Cops-and-robbers on multilayer graphs

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(This talk is based on joint work with Kitty Meeks, Will Pettersen and John Sylvester.)

I will describe the game of cops-and-robbers and then its generalisation to multilayer graphs. In this setting, a graph consists of a single set of vertices with multiple (potentially intersecting) edge sets. We allow the cops and robber to move only on their assigned layer, and ask if the cops can be guaranteed to catch the robber in finite time. Using several examples, I'll show that initial intuition about the best way to allocate cops to layers is not always correct. I will outline arguments showing that the number of cops required to catch a robber in a multilayer graph is neither bounded from above nor below by any function of the cop numbers of the individual layers. Additionally, we'll talk about a question of worst-case division of a simple graph into layers: given a simple graph G, what is the maximum number of cops required to catch a robber over all multilayer graphs where each edge of G is in at least one layer and all layers are connected? For cliques, suitably dense random graphs, and graphs of bounded treewidth, we have determined this parameter up to multiplicative constants. Lastly I'll outline a multilayer variant of Meyniel's conjecture, and show the existence of an infinite family of graphs whose multiayer cop number is bounded from below by a constant times $n/\log n$, where n is the number of vertices in the graph.