5th Workshop on GRAph Searching, Theory and Applications (GRASTA 2012)

Fedor V. Fomin, Richard J. Nowakowski, Pawel Pralat, Dimitrios M. Thilikos

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October 7–12, 2012

Banff International Research Station, Banff, AB, Canada

Organizers

Fedor Fomin (University of Bergen)
Richard Nowakowski (Dalhousie University)
Pawel Pralat (Ryerson University)
Dimitrios M. Thilikos (National and Kapodistrian University of Athens)

PROGRAM
Monday, October 8

8:55 - 9:00	Opening remarks
9:00 - 10:00	**Anthony Bonato**, Ryerson University
	Cops and Robbers: Directions and Generalizations
10:00 - 10:15	BREAK
10:15 - 10:45	**Jan Kratochvil**, Charles University
	Cops and robbers in special graph classes
10:45 - 11:15	**?**, University of ?
	?
11:15 - 11:45	**Josep Diaz**, Universitat Politecnica de Catalunya
	Metric dimension
	LUNCH BREAK
2:00 - 3:00	**Tobias Muller** , Mathematical institute of Utrecht University
	Cops and robbers on random geometric graphs
from 3:00	Open problem session

Tuesday, October 9

9:00 - 10:00	**Douglas B. West** , University of Illinois
	Revolutionaries and spies: Spy-good and spy-bad graphs
10:00 - 10:15	BREAK
10:15 - 10:45	**Przemyslaw Gordinowicz**, Technical University of Lodz
	Let us play the cleaning game
	LUNCH BREAK
from 2:00	Open problem session

Wednesday, October 10

9:00 - 10:00	**Peter Widmayer** , ETH Zurich
	Polygon Reconstruction with Little Information
10:00 - 10:15	BREAK
10:15 - 10:45	**Ladislav Stacho**, Simon Fraser University
	Graph traversal with constant number of pebbles
	LUNCH BREAK
from 2:00	Open problem session

Thursday, October 11

9:00 - 10:00	**Nicolas Nisse** , MASCOTTE team-project
	Routing reconfiguration and processing games
10:00 - 10:15	BREAK
10:15 - 10:45	**?**, University of ?
	?
	LUNCH BREAK
from 2:00	Open problem session

Friday, October 12

from 9:00	Open problem session

PARTICIPANTS

Bonato, Anthony (Ryerson University)
Clarke, Nancy (Acadia University)
Dereniowski, Dariusz (Gdansk University of Technology)
Diaz, Josep (Universitat Politecnica de Catalunya)
Dudek, Andrzej (Western Michigan University)
Dyer, Danny (Memorial University of Newfoundland)
Erickson, Lawrence (University of Illinois at Urbana-Champaign)
Finbow, Stephen (St. Francis Xavier University)
Fomin, Fedor (University of Bergen)
Gavenciak, Tomas (Charles University)
Gordinowicz, Przemyslaw (Technical University of Lodz)
Hahn, Gena (University of Montreal)
Kinnersley, Bill (University of Illinois at Urbana-Champaign)
Kratochvil, Jan (Charles University)
Messinger, Margaret-Ellen (Mount Allison University)
Muller, Tobias (Utrecht University)
Nisse, Nicolas (INRIA Sophia Antipolis)
Nowakowski, Richard (Dalhousie University)
Pardo Soares, Ronan (MASCOTTE)
Pralat, Pawel (Ryerson University)
Seamone, Ben (Universite de Montreal)
Shannon, Fitzpatrick (University of Prince Edward Island)
Stacho, Ladislav (Simon Fraser University)
Thilikos, Dimitrios (National and Kapodistrian University of Athens)
West, Douglas (University of Illinois Urbana-Champaign)
Widmayer, Peter (ETH)
Yang, Boting (University of Regina)

OPEN PROBLEMS

Pawel Pralat, Ryerson University
Meyniel's conjecture

The biggest open conjecture in the area of cops and robbers is the one of Meyniel, which asserts that for some absolute constant C, the cop number of every connected graph G is at most $C\sqrt{n}$, where $n = |V(G)|$. Today we only know that the cop number is at most $n2^{-(1+o(1))\sqrt{\log_2 n}}$ (which is still $n^{1-o(1)}$) for any connected graph on n vertices.

Pawel Pralat, Ryerson University
Revolutionaries and spies on random graphs

The behaviour of the spy number is analyzed for dense graphs (that is, graphs with average degree at least $n^{1/2+\varepsilon}$ for some $\varepsilon > 0$). For sparser graphs, only some bounds are provided and the picture is far from clear.

Pawel Pralat, Ryerson University
The firefighter problem

Consider the following *k-many firefighter problem* on a finite graph $G = (V, E)$. Suppose that a fire breaks out at a given vertex $v \in V$. In each subsequent time unit, a firefighter protects k vertices which are not yet on fire, and then the fire spreads to all unprotected neighbours of the vertices on fire. The objective of the firefighter is to save as many vertices as possible.

The surviving rate $\rho_k(G)$ of G is defined as the expected percentage of vertices that can be saved when a fire breaks out at a random vertex of G. Let

$$\tau_k = \begin{cases} \frac{30}{11} & \text{if } k = 1 \\ k + 2 - \frac{1}{k+2} & \text{if } k \geq 2. \end{cases}$$

It is known that there exists a constant $c > 0$ such that for any $\varepsilon > 0$ and $k \geq 1$, each graph G on n vertices with at most $(\tau_k - \varepsilon)n$ edges is not flammable; that is, $\rho_k(G) > c \cdot \varepsilon > 0$. Moreover, a construction of a family of flammable random graphs is proposed to show that the constants τ_k cannot be improved.

It would be nice to find the threshold for other families of graphs, including planar graphs.

Problem 1: Determine the largest real number M such that every planar graph G with $n \geq 2$ vertices and $\frac{2m}{n} \leq M - \varepsilon$ edges has $\rho_1(G) \geq c \cdot \varepsilon$ for some $c > 0$. It is known that $\frac{30}{11} \leq M \leq 4$.

One can generalize this question to any number of firefighters. We know that all planar graphs are not k-flammable for $k \geq 4$. However, it is conjectured that, in fact, planar graphs are not 2-flammable but the techniques are too local to

show it. Therefore, it seems that the question does not make sense for $k \geq 2$ (unless the conjecture is false).

Problem 2: Determine the least integer g^* such that there is a constant $0 < c < 1$ such that every planar graph G with girth at least g^* has $\rho(G) \geq c$. It is known that $5 \leq g^* \leq 7$.