

**LECTURE SERIES BY**  
**Dr. Eric Dolores Cuenca**  
**October 03-14, 2022**

**Dr. Dolores Cuenca** joined Yonsei University, Seoul, South Korea (KR) in 2021 as a postdoctoral researcher. He received a Ph.D. in mathematics from Northwestern University in 2016. In 2017 the artist Justus Harris and Dr. Eric Dolores won the international contest and art event Adaptation in the category Environment + Data. This competition is sponsored by the European Union. Dr. Eric Dolores Cuenca spent two years as a postdoctoral researcher at Florida State University before joining the company NewSci Labs as a Machine Learning Consultant. In his spare time Dr. Dolores collaborates with activist groups using technology to solve problems of society. His research interest is focused on the applications of algebraic operads. He has shown links between the theory of cellular automata, neural networks and combinatorics. In particular, he developed an algebra of power series in which the notion of order is encoded, leading to the discovering of two new binomial identities.

Topic: Order Series.

Day & Time: Monday, October 03, 2022, at 2:00 pm.

Venue: Department of Mathematics, University of the Punjab, Lahore

**Abstract:** To every poset  $X$ , Stanley considered the problem of counting the number  $\Omega(X, n)$ ,  $\Omega(X, n)^0$  of strict and non-strict order preserving maps from the poset  $X$  to the chain  $\langle n \rangle = 1 < 2 < \dots < n$ . He showed that these are given by polynomials in  $n$ . Consider the operad of posets, it contains a suboperad of series parallel posets that is generated by the chain  $1 < 2$  and the disjoint union  $1 \cup 1$ . We introduce an algebra of series parallel posets whose objects are the generating functions  $\Omega(X, 1)^0 x + \Omega(X, 2)^0 x^2 + \dots$ . We will discuss how this family inherits the algebraic properties of posets.

Topic: Panel Discussion

Day & Time: Tuesday, October 04, 2022, at 10:30 am.

Venue: Department of Mathematics, University of the Punjab, Lahore

Topic: Order Polytopes.

Day & Time: Wednesday, October 05, 2022, at 10:30 am.

Venue: Department of Mathematics, University of the Punjab, Lahore

**Abstract:** Given an integral polytope, Ehrhart showed how to associate a series encoding information about the number of integer points in the polytope. We will discuss how to transform the order series of a poset into the Ehrhart series of the order polytope. From the point of view of Ehrhart theory, we introduce a new positive basis in which the coefficients count intersection of simplices in the canonical triangulation of the order polytope.

Topic: Panel Discussion  
Day & Time: Thursday, October 06, 2022, at 10:30 am.  
Venue: Department of Mathematics, University of the Punjab, Lahore

Topic: Wixarika Posets.  
Day & Time: Monday, October 10, 2022, at 10:30 am.  
Venue: Department of Mathematics, University of the Punjab, Lahore

**Abstract:** We now introduce a family of posets in which the basis of the order series computes topological invariants. As a corollary we can describe an algorithm that takes as input a power series  $f(x)$ , and if possible, the algorithm returns those Wixarika posets whose order series is the power series  $f(x)$ . We also show links to number theory and applications to probability.

Topic: Applications of order series.  
Day & Time: Wednesday, October 12, 2022, at 10:30 am.  
Venue: Department of Mathematics, University of the Punjab, Lahore

**Abstract:** Since series parallel posets are isomorphic to series parallel order polytopes, what is the difference of using our base versus Ehrhart series? It turns out that our base allows for close formulas, with surprising connections to number theory. We will prove new identities involving the Riemann zeta function.

Topic: Panel Discussion  
Day & Time: Friday, October 14, 2022, at 10:30 am.  
Venue: Department of Mathematics, University of the Punjab, Lahore