Applied Combinatorics and the Natural Sciences II
(Chair/Président: **Marni Mishna** (Simon Fraser University)
Org: **Marni Mishna** (Simon Fraser University), **Chris Soteros** (University of Saskatchewan) and/et **Karen Yeats** (Simon Fraser University))

TOM BOOTHBY, Simon Fraser University
Topological Metrics on Permutations

In comparative genomics, biologists measure the similarity between genomes by modelling genome rearrangements. These metrics often correspond to lengths of factorizations of (signed) permutations into products from certain generating sets, for example block interchanges, or signed reversals. We draw an analogy to topological graph theory in which block interchanges naturally correspond to handles and signed reversals correspond to crosscaps, and investigate associated metrics used in comparative genomics.

SOPHIE BURRILL, Simon Fraser University
Using generating trees to construct Skolem sequences

A Skolem sequence is a linear arrangement of the multiset 1,1,2,2,...,n,n such that if r appears in positions i and j, then |i-j|=r. We first translate the problem to a particular set of perfect matchings, and then apply the method of generating trees for open arc diagrams to generate exhaustively all Skolem sequences of a given size. Tracking arc length between pairs of vertices in an arc diagram is the central task. Although we do not surpass previously known enumerative results, this method drastically reduces the search space compared to previously known methods.

E. J. JANSE VAN RENSBURG, York University
Some results on inhomogeneous percolation

Let $\mathbb{L}_0$ contain the origin and be an s-dimensional hypercubic sub-lattice of the d-dimensional hypercubic lattice $\mathbb{L}$ ($2 \leq s < d$). Percolation at densities (p, σ) is set up by declaring edges in $\mathbb{L}_0$ open with probability σ, and edges in $\mathbb{L} \backslash \mathbb{L}_0$ open with probability p. We prove existence of a critical curve $\sigma^*(p)$ such that the model is subcritical if $\sigma < \sigma^*(p)$. We show $\sigma^*(p)$ is strictly decreasing with $p \in (0, p_c(d))$, and $\sigma^*(p) = 0$ if $p \in (p_c(d), 1)$ (with $p_c(d)$ the critical density for homogeneous percolation in $\mathbb{L}$). Results about the critical point and cluster distributions will also be given.

CHRIS SOTEROS, University of Saskatchewan
Combinatorics of the entanglement complexity of stretched polygons in a lattice tube

Self-avoiding polygons on the simple cubic lattice are the standard statistical mechanics lattice model for ring polymers in dilute solution. Exact combinatorics for this model is notoriously challenging. If the polygons are confined to an infinite rectangular lattice tube, however, exact combinatorics is more accessible due to the one-dimensional nature of the tubular sublattice. In this talk I will present theoretical and exact enumeration results for stretched polygons in a lattice tube. In particular we have explored how entanglement complexity depends on the stretching force, polygon length and tube size for small tube sizes.

KAREN YEATS, Simon Fraser University
Using combinatorics to understand Dyson-Schwinger equations

Dyson-Schwinger equations are important integral equations in quantum field theory whose structure mirrors the recursive decomposition of Feynman diagrams into subdiagrams. I will discuss how we can try to understand Dyson-Schwinger equations combinatorially, first at the graph level as functional equations analogous to those coming from combinatorial specifications, and second, in nice cases, at the analytic level by unwinding into geometric series and chord diagrams.