Abstracts and Schedule
Discrete Mathematics Day of the Northeast
September 20, 2014
Bread Loaf Campus, Middlebury College
Ripton, VT

Be advised that the Inn's main building, known as the Bread Loaf Inn, will be commencing a renovation project in September. This will have this one building unavailable to us for this conference. Please use caution around construction zones.

Friday, September 19th, 3:30pm–11pm Guest-room check-in at Barn East. Room assignments were sent ahead of your arrival. If arriving after hours, your room should be open to you.

Saturday, September 20th
7am Coffee available in Bread Loaf Barn.
9:00–10:00am Registration in Bread Loaf Barn. Coffee and light refreshments served.

All lectures will take place in Barn Classroom 2.

10:00–11:00am
Speaker: Paul Wenger, Rochester Institute of Technology
Title: The Rainbow Saturation Number of Graphs

Abstract

In 1987, Hanson and Toft introduced the following question drawing from both saturation numbers and Ramsey numbers:

Let $H_1, \ldots, H_k$ be graphs. What is the minimum number of edges in an n-vertex graph G such that 1) G has a k-edge-coloring what does not contain a monochromatic copy of H_i in color i for any i, and 2) for every edge $e \in E(\overline{G})$, every k-edge-coloring of

$G + e$ contains a monochromatic coloring of H_i in color i for some i?

A *rainbow edge coloring* of a graph H is an edge coloring such that each edge receives a distinct color. In this talk we introduce an anti-Ramsey variation of the Hanson-Toft question: For a graph H, what is the minimum number of edges in an n-vertex t-edge-colored graph G that does not contain a rainbow copy of H, but the addition of any edge in any color to G completes a rainbow copy of H. We call this number the *t-rainbow saturation number* of H, denoted $\mathtt{sat}_t(n, H)$.

We will present a variety of results demonstrating some surprising behavior of rainbow saturation numbers. In particular, we will show that for $t \geq \binom{k}{2}$, the t-rainbow saturation number $\mathtt{sat}_t(n, K_k)$ lies between $\frac{n \log n}{\log \log n}$ and $n \log n$.

11:00am–12:00pm

Speaker: Anna Blasiak, Akamai Technologies
Title: Network Flow Models of Internet Routing

Abstract

These days the internet knows everything about us, but most of us know nothing about it. I plan to level the playing field by letting you in on how the web works and many of the mathematically interesting problems that arise from minimizing latency and maximizing throughput over a network. I'll begin with the classic network flow problem including theorems about max-flow, min-cuts, and LP-duality. This problem forms the core of more complex network flow formulations that, at least in part, model the internet routing problem. I'll introduce three such theoretical formulations: multi-commodity flow, oblivious routing, and network coding. I'll discuss the features and limitations of these formalizations, and highlight some of the seminal results in each.

12:15–1:15pm Lunch in Bread Loaf Barn.

1:15pm–1:30pm Conference photo

1:30–2:30pm
Speaker: Gábor Sárközy, Worcester Polytechnic Insitute and Rényi Institute

Title: Monochromatic covers in edge-colored graphs and hypergraphs

Abstract

We survey some results on the following problem: Say we are given fixed positive integers s, t and a family of graphs $\mathcal{F}$. Minimizing over all t-edge colorings of the complete graph on n vertices, we ask for the maximum number of vertices that can be covered by at most s monochromatic members of $\mathcal{F}$. This problem unites two classical

problems: at one end of the spectrum ($s = 1$) we have the Ramsey problem, while at the other end we have cover problems. But there are some interesting problems "in-between" as well.

Several of the results are joint with András Gyárfás and/or Endre Szemerédi.

2:30–3:30pm

Speaker: Ameera Chowdhury, Institute of Mathematics and its Applications
Title: The Manickam-Miklós-Singhi Conjectures for Sets and Vector Spaces

Abstract

More than twenty-five years ago, Manickam, Miklós, and Singhi conjectured that for positive integers n, k with $n \geq 4k$, every set of n real numbers with nonnegative sum has at least $\binom{n-1}{k-1}$ k-element subsets whose sum is also nonnegative. We verify this conjecture when $n \geq 8k^2$, which simultaneously improves and simplifies a bound of Alon, Huang, and Sudakov and also a bound of Pokrovskiy when $k < 10^{45}$.

Moreover, our arguments resolve the vector space analogue of this conjecture. Let V be an n-dimensional vector space over a finite field. Assign a real-valued weight to each 1-dimensional subspace in V so that the sum of all weights is zero. Define the weight of a subspace $S \subset V$ to be the sum of the weights of all the 1-dimensional subspaces it contains. We prove that if $n \geq 3k$, then the number of k-dimensional subspaces in V with nonnegative weight is at least the number of k-dimensional subspaces in V that contain a fixed 1-dimensional subspace. This result verifies a conjecture of Manickam and Singhi from 1988.

Joint work with Ghassan Sarkis (Pomona College) and Shahriar Shahriari (Pomona College).

3:30–4pm Coffee break on patio of Little Theatre.

4:00–5:00pm
Speaker: Pete L. Clark, University of Georgia
Title: Around the Chevalley-Warning Theorem

Abstract

I will discuss interrelationships among the classical theorems of Chevalley and Warning and more recent polynomial methods due to Alon, Alon-Tarsi, Alon-Füredi and Ball-Serra. I will give a "Restricted Input/Restricted Output" Generalization of Warning's Second Theorem over a finite principal ring and discuss a graph-theoretical application which generalizes a result of Alon-Friedland-Kalai.

Much of the work is joint with A. Forrow and J.R. Schmitt.

5:15–6:00pm Walk on campus trails.

6:00pm Cocktail Reception in Bread Loaf Barn.

6:30pm–8:30pm Dinner in Bread Loaf Barn.

Sunday, September 21st, 7:00–10:00am Continental breakfast available in Barn. Check-out by 2pm. Hope you enjoy each other's company, the weather, the mountains. Have a safe journey home.