5th Graph Searching in Canada (GRASCan) Workshop

July 20–21, 2016
Dalhousie University
Halifax, Canada

DALHOUSIE UNIVERSITY

AARMS

- All talks will take place in Chase 319 (Colloquium Room).
- Chase 319 is equipped with a large chalkboard and a data projector (but no computer).
- Chase 107, 210, and 319 are available for participants to use in the afternoons.

Wednesday, July 20

8:45 - 9:00	Opening remarks (Chase 319)
9:00 - 10:00	**Gena Hahn**, Université de Montréal *A survey of cops and robbers on infinite graphs*
10:00 - 10:30	COFFEE
10:30 - 11:00	**Anthony Bonato**, Ryerson University *Overprescribed Cops and Robbers*
11:00 - 11:30	**Shannon Fitzpatrick**, University of Prince Edward Island *Zombies and Survivors: A Deterministic Approach*
11:30 - 12:00	**Danny Dyer**, Memorial University of Newfoundland *Watching undergraduates watch graphs*

Thursday, July 21

9:00 - 10:00	**Paweł Prałat**, Ryerson University *Intersection of Graph Searching and Probability*
10:00 - 10:30	COFFEE
10:30 - 11:00	**Margaret-Ellen Messinger**, Mount Allison University *Eternal Domination and Eviction in Graphs*
11:00 - 11:30	**Danielle Cox**, Mount Saint Vincent University *Damage Inflicted by a Robber*
11:30 - 12:00	**Ben Seamone**, Université de Montréal *Fully active cops and robbers*

Abstracts of Talks

Gena Hahn, Université de Montréal — Wednesday
A survey of cops and robbers on infinite graphs — 9:00 - 10:00

Mostly without proofs we will survey what is known of the classic game of Cops and Robbers on infinite graphs. We will present some old results, not-so-old-results and rather new results, not all co-authored by the speaker, about the game and graphs. Related results and problems, expanding on previous talks, will also be presented.

Anthony Bonato, Ryerson University — Wednesday
Overprescribed Cops and Robbers — 10:30 - 11:00

Capture time measures the length of the game of Cops and Robbers assuming optimal play. If we add more cops than the cop number, then the capture time will monotonically decrease. Eventually, the capture time becomes 1 when we are at (or near) the domination number. We refer to this phenomenon as *temporal speed-up*. Temporal speed-up represents a new approach to Cops and Robbers, measuring the range of capture times for an overprescribed number of cops beyond the cop number.

We consider the temporal speed-up for various graph classes, including trees, multi-dimensional Cartesian grids, and hypercubes. For hypercubes Q_n of dimension n, the cop number is linear in n, with capture time order $n \log n$ Perhaps surprisingly, we show that the capture time of order $n \log n$ persists even up to an exponential number of cops.

Shannon Fitzpatrick, University of Prince Edward Island — Wednesday
Zombies and Survivors: A Deterministic Approach — 11:00 - 11:30

We consider a variant of the pursuit-evasion game Cops and Robber, called Zombies and Survivors. The zombies, being of limited intelligence, have a very simple objective at each round: move closer to a survivor. The zombies capture a survivor if one of the zombies moves onto the same vertex as a survivor. The survivor's objective is to avoid capture for as long as possible, hopefully indefinitely. Because there may be multiple geodesics, or shortest paths, joining a zombie and its nearest survivor, the game can be considered from a probabilistic or deterministic approach. In this talk, we consider a deterministic approach to the game, discuss how it differs from Cops and Robber, and examine the game on various classes of graphs. (This talk is based on joint work with J. Howell. M.E. Messinger and D.A. Pike.)

Danny Dyer, Memorial University of Newfoundland — Wednesday
Watching undergraduates watch graphs — 11:30 - 12:00

In this talk, I will talk about some results obtained with students working on NSERC USRA projects. Particularly, we are interested in examining the watchman's walk problem on Halin graphs, obtained from taking a planar embedding of a tree and connecting all the leaves with a new cyclical face. If that doesn't take up enough time, I'll also talk about circulant graphs. Joint work with Jared Howell, Shane Andrews, and possibly Kelly Clarke.

Paweł Prałat, Ryerson University — Thursday
Intersection of Graph Searching and Probability — 9:00 - 10:00

As you know I like Graph Searching problems but also Random Processes. I am going to present a few problems that lie in the intersection of the two. However, even the intersection is quite diverse; probability can come into the picture in three different ways, for example,

1) one can play a (deterministic) combinatorial game on a random board
2) one of the players makes random moves
3) probabilistic methods can help in analyzing a deterministic game

During the talk, I will show a few examples from each class.

Margaret-Ellen Messinger, Mount Allison University — Thursday
Eternal Domination and Eviction in Graphs — 10:30 - 11:00

Eternal Domination and Eviction are dynamic domination problems on graphs. A set of mobile agents occupy vertices of a dominating set with an objective to defend against an infinite sequence of attacks that occur, one at a time, at vertices of a graph. To defend against an attack, the agents move to adjacent vertices in order to occupy vertices of a dominating set that, depending on the model, either contains or does not contain the attacked vertex. This talk include recent work on the Eviction problem with W.F. Klostermeyer (UNF) and A. Angeli Ayello (Waterloo); it will also highlight some similarities and differences between Eternal Domination and Eviction.

Danielle Cox, Mount Saint Vincent University — Thursday
Damage Inflicted by a Robber — 11:00 - 11:30

In this talk we will introduce a new parameter, the *damage* inflicted by a robber. We will compute the damage for various families of graphs and establish bounds on this parameter. For copwin graphs the damage and capture time will be compared. This is joint work with Asiyeh Sanaei of Kwantlen Polytechnic University.

Ben Seamone, Université de Montréal, Dawson College
Fully active cops and robbers

Thursday
11:30 - 12:00

In the traditional cops and robbers game, the ability for a player to "pass" on her/his turn plays an important role in the analysis of winning strategies. In particular, many classic results rely on homomorphisms in reflexive graphs, where a mapping of an edge to a loop corresponds to a player staying put on her/his turn. In this talk, we explore the game of "fully active cops and robbers", where each player must move to an adjacent vertex on each turn. We give a general relationship between the cop number in the traditional game and the fully active game, and provide results on the active cop number for a variety of classes of graphs. This is joint work with Ilya Gromovikov (Dawson College) and Bill Kinnersley (University of Rhode Island).

Participants

Anthony Bonato* (Ryerson University)

Nancy Clarke (Acadia University)

Danielle Cox* (Mount Saint Vincent University)

Christopher Duffy (Dalhousie University)

Danny Dyer* (Memorial University of Newfoundland)

Shannon Fitzpatrick* (University of Prince Edward Island)

Gena Hahn* (Université de Montréal)

Bert Hartnell (Saint Mary's University)

Jared Howell (Memorial University of Newfoundland, Grenfell)

Margaret-Ellen Messinger* (Mount Allison University)

Todd Mullen (Dalhousie University)

Kerry Ojakian (Bronx Community College, CUNY)

Paweł Prałat* (Ryerson University)

Suzanne Seager (Mount Saint Vincent University)

Ben Seamone* (Université de Montréal, Dawson College)

(*) speaker

Thanks

GRASCan 2016 has been generously funded by

- Atlantic Association for Research in the Mathematical Sciences,
- Dalhousie University Dean of Science,
- Dalhousie University Department of Mathematics and Statistics.