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**Problems in Graph Searching**

**Problèmes de recherche dans les graphes (graph searching)**

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*Can Cop Number Equal Independence Number?*

In 2022 Turcotte asked if  $c(G) < \alpha(G)$  for all graphs with  $\alpha(G) \geq 3$ . Recently, Char, Maniya, and Pradhan proved this is false when  $\alpha = 3$  by demonstrating a single graph with cop number and independence number 3. The problem was not resolved for graphs with independence number greater than 3. We settle this problem using random graphs by proving the stronger result that for all  $k \geq 1$  there exists a graph  $G$  such that  $c(G) = \alpha(G) = \theta(G) = k$ . Next, we consider the structure of graphs achieving  $c(G) = \theta(G)$ , and in doing so we prove that if  $G$  is a perfect graph with  $\alpha(G) \geq 4$  then  $c(G) < \alpha(G)$ .

This is joint work with Imed Zaguia.

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*Eternal domination in Cayley graphs*

As usual, a dominating set in a graph is a set of  $D$  vertices such that every vertex of the graph is either in  $D$ , or is adjacent to a vertex of  $D$ . We can turn the idea of domination into a defensive game or strategy by thinking of the dominating set as a collection of guards, and insisting that should any vertex outside of  $D$  be attacked, the guards must be able to move along edges so that one of the guards moves to the attacked vertex, and the layout of the guards after the move is again a dominating set for the graph. If it is possible to continue to reconfigure the guards in this way forever, no matter what sequence of vertices is attacked, then we say that  $D$  is an *eternal dominating set* for the graph.

A Cayley graph is a graph with a great deal of symmetry: its automorphism group acts transitively on the vertices of the graph; moreover there is a subgroup of the automorphism group that acts regularly (sharply transitively) on the vertices. In some situations, symmetry can provide interesting and effective strategies for graph searching problems, but the presence of game pieces such as searchers often essentially breaks the symmetry of the graph, rendering it much less useful.

In this talk I will present recent results about eternal dominating sets for Cayley graphs. This is based on joint work with MacKenzie Carr, Nancy Clarke, and Gary MacGillivray.

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