
ERIC SUI, Carleton University (Math Enrichment Centre)

On Intersections of Hyperplanes Formed by n Points in Low-Dimensional Space

This research poster explores discrete geometry, a field laden with aspects of not only geometry, but also combinatorics. It focuses on the counting of intersections in various dimensions, with a focus on the second and the third. We are given n points in k dimensional space. We form hyperplanes ($k - 1$ dimensional objects) which are determined by k of the n points. How many unique $k - 2$ dimensional intersections of these hyperplanes exist? In this poster, we solve a simple combinatorial geometry problem as a precursor. This problem is defined in 2-dimensions and it is also focused on the formation of objects from points. Then, we solve the 2 dimensional and 3 dimensional cases using purely combinatorial techniques and provide diagrams for each of these cases. Further exploration would entail how we can solve this problem in 4 or higher dimensions. Possible approaches could be an inductive process involving lifting the points or a similar combinatorial approach for higher dimensions.