Parameterized Complexity News

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Welcome

Co-editors Valia Mitsou (LIRIS, CNRS Univ Lyon 1) vmitsou@liris.cnrs.fr and Frances Rosamond (Univ Bergen) Frances.Rosamond@uib.no. Congratulations to all for awards and prizes, graduates, new jobs, and wonderful research. Michael Wehar offers a new look at fine-grained FPT. IPEC Excellent Paper winner Marcin Wrochna and NWO award winner Johan Kwisthout contribute articles. Australia's Chris Wallace Award for a notable CS breakthrough has been awarded to Haris Azis. Haris writes about cake-cutting and suggests open problems.

Nerode Prize deadline March 1

Nominate now: EATCS-IPEC NERODE PRIZE for outstanding papers in multivariate algorithmics.
ELIGIBILITY: paper or series of research papers by a single author or by a team of authors published in a recognized refereed journal. The year of publication should be at least two years and at most ten years before the year of the award nomination. The research work nominated should be in the area of multivariate algorithms and complexity meant in a broad sense, and encompasses, but is not restricted to, those areas covered by IPEC.
NOMINATE: Send an email to Award Committee Chair containing a brief summary of the technical content of each nominated paper and a brief explanation of its significance. Send copies to the members of the committee. The Subject line of the nomination E-mail should contain the group of words "Nerode Prize Nomination".
SEND EMAIL: David Eppstein `eppstein@uci.edu`, Chair (UC, Irvine). Members: Dániel Marx `dmarx@cs.bme.hu` (Hungarian Acad Sci), Jianer Chen `chen@cse.tamu.edu` (Texas A&M).

Figure 1: Winners all: Eunjung Kim, Marcin Wrochna, Fedor Fomin, Johan Kwisthout

Eunjung Kim – CNRS Bronze Medal

Congratulations to **Eunjung Kim** (Charge de Recherche CNRS (Junior Researcher) LAMSADE, Univ Dauphine.) Eunjung has been awarded the Bronze Medal by the National Center for Scientific Research (CNRS). The Medal is intended to recognize and encourage an already productive French junior researcher who is a well-committed and promising specialist in computer science.

Fedor Fomin – Norwegian NFR Award

Congratulations to **Fedor Fomin** (Univ of Bergen) awarded a Norwegian Research Council (NFR) grant for *Multivariate Algorithms: New Domains and Paradigms*. Apply for 2 postdoc, 1 PhD position.

Contents of this issue:

Johan Kwisthout – TOP grant

Congratulations to **Johan Kwisthout** (Donders Institute for Brain, Cognition and Behaviour) who has received an NWO EW Physical Sciences Division TOP grant for the project *Parameterized Complexity of Approximate Bayesian Inference*. The 217,000 Euro grant is for four years (April 2017-March 2021). Applications for a PhD candidate on a fully paid fellowship for four years plus additional costs are being accepted.

Toby Walsh – Award for Excellence

Congratulations to **Toby Walsh** (UNSW Sydney and Data61, CSIRO) who has won the NSW Premier's Award for Excellence in Engineering and Information and Communications Technologies. Toby is a global leader in AI and one of the top five most-cited computer scientists in Australia. He researches the interface between optimisation (making better decisions), social choice (taking account of agents' preferences), and game theory (taking account of self-interested agents).

Saket Saurabh, Michael Fellows, Bart Jansen – JCSS, TALG

Congratulations to **Saket Saurabh** (Univ of Bergen) who has been invited as Associate Editor of *JCSS*. Congratulations to **Michael Fellows** (Univ Bergen) who has been appointed to the Editorial Board of *JCSS*. Congratulations to **Bart Jansen** (Eindhoven Univ) who has been appointed Associate Editor of *TALG*. These positions embody an enormous amount of volunteer work and responsibility. Please help these new editors by reviewing promptly and with good will. They are contributing mightily to the PC community and to TCS largely.

On the Complexity of Intersection Non-Emptiness Problems

by Michael Wehar (Univ at Buffalo) mwehar@buffalo.edu
Article Editor: Daniel Lokshtanov (Univ Bergen)

Given a finite list of DFA's (deterministic finite automata), does there exist a string that is accepted by all of the DFA's? This problem is known as the *intersection non-emptiness problem for finite automata* because it is equivalent to determining if the underlying regular languages have a non-empty intersection. There are many different parameters that one could associate with a given instance of this problem. We focus on a parameterization in terms of k, the number of automata in the list and n the number of states from the largest automaton (see more parameterizations from Wareham (2001)).

When parameterized in this way, the intersection non-emptiness problem is complete for $klog(n)$ space for non-deterministic Turing machines (this is known as XNL-complete under fpt-reductions). If one generalizes the problem to tree automata, then the intersection non-emptiness problem is complete for n^k time for deterministic Turing machines (this is known as XP-complete under fpt-reductions). If one restricts the automata to be symmetric, then the intersection non-emptiness problem is complete for $klog(n)$ space for deterministic Turing machines (this is known as XL-complete under fpt-reductions). Collectively, these intersection non-emptiness problems characterize the parameterized complexity classes XP, XNL, and XL which are the parameterized counterparts of P, NL, and L, respectively. Further restrictions on the automata yield complete problems for seemingly more restrictive parameterized complexity classes between W[1] and W[P].

The primary focus of this work is on a generalized technique of using automata to verify Turing machine computations. This technique yields parameter preserving fpt-reductions that we refer to as level-by-level reductions (similar, but more restrictive than linear-fpt reductions from Chen, Huang, Kanj, Xia (2004)).

By directly connecting the intersection non-emptiness problems with Turing machine computations, the level-by-level reductions yield both conditional and unconditional complexity lower bounds. In particular, one cannot solve the XP-complete problem in $f(k)*n^{o(k)}$ time. If one can solve the XNL-complete problem in $f(k)*n^{o(k)}$ time, then NL is separate from P. If one can solve the XL-complete problem in $f(k)*n^{o(k)}$ time, then L is separate from P. Further, if one can solve the W[1]-complete problem in $f(k)*n^{o(k)}$ time, then the exponential time hypothesis does not hold.

The lower bound for the intersection non-emptiness problem for tree automata (the XP-complete problem) is unconditional, meaning that that there is no efficient algorithm that solves the problem. Unconditional lower bounds are obtained in this work by providing a level-by-level reduction from a Turing machine acceptance problem to an intersection non-emptiness problem. The parameter preserving fpt-reduction converts classical lower bounds for Turing machine acceptance problems to lower bounds for intersection non-emptiness problems.

Link to dissertation: http://michaelwehar.com/documents/mwehar_dissertation.pdf

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More polynomial-FPT algorithms

by Marcin Wrochna (Univ of Warsaw)

Introduction The concept of parameterizing problems, modeling how practical instances may be more structured and simpler than their size suggests, also applies well to problems solvable in polynomial time. George Mertzios [3] previously presented this idea in the December 2015 Newsletter—the basic question for a problem and a parameter k is: can we solve it in time $k^{O(1)} \cdot n$? That is, with a *linear* dependence on the input size n for each value of k, but only a polynomial dependence on

k? More generally, how can techniques of parameterized complexity be applied to reduce resource needs of classical algorithms with large polynomial bounds?

Perhaps the most striking results to date are the negative answers by Abboud et al. [1]: the radius or diameter of a graph of treewidth k cannot be computed in time $2^{o(k)} \cdot n^{2-\varepsilon}$ for any $\varepsilon > 0$, assuming the Strong Exponential Time Hypothesis. In other words, even slightly reducing the quadratic exponent of the basic algorithm computing all-pairs-shortest-paths, let alone making it linear, is impossible, even in graphs of treewidth only slightly above logarithmic.

Matchings and Flows For many, the first polynomial-, but not linear-time algorithms that spring to mind are for matching or flow problems. Known approaches usually work similarly for different variants; on n vertices, m edges they give the following time bounds: $O(\sqrt{n}m)$ using augmenting paths, $O(n^{2.376})$ via matrix multiplication (an algebraic randomized approach by Mucha and Sankowski [5]), and $O(m^{1.43})$ in recent breakthroughs (an on-going line of research including Mądry's *electrical flows* [4] and Peng's quasi-linear time approximation scheme [6]). Even in the simplest case of Maximum Matching in unweighted bipartite graphs, no exact close-to-linear time algorithm is known as yet.

Leveraging the parameter treewidth, we can use the generic dynamic programming technique to find matchings and flows in $2^{O(k)} \cdot n$, so linear time for graphs of constant treewidth k. This approach cannot achieve a polynomial dependence on k, however. One of our main results in [2] is an $O(k^3 n \log n)$-time randomized algorithm for finding the cardinality of a maximum matching and $O(k^2 n \log n)$-time for finding a maximum vertex flow (vertex-disjoint s-t paths) in a directed graph.

Observe that $O(k^2 n \log n)$ is faster than all other known algorithms already for moderate values of treewidth, like $k = O(n^{1/3})$. We do not need constant or logarithmic bounds on parameters to achieve potentially practical speedups!

Divide & Conquer Let me sketch the simple approach used for finding vertex flows, as I believe similar algorithms might be just around the corner.

Given a directed graph G on n vertices, a tree decomposition of width k and vertices s, t, we want to find a maximum number of vertex-disjoint paths from s to t. The basic tool used is the Ford-Fulkerson augmenting path algorithm we teach freshmen: given ℓ disjoint s-t paths, it will find $\ell + 1$ such paths, if possible, in time linear in the number of edges, $O(kn)$. In particular, if s and t occur in bags of disjoint subtrees of the tree decomposition, this means there is a cut of size at most k separating them, so the maximum flow is bounded by k and can be found just by augmenting the empty flow k times, using $O(k^2 n)$ time in total.

If s and t occur in intersecting subtrees of the tree decomposition, we divide this intersection in half. That is, in the subtree of bags containing both s and t, we find a bag B (a node of the decomposition) that splits it in into components of at most half the size. We remove all vertices in B except for s and t from the whole decomposition and recurse into each component (eventually ending in components without bags containing both s and t). Recall that by definition of treewidth, B contains at most k vertices; so in any solution, at most k of the vertex-disjoint paths goes through B. Since by recursing we found a maximum number of paths not visiting B, we only need to run the Ford-Fulkerson algorithm up to k times to complete the solution, again using $O(k^2 n)$ time.

By cutting in half, we ensure the recursion has depth $O(\log n)$. At each level of the recursion, the components considered add up to $O(n)$ vertices, so we use $O(k^2 n)$ time at each level, giving $O(k^2 n \log n)$ in total.

Matrices For maximum matchings (in non-bipartite graphs) we used the algebraic approach, as in [5]. It allows to reduce the problem to computing the determinant of a certain sparse matrix (and other values typically computed by Gaussian elimination). In the case that interests us, the matrix not only has few non-zero entries, it also has small treewidth; this means, e.g., that the bipartite graph with rows and columns as vertices and non-zero entries as edges has small treewidth. In practical terms, any subset of rows or columns can be partitioned in two roughly equal halves, so that their interaction is bounded to a small number of columns or rows.

Surprisingly, almost all work on this basic case considered only semi-definite positive matrices. Without this assumption, the elimination process may find a zero on the diagonal, forcing us to continue eliminating with a different row or column. The choice of ordering or rows and columns in this process is called *pivoting*. For a chosen ordering, elimination creates new non-zero entries, which have to be somehow contained to bound the running time.

In [2], we express this ordering, containment and, most importantly, the relevant bounds, in terms of graph parameters. Given a graph of small pathwidth, an appropriate ordering of vertices and graph completion then follows in a natural way. This allows us to compute the determinant of an $n \times n$ matrix of pathwidth k (or, e.g., solve systems of linear equations given by this matrix) in time $O(k^2 n)$. This matches the cubic brute-force approach and improves over it whenever we have *any* non-trivial bound path decomposition—indeed, the algorithm in the end only rearranges how non-zero entries are listed.

Counterintuitively, treewidth seems to need more work, and a natural chordal completion is not enough. Fortunately, we can either reduce to the case of pathwidth, losing a $log^2 n$ factor, or perform a splitting procedure on the matrix to obtain a stronger tree-like structure, but losing a factor of k. Whether we can exactly match the brute-force cubic time remains an open question.

Conclusion We list many other intriguing questions in the full version of [2]; much remains to be explored in the "FPT inside P" world. The algorithms for sparse matrices make part of a fundamental algorithmic toolbox, allowing, e.g., to find the size of a maximum matching easily. However, a different approach might give a deterministic algorithm, or work in the weighted case as well.

The algorithms for matchings and flows can be also thought as tools for attacking other problems. A final fundamental tool in [2] for problems parameterized by treewidth is an algorithm approximating it. Given an integer k, in time $O(k^7 n \log n)$ it either concludes that no tree decomposition of width k exists, or outputs one of width $O(k^2)$. Thus, we do not need to provide decompositions on input to achieve the $k^{O(1)} n \log n$ running times (though the constants here are not so nice anymore).

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Fixed-error Randomized Tractability

by Johan Kwisthout (Radboud University) j.kwisthout@donders.ru.nl
Article Editor: Ulrike Stege (Univ of Victoria)

Computing posterior and marginal probabilities constitutes the backbone of almost all inferences in Bayesian networks. These computations are known to be intractable in general, both to compute exactly and to approximate, assuming that BPP $\neq$ NP. While it is well known under what constraints *exact* computation can be rendered tractable (viz., bounding tree-width of the moralized network and bounding the cardinality of the variables) it is less known under what constraints *approximate* Bayesian inference can be tractable. Typical approximations use randomized algorithms that return a result that is expected to be within bounds ϵ of the exact value with probability $1-\delta$. In general, these approximate problems are not tractable, but they may be rendered tractable when constrained. We proposed a formal framework to capture this parameterized tractability [2].

A convenient way of analysing stochastic computations is by means of a *Probabilistic Turing machine*. This is basically a non-deterministic machine where state transitions are stochastic, rather than non-deterministic; we can define complexity classes on the probability of acceptance of yes-instances on such a machine. A problem is in PP, the class of decision problems that are solvable by a probabilistic Turing machine in polynomial time, if the machine halts after polynomial time and the probability of acceptance of a yes-instance is $1/2 + \epsilon$ for $\epsilon > 0$; assuming binary and uniformly distributed state transitions this is the case if the *majority* of computation paths accepts. This majority may be exponentially small (e.g., $\epsilon = 1/c^n$ for a constant $c > 1$). In contrast, yes-instances for problems in BPP (*bounded* probabilistic polynomial time) are accepted with a probability that is polynomially bounded away from $1/2$ (i.e., $\epsilon = 1/n^c$). PP-complete problems, such as the problem of determining whether the *majority* of truth assignments to a Boolean formula ϕ satisfies ϕ, are considered to be intractable; indeed, it can be shown that NP $\subseteq$ PP. In contrast, it is believed that BPP = P [1].

To allow for a more fine-grained analysis of such algorithms, I introduced the parameterized complexity classes FERT and XER as randomized analogs to FPT and XP (think 'fixed-error randomized tractable' and 'exponential-error randomization'), defined as follows:

Definition (FERT). Let Π be a decision problem and let $\kappa{-}\Pi$ be a parameterization of Π. We have that $\kappa{-}\Pi \in$ FERT if and only if there exists a probabilistic Turing machine $\mathcal{M}$ that halts after time, polynomial in the size of the input x, with the following acceptance criteria. $\mathcal{M}$ accepts *Yes*-instances of Π with probability $1/2 + \min(f(\kappa), 1/|x|^c)$ for a constant c and arbitrary function $f : \mathbb{R} \to \langle 0, 1/2]$; *No*-instances are accepted with probability at most $1/2$.

Definition (XER). Let Π be a decision problem and let $\kappa{-}\Pi$ be a parameterization of Π. We have that $\kappa{-}\Pi \in$ XER if and only if there exists a probabilistic Turing machine $\mathcal{M}$ that halts after time, polynomial in the size of the input x, with the following acceptance criteria. $\mathcal{M}$ accepts *Yes*-instances of Π with probability $1/2 + \min(1/|x|^{f(\kappa)}, 1/|x|^c)$ for a constant c and arbitrary function f; *No*-instances are accepted with probability at most $1/2$.

In [3] I gave an overview of known parameterized results for approximation algorithms for Bayesian networks; depending on the parameterization, such problems can be in FERT, in XER, or even para-PP-hard. Interestingly, some of these randomized algorithms can be de-randomized at the cost of an additional parameter to be constrained. For example, while $\{\epsilon\}$-additive-approximation of marginal inference is in FERT, one can show that $\{\epsilon, d\}$-additive-approximation is in FPT; where d denotes the maximum in-degree of the Bayesian network. These de-randomization results might shed some interesting light on the question whether BPP = P by looking at the parameterized analogs FERT and FPT of these complexity classes.

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Figure 2: Oz Award Winners: Toby Walsh, Haris Aziz

Algorithmics for Multi-agent Allocation Problems

by Haris Aziz (UNSW, Data61) haris.aziz@data61.csiro.au

Introduction In the past couple of decades, there have been exciting developments at the interface of computer science and economics. Within economics, two particular subfields that have been part of these developments are game theory and social choice theory. Whereas game theory is the study of strategic interaction, social choice is the study of collective decision making. A fundamental question at this interface between computer science and economics is *"who gets what?"* This question arises in many settings including matching agents in a two-sided matching market, allocating kidneys in a kidney exchange market, and dividing rent among housemates (see e.g., [11]). Concepts from economics help formalize properties of allocations as well as the allocation methods, while techniques from computer science are helpful in coming up with constructive solutions.

The cake cutting problem I discuss one particular problem in mathematical economics that I have been working on and which has benefited from refreshed algorithmic study. The *cake cutting problem* is a general allocation problem in which the cake is a heterogeneous divisible resource represented by an interval [6, 15]. The problem is to find a fair allocation by eliciting sufficient information about the agent valuations. Originally formalized by Hugo Steinhaus in the 1940's, the problem has attracted attention in mathematics, computer science and economics. One of the most important criteria for fairness is *envy-freeness*. An allocation is envy-free if no agent would prefer replacing her allocation with another agent's. A cake cutting protocol is envy-free if each agent is guaranteed to be non-envious if she reports her real valuations while interacting with the protocol.

The most famous envy-free cake cutting protocol is the two-agent *Divide and Choose* protocol where one agent divides the cake and the other agent chooses. The cutter gets the remaining piece. Although Divide and Choose has been known and used since time immemorial, it was only in the 1960's that John Selfridge and John Conway independently proposed an envy-free protocol for three agents. Then in the early 1990's, Steven Brams and Alan Taylor invented a general finite envy-free cake cutting protocol [5]. The protocol can require arbitrary number of steps and cuts on the cake even for four agents. It has been an open problem whether a four-agent envy-free protocol exists or not for which the number of queries is bounded in the number of agents [5, 14]. Last year, my coauthor Simon Mackenzie and I presented the first bounded four agent envy-free protocol [1]. We then generalized the protocol to any number of agents [2].

Conclusion We hope that our new results will spur faster and simpler algorithms for the problem. Current work involves understanding what is the optimal bound for the problem. It will be interesting to take a parametrized view of the problem or explore restricted versions of the problem. For example one can explore the parameters the number of agent types (with the same valuations) or the parameter number of discontinuity points of the valuation density function. One can study parameterized and restricted valuations (see e.g., [7, 8, 10]). If one foregoes the requirement of allocating the whole cake, one can consider the parameter the fraction of total value of the cake that each agent expects to get in an envy-free allocation (see e.g., [16]). Another research direction would be exploring alternative query models.

More generally, multi-agent allocation provides a well-spring for algorithmic problems (see e.g., [12]). Whereas the cake cutting problem that I discussed concerns a divisible resource, there are many allocation problems where the resources are indivisible or additionally involve money. There can also be other challenging requirements such maximizing the welfare of agents, ensuring that the allocation algorithm is strategyproof, or allowing more complex preferences from agents. As we endeavour to tackle general and complex allocation problems, it will be useful to continue exploring the algorithms toolkit including the potential of multivariate algorithmics (see e.g., [3, 4, 8, 9, 13, 17]).

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Algorithms – Travel Award

Prof. Dr. Henning Fernau, Editor-in-Chief of *Algorithms* announces the opening of a competition for an annual **Travel Award** sponsored by *Algorithms*. The Travel Award consisting of 800 Swiss Francs will be granted to a PhD student in the area of algorithms and their applications, to attend a conference in 2017. Applications until 31 March 2017.

CONFERENCES AND WORKSHOPS

May – St. Petersburg CS Student School

Recent Advances in Algorithms: International Computer Science Student School, May 22 – 26, St. Petersburg, Russia http://raa-school.org. The school offers the opportunity to learn about recent breakthroughs in several domains of algorithms: from classical areas like network algorithms and longest paths in graphs to recently emerged areas like streaming algorithms and algorithms for high dimensional data. The primarily audience consists of PhD students interested in Algorithms. Bright master students, postdocs, young researchers and even faculty are also very welcome.
Lecturers: Michael Kapralov (EPFL) Streaming Algorithms, Aleksander Mądry (MIT) Graph Algorithms and Continuous Optimization, Ilya Razenshteyn (MIT) Algorithms for High-Dimensional Data, Saket Saurabh (IMSc) Longest Paths in Graphs: Parameterized Algorithms.

June–WG

The **43rd International Workshop on Graph-Theoretic Concepts in Computer Science** June 21-23, Heeze (near Eindhoven), the Netherlands, http://www.win.tue.nl/wg2017/. Invited Speakers: Fedor V. Fomin, Remco van der Hofstad, Petra Mutzel. Submission deadline: Feb 27.
Program Chairs: Hans L. Bodlaender (Eindhoven and Utrecht), Gerhard J. Woeginger (Eindhoven).

June–FAW'17

The **11th International Frontiers of Algorithmics Workshop** will be held June 23-25, Chengdu, China.
Program Chairs: Frances Rosamond (Univ of Bergen) and Mingyu Xiao (Univ of Electronic Science and Technology of China).

June–Dagstuhl Seminar 17261

Dagstuhl 17261: **Voting: Beyond Simple Majorities and Single-Winner Elections**, June 25–30.
Organizers: Dorothea Baumeister (Heinrich–Heine–Univ Dusseldorf), Piotr Faliszewski (AGH Univ of Science & Technology, Krakow), Annick Laruelle (Univ of the Basque Country, Bilbao), Toby Walsh (TU Berlin).

July–IWOCA'17

The **28th International Workshop on Combinatorial Algorithms** is held from 17–21 July in Newcastle, Australia. This is a very special IWOCA, dedicated to the memory of Prof Mirka Miller, one of IWOCA's founders. Mirka was diagnosed with gastro-oesophageal cancer in 2015 and died of this disease on 2 January, 2016. This particular IWOCA gathering is as much about celebrating the life and work of this wonderful person as it is in continuing her legacy. IWOCA is just one aspect.
Program Chairs: Ljiljana Brankovic (Univ Newcasatle), Joe Ryan (Univ Newcasatle).

August–COCOON

The 23rd Annual International Computing and Combinatorics Conference (COCOON) August 3–5, 2017, Hong Kong, China http://cocoon2017.comp.polyu.edu.hk/. Invited speakers: Dániel Marx (Hungarian Academy of Sciences, Hungary) Shang-Hua Teng (University of Southern California, USA) Virginia Vassilevska Williams (Stanford University, USA) Paper submission: March 20.
Program Chairs: Yixin Cao (Hong Kong Polytechnic Univ), Jianer Chen (Texas A&M Univ).

August – SAT 2017

The International Conference on Theory and Applications of Satisfiability Testing (SAT), takes place in Melbourne, Australia alongside CP 2017 and ICLP 2017 from August 28th to September 1st, 2017 which is the week immediately following IJCAI 2017. http://sat2017.gitlab.io/ Abstract submission: 26 Apr 2017. Paper submission: 2 May.
Program Chairs: Serge Gaspers (UNSW Sydney and Data61, CSIRO) and Toby Walsh (UNSW Sydney and Data61, CSIRO).

August – RANDOM & APPROX

21th RANDOM 2017 & APPROX 2017, UC Berkeley, California, August 16 - 18, 2017. urlhttp://cui.unige.ch/tcs/random-approx/. Paper Submission: April 21.
Program Chairs: RANDOM Santosh Vempala (Gatech), APPROX David Williamson (Cornell Univ). Workshop Chairs: José Rolim (Univ Geneva), Klaus Jansen (Univ Kiel).

Sept–IPEC'17

ALGO 2017 is held from 4–8 September 2017 in Vienna, Austria.

Sept–PACE'17

The **Parameterized Algorithms and Computational Experiments Challenge (PACE)** to investigate the applicability of algorithmic ideas studied and developed in the subfields of multivariate, fine-grained, parameterized, or fixed-parameter tractable algorithms. https://pacechallenge.wordpress.com/.
March 1st, 2017: Submission of preliminary version for bugfixing and leaderboard
May 1st, 2017: Submission of final version
June 1st, 2017: Announcement of the results
September 4-8, 2017: Award ceremony at IPEC'17.
Committee Chairs: ˆ Track A (Tree Width): Holger Dell (Saarland University and Cluster of Excellence (MMCI)). Track B (Minimum Fill-in): Christian Komusiewicz (Chair) (Friedrich-Schiller-University Jena), Nimrod Talmon (Weizmann Institute of Science), Mathias Weller (Laboratory of Informatics, Robotics, and Microelectronics of Montpellier (LIRMM)).

Moving Around – Congratulations to all

Edouard Bonnet has joined the Foundations of Computing group, Department of Computer Science, Middlesex Univ, London, working with Panos Giannopoulos.
Lin Chen has accepted a Research Assistant Professorship at Univ Houston working with Prof. Dr. Larry Shihas. Edouard Bonnet:
Tillman Miltzow is moving to the Algorithms Research Group, Computer Science Dept, Univ Libre de Bruxelles (ULB) working with Jean Cardinal.
Valia Mitsou has joined the LIRIS Lab, CNRS (Univ Lyon 1), working on the ANR Games and Graphs project with Eric Duchêne.

CONGRATULATIONS New PhDs

Markus Dregi, *Beyond the question of fixed-parameter tractability*, 2017, University of Bergen, Norway. The thesis is about what you do after you know whether your problem is FPT or not. I.e, it is about the "optimality" program, subexponential algorithms, kernelization and FPT-approximation. Advisor: Daniel Lokshtanov, University of Bergen. Congratulations, Dr. Dregi. Markus has accepted a position as Consultant at Webstep, in Bergen.

Michael Wehar, *On the Complexity of Intersection Non-Emptiness Problems*, Dec 2016, State University at Buffalo, USA. The dissertation is discussed in this newsletter. Supervisor: Kenneth Regan, University of Buffalo. Congratulations, Dr. Wehar. Michael has accepted a position at CapSen Robotics.