6th Graph Searching in Canada (GRASCan) Workshop

Aug 7–8, 2017

Grenfell Campus, MUN

Corner Brook, Canada

GRENFELL CAMPUS | MEMORIAL UNIVERSITY

AARMS

Monday, August 7

8:45 - 9:00	Opening remarks
9:00 - 10:00	**Nancy Clarke**, Acadia University *Strategies for cops left largely in the dark*
10:00 - 10:30	COFFEE
10:30 - 11:00	**Anthony Bonato**, Ryerson University *Topological directions in Cops and Robbers*
11:00 - 11:30	**Danielle Cox**, Mount Saint Vincent University *Limited visibility Cops and Robbers*
11:30 - 12:00	**Margaret-Ellen Messinger**, Mount Allison University *Eviction and Swap Sets*

Tuesday, August 8

9:00 - 10:00	**Jan Kratochvíl**, Charles University *Cops and Robbers in geometric intersection graphs*
10:00 - 10:30	COFFEE
10:30 - 11:00	**Fionn Mc inerney**, Inria, France *Spy game on graphs*
11:00 - 11:30	**Boting Yang**, University of Regina *The one-cop-moves game on planar graphs*
11:30 - 12:00	**Aras Erzurumluoglu**, University of Ottawa *Relating the brushing number to the zero-forcing number*
12:00 - 12:30	**Jessica Enright**, University of Stirling *Fire-breaking for network epidemiology*

Abstracts of Talks

Nancy E. Clarke, Acadia University — Monday
Strategies for cops left largely in the dark — 9:00 - 10:00

In this talk, we consider various variations of the Cops and Robbers game in which the cop side plays with incomplete (or mis)information. In the first series of variations, the partial information may be provided via selected vertices of a graph, or via selected edges, and may or may not include information about the robber's direction in addition to his position. In all cases, we give bounds on the amount of such information needed by a single cop to guarantee a win on a copwin graph. We then consider several variations of the game in which the partial information is more dynamic in nature in the sense that it is provided via witnesses who report sightings of the robber, is dependent on the proximity of the cop(s) to the robber, or instead is actually misinformation provided by the robber side. In all cases, we work toward characterizations of the graphs on which a single cop can guarantee a win.

Anthony Bonato, Ryerson University — Monday
Topological directions in Cops and Robbers — 10:30 - 11:00

In 2001, Schroeder conjectured that if a graph has genus g, then its cop number is at most $g + 3$. While Schroeder?s bound known to hold for planar and toroidal graphs, the case for graphs with higher genus remains open. We survey what is known at the intersection of Cops and Robbers and topological graph theory, and outline key outstanding questions in this direction.

Danielle Cox, Mount Saint Vincent University — Monday
Limited visibility Cops and Robbers — 11:00 - 11:30

Limited Visibility Cops and Robbers is a variation of the traditional Cops & Robber game where the Cops can only see distance ℓ from their current location, but the Robber still has perfect information. Results regarding monotonicity, retracts, trees and chordal graphs will be presented. This is joint work with N. Clarke, C. Duffy, D. Dyer, S. Fitzpatrick, and M.E. Messinger.

Margaret-Ellen Messinger, Mount Allison University — Monday 11:30 - 12:00
Eviction and Swap Sets

"Swap" sets often arise when considering the eternal dominating set model of Eviction. Dominating sets D and D are called swaps sets if they are disjoint and there exists a perfect matching between them. We consider the cardinality of the smallest such sets D, D in a graph (provided they exist) and study the parameter on trees and Cartesian products. We also explore the relationship to the independence number of a graph. This is joint work with W.F. Klostermeyer (UNF) and A. Angeli Ayello (Waterloo).

Jan Kratochvíl, Charles University, Prague — Tuesday 9:00 - 10:00
Cops and robbers in geometric intersection graphs

We survey results on the classical Nowakowski-Winkler Cops and Robbers pursuit game when played on special graph classes. In particular, we consider geometric intersection graphs such as interval graphs, circle graphs, function graphs, outerstring graphs and string graphs. Generalization to surfaces of higher genus and intersection graphs in higher dimensions will be also mentioned.

The talk is based on a joint work with Tomas Gavenciak, Przemyslaw Gordinowicz, Vit Jelinek, and Pavel Klavik.

Fionn Mc inerney, Inria, France — Tuesday 10:30 - 11:00
Spy game on graphs

We define and study a new vertex pursuit game on graphs called Spy Game. An important contribution of this work is to show that linear programming can be used to make new progress in the study of these types of games.

In our game, a first agent, the Spy, moves at speed $s \geq 2$ in a graph in the search of a vertex that is distance at least $d+1$ from all other agents, the Guards, who want to control him (that is, assure that there is always at least 1 guard at distance at most d from the spy). Given a graph G, the minimum number of guards necessary to satisfy this objective is called the guard number and is noted $gn_{s,d}(G)$. The problem is to calculate $gn_{s,d}(G)$ as well as a corresponding strategy for the guards. This 2-player game (spy and guards) is similar to Cops and Robbers and Eternal Domination.

We study the complexity of calculating $gn_{s,d}(G)$ and present winning strategies for the guards in diverse classes of graphs. Some of our proofs are combinatorial while others are based on the use of linear programming which we show can be of great use in the analysis of these types of games.

Boting Yang, University of Regina — Tuesday 11:00 - 11:30

The one-cop-moves game on planar graphs

For the Cops and Robbers game, Aigner and Fromme established thatin every connected planar graph, three cops are sufficient to capture a single robber. In this talk, we consider a recently studied variant of the cops-and-robbers game, alternately called the lazy-cops-and-robbers game, one-active-cop game, or the one-cop-moves game, where at most one cop can move during any round. We show that Aigner and Fromme's result does not generalize to this game variant by constructing a connected planar graph on which a robber can indefinitely evade three cops in the one-cop-moves game. This answers a question recently raised bySullivan, Townsend and Werzanski. This talk is based on joint work with Ziyuan Gao.

Aras Erzurumluoglu, University of Ottawa — Tuesday 11:30 - 12:00

Relating the brushing number to the zero-forcing number

Eroh et al. proved that the zero-forcing number of a graph G, denoted by $Z(G)$, satisfies $Z(G) \leq 2Z(L(G))$ (where $L(G)$ denotes the line graph of G); and they conjectured that $Z(G) \leq Z(L(G))$. This talk will be based on a recent joint work with Karen Meagher and David Pike, where we proved this conjecture for the affirmative and also established that $B(G) \leq Z(L(G))$ and $B(G) \leq B(L(G))$ also hold, where $B(G)$ stands for the brushing number of a graph. If time permits, I will also discuss the generalization of zero-forcing to the setting of hypergraphs as is defined by Bergen et al., and mention some related new results.

Jessica Enright, University of Stirling, UK — Tuesday 12:00 - 12:30

Fire-breaking for network epidemiology

We propose a one-step version of firefighting (called fire-breaking) on a graph in which a fire starts at some vertex, and the protector must immediately protect a fixed number of non-burning vertices. The fire then spreads with no further intervention from the protector. Given a graph G on n vertices, a fire starting vertex v_s in G, a protection capacity k, and a fraction $1/q$, we ask if there is a selection of at most k vertices that the protector can protect to save at least n/q vertices from a fire starting at v_s.

Our interest in this problem is motivated partially by applications in livestock epidemiology, and we will briefly describe some networks in this application area and the nature of the applications.

We are interested in a number of versions of this problem, including edge and vertex versions, as well as versions in which the fire starting point is unknown, but is instead drawn from a known distribution - in this case we are interested in the optimal protection strategy in expectation. We have only just started this work, and are very interested in collaboration on these problems. This is joint work with David Pike, Jared Howell, and Andrea Burgess.

Thanks

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