上海交通大学第六届图论与组合学术研讨会

11.5	10:00-22:00 注册报到(上海交通大学学术活动中心)	
11.6	地点:	理科群楼**6**号楼**706**教室 腾讯会议链接**: https://meeting.tencent.com/dm/LqkfIzp5AKfz** 腾讯会议号码**: 179 325 685,** 密码**: 211106**
	主持人: 汪彦 (上海交通大学)	09:00-09:10 开幕式及合影
	主持人: 马俊 (上海交通大学)	09:10-09:55 宁博(南开大学) 题目: Stability in Bondy's theorem on paths and cycles
		10:05-10:50 韩杰(北京理工大学) 题目: Quasi-randomness and graph theory
		11:00-11:45 袁龙图(华东师范大学) 题目: Supersaturation for matching-critical graphs
	11:45-14:00 午间休息	
	主持人: 李吉有 (上海交通大学)	14:00-14:45 侯建锋(福州大学) 题目: The zero-error capacity of binary channels with 2-memories
		14:55-15:40 吴河辉(上海数学中心) 题目: Proper orientations and proper chromatic number
	15:40-16:00 茶歇	
	主持人: 张晓东 (上海交通大学)	16:00-16:45 史永堂(南开大学) 题目: Some new results on Lagrangians of hypergraphs
		16:55-17:40 胡平(中山大学) 题目: Large multipartite subgraphs in H-free graphs
		17:50-18:35 谢齐沁(上海大学) 题目: A Ramsey type problem for highly connected subgraphs
11.7	地点:	理科群楼**6**号楼**706**教室 腾讯会议链接**: https://meeting.tencent.com/dm/R3NEhfUgJecO** 腾讯会议号码**: 634 884 197,** 密码**: 211107**
	主持人: 汪彦 (上海交通大学)	09:00-09:45 杨天驰(中国科学技术大学) 题目: Some extremal results on 4-cycles
		09:55-10:40 王光辉(山东大学) 题目: Rainbow Hamilton cycles in hypergraph systems
	10:40-11:00 茶歇	
	主持人: 张晓东 (上海交通大学)	11:00-11:45 刘旭钧(西交利物浦大学) 题目: Monochromatic connected matchings, paths and cycles in 2-edge-colored multipartite graphs
		11:55-12:40 彭兴(安徽大学) 题目: The Ramsey number of quadrilateral versus books

摘要

Stability in Bondy's theorem on paths and cycles

宁博
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Abstract

In this talk, we study the stability result of a well-known theorem of Bondy. We prove that for any 2-connected non-hamiltonian graph, if every vertex except for at most one vertex has degree at least k, then it contains a cycle of length at least $2k+2$ except for some special families of graphs. Our results imply several previous classical theorems including a deep and old result by Voss. We point out the idea behind stability in Bondy's theorem can directly imply a positive solution to the following problem: Is there a polynomial time algorithm to decide whether a 2-connected graph G on n vertices has a cycle of length at least $\min\{2\delta(G)+2, n\}$. This problem originally motivates the recent study on algorithmic aspects of Dirac's theorem by Fomin et al., although a stronger problem was solved by them by completely different methods.

Quasi-randomness and graph theory

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Abstract

Since launched in late '70s, quasi-random graphs and hypergraphs has been a central topic in graph theory, discrete probability theory and theoretical computer science. We will have a very brief introduction on the quasi-randomness in graph theory and mention some recent developments.

Supersaturation for matching-critical graphs

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Abstract

Let G be a given graph with $\lambda(G) = k$, if the decomposition family of G, $\mathcal{M}(G)$, contains a copy of M_k, then we say that G is matching critical. Turán number, $\mathrm{ex}(n, F)$, of a graph F implies that a graph on n vertices with $\mathrm{ex}(n, F) + 1$ edges contains at least one copy of F. Denote by $\#F(H)$ the number of copies of F in graph H. We will consider the following question for matching critical graphs.

Question. Determine the following function for a graph F:

$$h_F(n, q) = \min\{\#F(H) : |V(H)| = n, |E(H)| = \mathrm{ex}(n, F) + q\},$$

the minimum number of copies of F in a graph H on n vertices and $\mathrm{ex}(n, F) + q$ edges.

The zero-error capacity of binary channels with 2-memories

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Abstract

The zero-error capacity of a noisy channel is defined as the least upper bound of rates at which it is possible to transmit information with zero probability of error. It was posed by Shannon and extended to channels with memories by Ahlswede, Cai and Zhang. In this paper, we give a first step towards the zero-error capacity problems of binary channels with 2-memories, and determine the zero-error capacity of at least 2^{24} possible cases in all 2^{28} cases.

Proper orientations and proper chromatic number

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Abstract

The proper chromatic number $\vec{\chi}(G)$ of a graph G is the minimum k such that there exists an orientation of the edges of G with all vertex-outdegrees at most k and such that for any adjacent vertices, the outdegrees are different. Two major conjectures about the proper chromatic number are resolved. First it is shown, that $\vec{\chi}(G)$ of any planar graph G is bounded (in fact, it is at most 14). Secondly, it is shown that for every graph, $\vec{\chi}(G)$ is at most $O(\frac{r \log r}{\log \log r}) + \frac{1}{2}MAD(G)$, where $r = \chi(G)$ is the usual chromatic number of the graph, and $MAD(G)$ is the maximum average degree taken over all subgraphs of G. Several other related results are derived. Our proofs are based on a novel notion of fractional orientations. This is joint work with Bojan Mohar in Simon Fraser University and Yaobin Chen in Fudan University.

Some new results on Lagrangians of hypergraphs

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Abstract

A well-known conjecture of Frankl and Füredi states that the r-graph with m edges formed by taking the first m sets in the colex ordering of $\mathbb{N}^{(r)}$ has the largest Lagrangian of all r-graphs with m edges. The conjecture was settled when $r = 3$ for sufficiently large m. For $r \geq 4$, Gruslys, Letzter and Morrison [Hypergraph Lagrangians I: The Frankl-Füredi conjecture is false, Adv. Math., 365(2020), 107063] confirmed the conjecture when m belongs to the principal range $\left[\binom{t-1}{r}, \binom{t}{r} - \binom{t-2}{r-2}\right]$ for sufficiently large t, and found an infinite family of counterexamples for $r \geq 4$ and $m = \binom{t}{r} - \binom{t-2}{r-2} + s$, where $r \leq s \leq \alpha_r \binom{t-2}{r-2}$ for some constant α_r. In this talk, we will present some more maximisers of the Lagrangian outside the principal range.

Joint work with Ran Gu, Hui Lei and Yuejian Peng.

Large multipartite subgraphs in H-free graphs

胡平
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Abstract

Füredi proved that every K_{r+1}-free graph G can be made r-partite by removing at most $\frac{r-1}{2r}v^2(G) - e(G)$ edges. We investigate strengthenings of his result. For $r \leq 4$, we show that every K_{r+1}-free graph G can be made r-partite by removing at most

$$\frac{4}{5}(\frac{r-1}{2r}v^2(G) - e(G))$$

edges, and conjecture that the same is true for every r. We show that this conjecture implies a solution of a problem of Sudakov on making K_{r+1}-free graphs bipartite for large r. Finally, we show that every K_6-free graph G can be made bipartite by removing at most $4v^2(G)/25$ edges, solving the case $r = 5$ of Sudakov's problem.

Our main tool is Razborov's flag algebras. Joint work with Bernard Lidický, Taísa Martins, Sergey Norin and Jan Volec.

A Ramsey type problem for highly connected subgraphs

谢齐沁
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Abstract

Bollobás and Gyárfás conjectured that for any $k, n \in \mathbb{Z}^+$ with $n > 4(k-1)$, every 2-edge-coloring of the complete graph on n vertices leads to a k-connected monochromatic subgraph with at least $n - 2k + 2$ vertices. We find a counterexample with $n = 5k - 2\lceil\sqrt{2k-1}\rceil - 3$, thus disproving the conjecture. Moreover we completely solved the problem by showing the conjecture is true for larger n.

Some extremal results on 4-cycles

杨天驰
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Abstract

In this talk, we will introduce our series of work on 4-cycles. Let $ex(n, C_4)$ be the maximum number of edges in an n-vertex C_4-free graph. Firstly, we give a new upper bound for it, which disproves a conjecture of Erdős. Secondly, we investigate a long-standing conjecture of Erdős and Simonovits, which says that every n-vertex graph with $ex(n, C_4) + 1$ edges contains at least 2 copies of C_4 when n is large. On the one hand, we prove it to be true for the cases $n = q^2 + q + 1$ when $q = 2^k$ is large. Moreover, such graph has at least $q - 1$ copies of C_4. On the other hand, we find their conjecture does not hold for the cases $n = q^2 + q + 2$ when $q = 4^k$ is large. This is a joint work with Jialin He and Jie Ma.

Rainbow Hamilton cycles in hypergraph systems

王光辉
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Abstract

We study the rainbow version of subgraph containment problems in a family of (hyper)graphs, which generalizes the classical subgraph containment problems in a single host graphs. We mainly mention the existence of rainbow Hamilton cycles in hypergraph systems.

Monochromatic connected matchings, paths and cycles in 2-edge-colored multipartite graphs

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Abstract

We solve four similar problems: For every fixed s and large n, we describe all values of $n_1, \ldots, n_s$ such that for every 2-edge-coloring of the complete s-partite graph $K_{n_1,\ldots,n_s}$ there exists a monochromatic (i) cycle C_{2n} with $2n$ vertices, (ii) cycle $C_{\geq 2n}$ with at least $2n$ vertices, (iii) path P_{2n} with $2n$ vertices, and (iv) path P_{2n+1} with $2n+1$ vertices. This implies a generalization of the conjecture by Gyárfás, Ruszinkó, Sárkőzy and Szemerédi that for every 2-edge-coloring of the complete 3-partite graph $K_{n,n,n}$ there is a monochromatic path P_{2n+1}.

An important tool is our recent stability theorem on monochromatic connected matchings (A matching M in G is connected if all the edges of M are in the same component of G). We will also talk about exact Ramsey-type bounds on the sizes of monochromatic connected matchings in 2-colored multipartite graphs. Joint work with József Balogh, Alexandr Kostochka and Mikhail Lavrov.

The Ramsey number of quadrilateral versus books

彭兴
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Abstract

A book B_n is a set of n triangles all sharing a common edges. Previously, we only know the Ramsey number $R(C_4, B_n)$ for $n \leq 14$. In this talk, I will introduce a recent result which establishes the exact value of $R(C_4, B_n)$ for infinitely many n. This is joint work with Tianyu Li and Qizhong Lin.

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