Participants will investigate the following two-player game played on a finite graph $G$. One player assigns a collection of pawns (cops) to the vertices of $G$ and then a second player assigns a single pawn (the robber) to another vertex. Players alternate turns moving any number of their pawns to adjacent vertices. The cop player wins if the robber can be captured by moving a cop to the same vertex; the robber player wins if the robber can always avoid capture. The fundamental problem is to determine the fewest number of cops required to ensure that the cop player can always win; this minimal number is called the cop number of the graph. This problem was introduced by Quillot in the late 1970’s and, independently, by Nowakowski and Winkler in the early 1980’s. Both groups characterized those graphs having cop number equal to one in terms of a sequence of reduction moves on the graph $G$. In 2010, Clarke and McGillivray found an analogous algorithm for determining the cop number of $G$.

The students in this research group will be able to immediately investigate the fundamental problem, construct examples, and read many accessible papers which introduce the topic. There are many open problems and many interesting special classes of graphs which can be investigated. The project offers opportunities for both theoretical and experimental discoveries.

References: