

MATHEMATICAL STRUCTURES SEMINAR

Matroids and their Interplay with Graphs

Nancy Ann Neudauer (Pacific University, USA)

DATE: Monday, 14 April 2025 | 11h00 – 13h00 SAST

VENUE: Online

ABSTRACT

Tutte famously said, “If a theorem about graphs can be expressed in terms of the edges and circuits only it probably exemplifies a more general theorem about matroids.” Which results about graphs could we extend to matroids? Or which results on matroids might help us solve graph theory problems? Matroids are everywhere. Vector spaces are matroids. Matroids are useful in situations that are modelled by both graphs and matrices. Bicircular matroids model generalized net workflow problems whose algorithms are more efficient than those available for general linear programming codes. We consider the essential role of matroids in combinatorial optimization and their relationship to the greedy algorithm. In 1933, three Harvard junior-fellows tied together some recurring themes in mathematics, into what Gian Carlo Rota called one of the most important ideas of our day. They were finding properties of dependence in multiple mathematical structures. What resulted is the matroid, which abstracts notions of algebraic dependence, linear independence, and geometric dependence, thus unifying several areas of mathematics. The usefulness of matroids to pure mathematical research is similar to that of groups— by studying an abstract version of phenomena that occur in different realms of mathematics, we learn something about all those realms simultaneously.

BIOGRAPHY



Nancy Ann Neudauer is a Professor of Mathematics at Pacific University in the United States and serves as Associate Secretary of the Mathematical Association of America (MAA). She is also Co-director of the Center for Undergraduate Research in Mathematics (CURM), a programme that supports students and faculty across the US with research mini-grants, backed by a \$1.6 million grant over five years.

She holds a PhD in Mathematics (with a minor in Business and Law) and a BBA in Actuarial Science and Risk Management, both from the University of Wisconsin. Her research lies in matroid theory and graph theory, supported by grants from the Simons Foundation, US National Science Foundation, Fulbright Program, and an endowed Research Chair.

Nancy has long been a leader in mathematical outreach and education. She has served on the Board of Directors and the Congress of the MAA, served as the Program Chair of the Cascadia Combinatorial Feast since 2001, directed the Dolciani Mathematics Enrichment Grant Programme for over a decade, and has played a key role in projects focused on the education of mathematics teachers. She has received multiple honours, including a Distinguished Teaching Award and a Meritorious Service Award.

As a Fulbright Specialist, her outreach extends to the African Institute for Mathematical Sciences (AIMS) centres in South Africa, Tanzania, Ghana, Cameroon, and Rwanda. She is also a recipient of the Fulbright Global Scholars Award.

Passionate about making advanced mathematics more accessible, Nancy aims to introduce matroid theory to mathematicians and students worldwide. Her upcoming book, *Matroids for the Working Mathematician*, is set to further this mission when it is published next year.

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