DR. MARNI MISHNA

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Title: **Towards a combinatorial understanding of transcendental functions.**

Abstract
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Mathematical transcendance refers to objects (usually numbers or functions) that do not satisfy any polynomial equation, that is, they are not algebraic. The numbers π and e are famous transcendental numbers, and e^x and the Gamma function are examples of transcendental functions. The problem of understanding the structure of transcendental objects has fascinated mathematicians for well over a century. Combinatorics provides an intuitive framework to study power series. A combinatorial family is associated to a power series in $\mathbb{R}[[x]]$ via its enumerative generating function wherein the number of objects of size n is the coefficient of x^n. Twentieth century combinatorics and theoretical computer science provided characterizations of classes with rational and algebraic generating functions. Finding natural extensions of these correspondences has been a motivating goal of enumerative combinatorics for several decades.

This talk will focus on two well studied classes of transcendental functions: the differentiably finite and differentially algebraic. We will illustrate how a geometrical approach allows us to classify the generating functions of families of walks on lattices. Lattice path and random walk models are in bijection with a striking number of classes with transcendental generating functions: from pattern avoiding permutations, to Young tableaux of bounded height and so this program and has led to progress in characterizing differential transcendence of other combinatorial generating functions arising in the literature, and indeed generally.

Bio: Dr. Mishna is a Professor of mathematics at Simon Fraser University. Her research investigates interactions between discrete structures and many diverse areas such as representation theory, functional equation theory, and algebraic geometry. She has authored the book "Analytic Combinatorics: a multidimensional approach", has collaborated with 35 different co-authors, and has supervised 30 students and postdocs. Dr. Mishna received her Ph.D. from UQAM in 2003. From 2003-2005 she held an NSERC PDF at Bordeaux and at the Fields Institute, and joined SFU in 2005. Dr. Mishna has been a plenary speaker at numerous international conferences and was a co-PI in a PIMS collaborative research group in Applied Combinatorics. From 2019-2021 Dr. Mishna was the Pacific Institute of Mathematical Sciences Deputy Director.

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