

Lewis University
STEM Undergraduate Research Experience
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Faculty Mentor - Project Application

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Title: Polytopes Associated to Graphs

Abstract

Polytopes are generalizations of polygons and polyhedra, polytopes of dimension two and three, respectively. As geometric objects with combinatorially interesting properties, polytopes have important applications in diverse areas such as linear programming, optimization, physics, and topology. Recently, there is a heightened interest in studying polytopes associated to graphs. We will use the Laplacian matrix of a graph to form a polytope by considering the rows of the matrix as vertices of the polytope. This technique of generating polytopes was introduced in 2017, and there is much to be explored. In this project, we work to discover which families of graphs yield certain polytopes with desirable properties. We also experiment with known operations on graphs and study their effects on the corresponding polytopes. Our methods include matrix manipulations, interpretation of lattice points as code words from coding theory, and minor computer computations.