2023 組合數學與圖論紀念研討會

2023 One Day Workshop on Combinatorics and Graph Theory

Time: **February 17 (Fri.), 2023**

Venue: Auditorium, 6F, Astronomy-Mathematics Building

(National Taiwan University Campus)

Invited Speakers

Jing Huang 黃靖 University of Victoria

Hsin-Hao Lai 賴欣豪 National Kaohsiung Normal University

Wei-Tian Li 李渭天 National Chung Hsing University

Jephian C.-H. Lin 林晉宏 National Sun Yat-sen University

Xuding Zhu 朱緒鼎 Zhejiang Normal University

Organizers: Chun-Ju Lai 賴俊儒 (AS)、Jephian C.-H. Lin 林晉宏 (NSYSU)、Yeong-Nan Yeh 葉永南 (AS)

敬請註冊

Registration required.

中 央 研 究 院 數 學 研 究 所

Institute of Mathematics, Academia Sinica

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Click here to register → https://forms.gle/wXwnEqZNaUq8UyNn8 (Deadline 17:00, February 15)

09:30 ~ 10:00	Opening Remark
10:00 ~ 10:40	朱緒鼎 Xuding Zhu
10:40 ~ 11:00	Coffee Break
11:00 ~ 11:40	黃靖 Jing Huang
11:40 ~ 13:00	Group Photo & Lunch Time
13:00 ~ 13:40	賴欣豪 Hsin-Hao Lai
14:00 ~ 14:40	李渭天 Wei-Tian Li
14:40 ~ 15:00	Tea Time
15:00 ~ 15:40	林晉宏 Jephian C.-H. Lin
15:40 ~ 17:00	Free Discussions

(Last updated: February 13, 2023)

List Version of 1-2-3 Conjecture

Xuding Zhu
Department of Mathematics
Zhejiang Normal University

The well-known 1-2-3 Conjecture by Karoński, Łuczak and Thomason states that the edges of any connected graph with at least three vertices can be assigned weights 1, 2 or 3 so that for each edge uv the sums of the weights at u and at v are distinct.

The list version of the 1-2-3 Conjecture by Bartnicki, Grytczuk and Niwczyk states that the same holds if each edge e has the choice of weights not necessarily from $\{1, 2, 3\}$, but from any set $\{x(e), y(e), z(e)\}$ of three real numbers.

The goal of this talk is to survey developments on the 1-2-3 Conjecture, especially on the list version of the 1-2-3 Conjecture.

Strong Cocomparability Graphs and Slash-free Orderings of Matrices

Jing Huang
Department of Mathematics and Statistics
University of Victoria

We introduce the class of strong cocomparability graphs, as the class of reflexive graphs whose adjacency matrix can be rearranged by a simultaneous row and column permutation to avoid the submatrix with rows $01, 10$, which we call *Slash*.

We provide an ordering characterization, a forbidden structure characterization, and a polynomial-time recognition algorithm, for the class. These results complete the picture in which in addition to, or instead of, the *Slash* matrix one forbids the Γ matrix (which has rows $11, 10$). It is well known that in these two cases one obtains the class of interval graphs, and the class of strongly chordal graphs, respectively.

By complementation, we obtain the class of strong comparability graphs, whose adjacency matrix can be rearranged by a simultaneous row and column permutation to avoid the two-by-two identity submatrix. Thus our results give characterizations and algorithms for this class of irreflexive graphs as well. In other words, our results may be interpreted as solving the following problem: given a symmetric $0, 1$-matrix with 0-diagonal, can the rows and columns of be simultaneously permuted to avoid the two-by-two identity submatrix?

This is joint work with Pavol Hell and Jephian Lin

Applications of the Combinatorial Nullstellensatz to Incidence Coloring

Hsin-Hao Lai
Department of Mathematics
National Kaohsiung Normal University

Combinatorial Nullstellensatz is a polynomial method first introduced by Noga Alon in 1999. It became a powerful tool in many fields of combinatorics, including additive combinatorics, combinatorial geometry and graph theory.

An *incidence* (v, e) of a graph G is a pair of incident vertex v and edge e. Two incidences are adjacent if and only if they have the same vertex, they have the same edge, or the two vertices of them form the edge of one of the two incidences. The *incidence coloring* is a graph labeling such that each incidence is assigned a color and adjacent incidences must be colored differently. The *incidence chromatic number* of a graph G is the least integer k such that G has an incidence coloring with k colors.

In this talk, I will introduce some applications of Combinatorial Nullstellensatz in the study of incidence colorings.

Shifted-antimagic Labelings for Graphs

Wei-Tian Li
Department of Applied Mathematics
National Chung Hsing University

The concept of antimagic labelings of a graph is to produce distinct vertex sums by labeling edges through consecutive integers starting from one. A long-standing conjecture proposed by Hartsfield and Ringel is that every connected graph, except a single edge, is antimagic. Many graphs are known to be antimagic, but little is known about sparse graphs as well as trees.

In this talk, we will study the k-shifted-antimagic labeling which uses the consecutive integers starting from $k+1$, instead of starting from one, where k is a given integer. We establish connections among various concepts proposed in the literature of antimagic labelings and extends previous results in the following aspects:

- Some classes of graphs, including trees and graphs whose vertices are of odd degrees, which have not been verified to be antimagic are shown to be k-shifted-antimagic for sufficiently large k.
- Some graphs are proved to be k-shifted-antimagic for all k, while some are proved not for some particular k. In particlar, we determine the values of k for which trees of diamter at most 5 are k-shifted antimagic.
- Disconnected graphs are also considered. We characterize the linear forests and star forests that are k-shifted antimagic for every integer k.
- Labeling the grpahs with $|E(G)|$ distinct real numbers.

This talk contains the joint work with Fei-Huang Chang, Hong-Bin Chen, and Zhishi Pan and some work with my students, Eranda Dhananjaya, Yi-Shun Wang, and You-ying Tsai.

Perceptron Learning Algorithm: Theory and Practice

Jephian C.-H. Lin
Department of Applied Mathematics
National Sun Yat-sen University

The perceptron learning algoritm is a machine learning algorithm that finds an affine hyperplane that separates points with two labels according to their labels. With this idea, the machine knows how to solve a classification problem, if the labeled points can be separated by an affine hyperplane.

In this talk we will revisit this algorithm and go through the proof of its convergence. Then we will run some experiments to see its performance.