Workshop "Graph Theory for Combinatorial Reconfiguration"

Fully Online, November 29, 2021

16:00-17:00 (JST), 8:00-9:00 (CET), 2:00-3:00 (EST)

Atsuhiro Nakamoto "Flip distance of triangulations on surfaces"

In a triangulation on the sphere S (or other surfaces), a diagonal flip is to switch an edge in a quadrilateral region formed by two adjacent faces. If a diagonal flip makes multiple edges or a loop in a triangulation, then we do not apply it. Wagner proved that for any n>2, any two n-vertex triangulations on S can be transformed into each other by diagonal flips. Using Wagner's algorithm, we can get an O(n^2)-algorithm for the number of diagonal flips for two n-vertex triangulations on S to transform one to the other. Now we know that there is an O(n)-algorithm for the number of diagonal flips for triangulations on S, and that the order is best possible. In our talk, we deal with this problem and its history, and consider what is difficult in the problem. Moreover, we give a survey on some results for related topics.

17:10-18:10 (JST), 9:10-10:10 (CET), 3:10-4:10 (EST)

Jakub Przybyło "On the 1-2-3 conjecture"

A simple graph more often than not contains adjacent vertices with equal degrees. This in particular holds for all pairs of neighbours in regular graphs, while a lot such pairs can be expected e.g., in many random models. Is there a universal constant K, say K=3, such that one may always dispose of such pairs from any given connected graph with at least three vertices by blowing its selected edges into at most K parallel edges? This question was first posed in 2004 by Karoński, Łuczak and Thomason, who equivalently asked if one may assign weights 1, 2, 3 to the edges of every such graph so that adjacent vertices receive distinct weighted degrees-- the sums of their incident weights. This basic problem is commonly referred to as the 1-2-3 Conjecture nowadays, and has been addressed in multiple papers, constituting wealthy source of inspiration for developing new techniques and intriguing further questions.

While the best result concerning the 1-2-3 Conjecture asserts that weights 1, 2, 3, 4, 5 are sufficient, we shall present a simple proof that it is enough to use weights 1, 2, 3, 4 in the case of regular graphs, followed by a sketch of a much more complex probabilistic argument implying that the 1-2-3 Conjectures holds if only the minimum degree Δ of a graph is large enough, i.e. when $\Delta = \Omega(\log \Delta)$, where Δ denotes the maximum degree of the graph. We shall also in particular discuss a list variant of this problem, the best results concerning which exploit algebraic approach, based on Alon's Combinatorial Nullstellensatz.

18:20-19:20 (JST), 10:20-11:20 (CET), 4:20-5:20 (EST)

Zdeněk Dvořák "Applications of sublinear separators in graph coloring"

We explore several applications of sublinear separators, e.g., in design of distributed coloring algorithms for graphs on surfaces or in clustered coloring.

19:20-21:00 (JST), 11:20-13:00 (CET), 5:20-7:00 (EST) Free discussion

21:00-22:00 (JST), 13:00-14:00 (CET), 7:00-8:00 (EST)

Tomáš Kaiser “Hamiltonicity and toughness of graphs”

Chvátal conjectured in 1973 that there is a positive integer t such that every t-tough graph is Hamiltonian. (A graph G is t-tough if for every separating set X, G-X has at most |X|/t components.) After nearly five decades, Chvátal's conjecture remains a fundamental open question in Hamiltonian graph theory. In this talk, we will survey what is known about this fascinating conjecture, including positive results for chordal graphs and line graphs, and constructions providing a lower bound for the constant t. The talk includes joint work with Petr Vrána, Adam Kabela and Zdenek Ryjácek.

22:10-23:10 (JST), 14:10-15:10 (CET), 8:10-9:10 (EST)

Maria Chudnovsky “Induced subgraphs and tree decompositions”

Tree decompositions are a powerful tool in both structural graph theory and graph algorithms. Many hard problems become tractable if the input graph is known to have a tree decomposition of bounded “width”. Exhibiting a particular kind of a tree decomposition is also a useful way to describe the structure of a graph. Tree decompositions have traditionally been used in the context of forbidden graph minors; bringing them into the realm of forbidden induced subgraphs has until recently remained out of reach. Over the last couple of years we have made significant progress in this direction, exploring both the classical notion of bounded tree-width, and concepts of more structural flavor. This talk will survey some of these ideas and results.

23:20-24:20 (JST), 15:20-16:20 (CET), 9:20-10:20 (EST)

Zi-Xia Song “Hadwiger's conjecture”

Hadwiger's conjecture from 1943 states that for every positive integer t, every graph either can be t-colored or has a subgraph that can be contracted to the complete graph on t+1 vertices. This is a far-reaching generalization of the Four-Color Theorem and perhaps the most famous conjecture in graph theory. In this talk we will survey the history of Hadwiger's conjecture and the main ideas of recent results.

24:20-25:20 (JST), 16:20-17:20 (CET), 10:20-11:20 (EST) Free discussion