Midwinter meeting in discrete probability
January 10-11, 2023, Umeå

All talks are in room MC413 in the MIT-building

Wednesday

9.15-10.15 Eero Räty First-order convergence for permutation classes

Let $\mathcal{F}$ denote a permutation class. Given a first order sentence Ψ, let $p_{n,\Psi}$ denote the probability that a uniformly chosen permutation from $\mathcal{F}$ of size n satisfies Ψ. We say that $\mathcal{F}$ satisfies a logical limit law if for any first-order sentence Ψ the sequence of probabilities $p_{n,\Psi}$ converges as $n \to \infty$.

In 2023 Albert, Bouvel, Féray and Noy proved that the class of 231-avoiding permutations satisfies a logical limit law, and later in 2023 Ozdemir proved that the class of 321-avoiding permutations satisfies a logical limit law.

In 2011, Vatter gave a characterisation of all permutation classes whose growth rate is less than a certain constant $\kappa \approx 2.20557$. Using this characterisation, we verify the existence of a logical limit law for many such classes.

This work is joint with Victor Falgas-Ravry, Klas Markstrom, Fiona Skerman, Maryam Sharifzadeh and István Tomon.

10.15-10.45 Coffee

10.45-11.15 Svante Janson Almost sure convergence of triangular Pólya urns.

11.15-11.45 Stephan Wagner, The birth of the strong components

We consider random digraphs in a directed version of the classical Erd?s–Rényi model: given n vertices, each possible directed edge is inserted with probability p, independently of the others. It turns out that these graphs undergo a phase transition when p is about 1/n, which can be seen in the answer to questions such as: what is the probability that there are no directed cycles (equivalently, that all strongly connected components are singletons)? Using methods from analytic combinatorics, we obtain very precise asymptotic answers to questions of this kind.

Lunch 12.00-13.15

13.15-14.00 Stanislav Volkov Jante's Law has a continuous limit

Equality is a cornerstone of Swedish culture. The "We're all the same" mentality originates from the pan-Scandinavian concept known as the Jante Law, the ten "commandments" derived from Aksel Sandemose's 1933 book "A Fugitive Crosses His Tracks." For many Scandinavians, these rules subconsciously influence their everyday lives, emphasizing that no one should be seen as different from the "collective identity." This "law" has contributed to the development of an egalitarian society marked by higher levels of humility compared to most other places.

In my presentation, based on a series of papers, including the most recent one, I will describe interacting stochastic particle models that emulate the development of such societies and the convergence to a common consensual limit. The continuity of this limit has proven to be a much more challenging task than establishing its existence.

14.05–14.50 Fabian Burghart A CLT for m-dependent random variables in graphs

We consider m-dependent random variables X_{nv} placed at the vertices v of a graph G_n. The main result is a modification of a CLT for triangular arrays of m-dependent random variables due to Orey (1957) to show normal convergence of $\sum_v X_{nv}$, under some assumptions on the sequence of graphs G_n (which are shown to be satisfied e.g. when the G_n have bounded degree and treewidth), and, separately, some (mild) conditions on the random variables. We compare graphical m-dependence to some established CLT's for m-dependent triangular arrays. If time permits, we will conclude with one or two examples.

14.50-15.30 Coffee

15.30-16.15 Tom Britton Semi-directed networks and their relation to epidemic models

First we describe the configuration model for a semi-directed network consisting of both directed and undirected edges, and some large population properties of such networks. Then we show that the final outcome of a surprisingly large class of epidemic models can be characterized by such semi-directed networks.

18.30 Dinner at Rex for registered participants

Thursday

9.15-9.45 Istvan Tomon Graph discrepancy

9.45-10.15 Vilhelm Agdur A classification of community detection methods on graphs satisfying certain axioms

We consider the problem of community detection on graphs, and we state two natural hypotheses restricting their behaviour under edge and vertex additions and when taking induced subgraphs. We show that these two properties together are equivalent to being given by a representation by a set of simple graphs. This thus gives a complete classification of community detection methods with these properties.

10.15-10.40 Coffee

10.40-11.10 Timo Vilkas Maker-Breaker games on Galton-Watson trees

Maker-breaker is a classical combinatorial game in which one player fixates, the other one removes edges (taking turns) in order to connect/isolate nodes. Strategies and success probabilities are assessed for different levels of information the players receive.

11.10-11.55 Lorents Landgren Most Reliable Graphs with Low Corank

Which connected graph, given n vertices and m edges, is most likely to remain connected under edge-percolation with parameter $p \in (0, 1)$? The question was first asked by Boesch et al. in 1985 (and independently by Steif to Landgren in 2021). It turns out that the answer sometimes depends upon p and sometimes not.

We investigate families of graphs with low *corank*, $k + 1$, where $k = m - n$. When $k = 0, 1, 2$ or 3 there is always a unique graph which is most reliable, uniformly in p. The four sequences of optimal graphs are all obtained as particular subdivisions of, respectively, a circle (degenerate case), the 3-edge dipole, K_4, and the utility graph $K_{3,3}$. These "blueprints" are more or less degenerate *Möbius ladders* of increasing order.

For $k = 4$, the most reliable graph is generally p-dependent. However, it still always seems to be a subdivision of a Möbius ladder, which is known as the Wagner graph. The Möbius-pattern is known to be broken by the Petersen graph, which is most reliable among $(10, 15)$-graphs, where $k = 5$. A proof that subdivisions of the Petersen graph are most reliable for $(n, n + 5)$-graphs when $n > 10$, is currently out of reach.

Lunch 12.00-13.15

13.15-14.00 Altar Ciceksiz, Asymptotic distribution of the longest k-alternating subsequence

We define the longest k-alternating subsequence of a permutation to be the length of the longest subsequence, denoted L, where the difference between the consecutive elements alternate between being positive and negative and the magnitude of the difference for consecutive elements of the subsequence is at least k. Taking a uniformly random permutation, the expectation of L has been computed asymptotically by Pak and Pemantle in 2015 and later by Cai who gave an exact formula. We compute the variance of l and give a central limit theorem.

14.00 Coffee