



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

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► **To cite this version:**

Fedor Fomin, Richard J. Nowakowski, Pawel Pralat, Dimitrios M. Thilikos. 5th Workshop on GRaph Searching, Theory and Applications (GRASTA 2012). France. pp.1-12, 2012, <<http://www.birs.ca/events/2012/5-day-workshops/12w5055>>. <lirmm-00904556>

**HAL Id: lirmm-00904556**

**<https://hal-lirmm.ccsd.cnrs.fr/lirmm-00904556>**

Submitted on 14 Nov 2013

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



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

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

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## Tuesday, October 9

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

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## Wednesday, October 10

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

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## Thursday, October 11

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

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## Friday, October 12

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from 9:00	Open problem session
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# 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  $\tau_k$  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  $5 \leq g^* \leq 7$ .