　歇	
主持人	**苗正科**	
16:50-17:20	冯立华	图的一种新的广义特征值
17:20-17:50	韩　杰	A rainbow Hajnal-Szemerédi Theorem

当组合优化遇到博弈论

陈旭瑾（中国科学院数学与系统科学研究院）

报告摘要：博弈论是一个研究理性参与者策略互动的数学分支，其关注的是：个体追求自身利益最大化，系统未必能实现整体最优。组合优化则相反，它通常牺牲部分个体的利益来优化整体目标。当今，互联网等大规模网络的兴起，同时向这两个学科提出新挑战。这些大规模网络的形成与运转往往由数以千计万计的寻求自身利益最大化的自利参与者共同完成，没有也很难像传统优化那样设计中心化算法来协调各个参与者的自利决策行为，系统往往处于一种无政府状态。如何在这种无政府的自利的策略环境下，尽可能的优化系统的整体目标？这就是我们网络时代亟需解决的组合优化与博弈论深度交叉融合的一个核心问题。我们的工作以“优化和均衡”为主线，强调个体自利行为带来的系统分布式特性，研究了自私路由、自私负载平衡、时序规划、社会选择等策略环境中的组合优化问题；定量分析博弈均衡解的系统效率；设计高效算法机制诱导出优良均衡，获得网络高效性与稳定性之间的优良平衡。

On the Extensional Eigenvalues of Graphs

冯立华（中南大学）

报告摘要：In this talk, we provide a new generalization of the eigenvalues of graphs, and report some basic properties.

A Rainbow Hajnal-Szemeredi Theorem

韩杰（北京理工大学）

报告摘要： There has been a recent interest in extending classical graph theory theorems to the rainbow setting, most notably, a rainbow version of the Mantel's Theorem and a rainbow version of the Dirac's Theorem. In this talk I will survey these recent developments and explain how to obtain a rainbow analogue of (an asymptotic version of) the Hajnal-Szemeredi Theorem.

Spectral Turán-type Problems on Friendship Graphs and Triangle-free Graphs

刘瑞芳（郑州大学）

报告摘要： Spectral Turán-type problem is one of central problems in spectral extremal graph theory. Erdős et al. [J. Combin. Theory Ser. B 64 (1995) 89-100] obtained the exact Turán number of the friendship graph F_k for $n \geq 50k^2$, and characterized all its extremal graphs. Cioabă et al. [Electron. J. Combin. 27 (2020) Paper 22] initially introduced Triangle Removal Lemma into a spectral Turán-type problem, and they showed that $SPEX(n, F_k) \subseteq EX(n, F_k)$ for sufficient large n, where $EX(n, F_k)$ and $SPEX(n, F_k)$ are the families of n-vertex F_k-free graphs with maximum size and maximum spectral radius, respectively. We determine the uniqueness of the family $SPEX(n, F_k)$ for sufficiently large n. Furthermore, a classic result in extremal graph theory, known as Mantel's theorem, states that every non-bipartite graph of order n with size $m > \lfloor \frac{n^2}{4} \rfloor$ contains a triangle. Lin, Ning and Wu [Comb. Probab. Comput. 30 (2021) 258-270] proved a spectral version of Mantel's theorem for given order n. Zhai and Shu [Discrete Math. 345 (2022) 112630] investigated a spectral version for fixed size m. We prove Q-spectral versions of Mantel's theorem.

Minimal Quadrangulations of Surfaces

刘文忠（南京航空航天大学）

报告摘要： A *quadrangular* embedding of a graph in surface Σ, also known as *quadrangulation* of Σ, is a cellular embedding in which every face is bounded by a 4-cycle. A quadrangulation of Σ is *minimal* if there is no quadrangular embedding of a (simple) graph of smaller order in Σ. In our recent works we determine $n(\Sigma)$, the order of a minimal quadrangulation of a surface Σ, for all surfaces, both orientable and nonorientable. Letting S_0 denote the sphere and N_2 the Klein bottle, we prove that $n(S_0) = 4$, $n(N_2) = 6$, and $n(\Sigma) = \lceil (5 + \sqrt{25 - 16\chi(\Sigma)})/2 \rceil$ for all other surfaces Σ, where $\chi(\Sigma)$ is the Euler characteristic.

This is joint work mainly with M.N. Ellingham and Dong Ye.

Removable Edges in Near-bipartite Bricks

卢福良（闽南师范大学）

报告摘要： An edge e of a matching covered graph G is *removable* if $G - e$ is also matching covered. The notion of removable edge arises in connection with ear decompositions of matching covered graphs introduced by Lovász and Plummer. A nonbipartite matching covered graph G is a *brick* if it is free of nontrivial tight cuts. Carvalho, Lucchesi, and Murty proved that every brick other than K_4 and $\overline{C_6}$ has at least $\Delta - 2$ removable edges. A brick G is *near-bipartite* if it has a pair of edges $\{e_1, e_2\}$ such that $G - \{e_1, e_2\}$ is a bipartite matching covered graph.In this talk, I will report our result: in a near-bipartite brick G with six vertices or more, every vertex is incident with at most two nonremovable edges, except no more than six vertices of degree three that lie in two disjoint triangles; consequently, G has at least $\frac{|V(G)|-6}{2}$ removable edges. Moreover, all the graphs that attain this lower bound are characterized. This is a joint work with Yipei Zhang, Xiumei Wang and Jinjiang Yuan.

Eulerian Polynomials, Stirling Permutations and Perfect Matchings

叶永南（温州大学）

报告摘要： In this talk, we discuss several variants of the EGF of the classical Eulerian polynomials. We also discuss the connections among Eulerian polynomials, Stirling permutations and perfect matchings. From this talk, one can see that the EGF of the classical Eulerian polynomials contains more information than is generally realized.

Some Results and Problems on Cross-intersecting Families

张华军（绍兴文理学院）

报告摘要： Let n, k, ℓ and t be four positive integers satisfying $n \geq k + \ell + t$. Let $\mathcal{A} \subseteq \binom{[n]}{k}$ and $\mathcal{B} \subseteq \binom{[n]}{\ell}$. Two families $\mathcal{A}$ and $\mathcal{B}$ are called cross t-intersecting if $|A \cap B| \geq t$ for all $A \in \mathcal{A}$ and $B \in \mathcal{B}$. In this talk, we will introduce some results and problems on cross t-intersecting families.

Edge Coloring of Linear Hypergraphs

张霞（山东师范大学）

报告摘要： A k-edge coloring of a hypergraph H is a coloring of the edges of H with k colors such that any two intersecting edges receive distinct colors. The Erdos-Faber-Lovasz conjecture states that every loopless linear hypergraph with n vertices has an n-edge coloring. In 2021, Kang, Kelly, Kuhn, Methuku and Osthus confirmed the conjecture for sufficiently large n. In this paper, we verify the conjecture for collision-weak hypergraphs. This strictly extends two related results of Bretto, Faisant and Hennecart in 2020.

The Game of Cops and Robbers on Grids

张闫博（河北师范大学）

报告摘要： Cops and robbers is a two player turn-based game played on a graph where cops try to capture the robber. In this talk, we introduce some variants of the game, and show some new results on grids. This is a joint work with Hexuan Zhi.

Approximation Algorithms for Minimum Weight Connected Dominating Set

张昭（浙江师范大学）

报告摘要： A connected dominating set (CDS) of a graph G is a vertex set C such that every vertex in $V(G)\backslash C$ has at least one neighbor in C and the subgraph of G induced by C is connected. The goal of the minimum weight connected dominating set problem (MinWCDS) is to find a CDS with the minimum total vertex weight. The best previously known approximation ratio for MinWCDS is $(1.35+\epsilon)ln(n)$, due to Guha and Khuller in 1999. In this talk, I' ll introduce our recent result which breaks the barrier of $ln(n)$, improving the ratio to $2ln\Delta$, where Δ is the maximum degree of the graph (note that in general, Δ is much smaller than n).