NATHANN COHEN
CNRS RESEARCHER IN COMPUTER SCIENCE

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6th February 1986 – French
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French, English (fluent)

Professional history

2012 -	**Researcher** in Computer Science, CNRS / Université Paris XI Associate Researcher at INRIA Labs, Sophia-Antipolis
2011 - 2012	**Postdoc** in Discrete Geometry, Université Libre de Bruxelles (Belgium)
2008 - 2011	**Ph.D. student**, MASCOTTE project I3S (CNRS-UNS)/INRIA Labs, Sophia Antipolis (France)
2008 - 2011	**Teacher Assistant** for the Engineer school Polytech'Nice
2008	**Internship**, MASCOTTE project, Sophia Antipolis (France)

Education

01/10/2008 - 29/10/2011 **Ph.D. in Computer Science, Université de Nice Sophia Antipolis (UNS)**

Title : *Three years of Graphs and music* (defended the 20/10/2011)

MASCOTTE Project – I3S (CNRS-UNS)/INRIA Labs, Sophia Antipolis

Jørgen BANG-JENSEN	Prof. Univ. of Southern Denmark	Referee
Daniel KRÁL'	Associate Prof. Charles University	Referee
András SEBŐ	Research Director, G-SCOP, Grenoble	Referee
Frédéric HAVET	Tenured Researcher, CNRS	Supervisor
Stéphane BESSY	Tenured Researcher, LIRMM, Montpellier	Examinator
Victor CHEPOI	Prof. Université de la Mediterranée	Examinator
Ioan TODINCA	Prof. LIFO, Université d'Orléans	Examinator
Stéphane PERENNES	Research Director, CNRS	Guest

2003 - 2008 **M.Sc. in Mathematics**, Université Claude Bernard – Lyon I (France)

Prize

Flinders Hamiltonian Cycle Project Challenge (2016)

1001 instances of the HAMILTONIAN CYCLE PROBLEM were made available by the Flinders University (Australia) to be solved by researchers woldwide. Together with David Coudert (INRIA) we solved 985 of them and were ranked 1st in the competition.

Research Interests

I am interested by combinatorics at large, and I work gladly on anything with anybody who has a problem and genuinely wants to know the solution. When it comes to theory, my personal interest is for decomposition and structural properties of graphs and hypergraphs (e.g. characterize all structures avoiding a given pattern), or to prove the existence of such structures. I attack such problems both theoretically and experimentally. Additionally, I grow everyday more curious of the wonderful structures called Combinatorial Designs.

Software developpement – Sage

I use Sage (a general mathematics software) for research, and contributed to it anything I could possibly need from 2009 to 2016. I submitted 650+ patches and peer-reviewed 600+, and I was de facto in charge of code related to Graph Theory, Linear Programming and Combinatorial Designs. I also coauthored a book explaining the use of Sage to french undergraduate students.

Sage is written in **Python** and **Cython** (=Python+C), so that the most critical parts of the code can be pure C. I especially like to spend time on careful implementations of the most fundamental functions, trying to find the algorithm and data structures that will make them as **efficient and simple** as possible. Its graph library has a uniquely **wide scope**.

Graphs Theory: Sage can build 150+ named graphs or graph families of theoretical interest. It contains hundreds of graph functions representing the main concepts known to researchers, which includes exact solvers for NP-Hard problems. Several of its features are not available anywhere else in a public software, in particular recognition algorithms.

Linear Programming: Sage has its own interface with the most famous MILP solvers (GLPK, Coin-OR CBC, Gurobi, and CPLEX). It is its main tool to solve NP-Hard graph problems, and an extremely powerful way to solve the combinatorial problems that researchers meet daily.

`http://steinertriples.fr/ncohen/contributions`

Mathematical Databases

Combinatorial Designs and **Strongly Regular Graphs** are mathematical objects whose constructions are scattered across scientific literature. In two databases (integrated in Sage) I attempted to **gather** all known constructions, as well as to ensure the **reproducibility** of the constructions.

There databases are actually a combination of both pure data and recursive constructions based on them used in the litterature.

Combinatorial Designs	`https://goo.gl/IMRu5q`
Strongly Regular Graphs	`https://arxiv.org/abs/1601.00181`

Software development – Side projects

- I experiment and try to improve my skills in **Machine Learning**. In particular I work on **Neural Networks** with **TensorFlow** for my own purposes (speaker recognition) or for Kaggle competitions.
- **Parsing** of citation data contained in ArXiv scientific pdf papers. This is done through a combination of Python/Perl/Bash scripts. This endeavour necessitates to build several related databases on the way (journal names, different abbreviations, editors, etc...).
- `PDF_table_scraper` – a Python script to extract data stored as a table inside pdf files.
  This is useful for associations like *RegardsCitoyens* who strive to share **data of public interest** published by the french administration.
  `https://github.com/regardscitoyens/PDF_table_scraper`.
- `semantically_augmented_sage` – a draft of a connection between Sage and DBpedia.
  Indeed, some mathematical objects have an associated Wikipedia page (and thus a DBpedia entity), whose properties can be checked and used interactively, through SPARQL requests.
  `https://github.com/nathanncohen/semantically_augmented_sage`

Teaching

2016	Bash	3rd year
2011	Discrete Mathematics	3rd year
2010	Algorithms and introduction to Java	3rd year
2010	Games and strategies	1st year
2009	Introduction to UNIX	3rd year

Outline

I am used to (and love) abstractions from the theoretical world (mathematics and computer science) and I have experience with (and love) their most practical aspects when they are transformed into code. I want to find a position where my knowledge and work are put to good use, if possible in a collaborative environment.

- Languages: Python, Cython, C, Bash, LaTeX
- Tools: Everything that lives in a console (e.g. Git, Emacs, ...)
- Theoretical and pratical aspects of algorithms and data structures
- Enthusiastic, curious, helpful
- Used to public speaking
- Current interests as a developer:
  - Machine Learning (Neural Networks in particular)
  - Open Data
  - Semantic databases
  - Distributed Algorithms and Data Structures

Publications

Journals:

1. Nathann Cohen and Dmitrii V. Pasechnik. Implementing Brouwer's database of strongly regular graphs. *Designs, Codes and Cryptography (accepted)*. `http://arxiv.org/abs/1601.0018`

2. Jean-Alexandre Angles d'Auriac, Nathann Cohen, Sylvain Legay, Yannis Manoussakis, Abdelhakim El Maftouhia, and Ararat Harutyunyan. Connected tropical subgraphs in vertex-colored graphs. *Discrete Mathematics and Theoretical Computer Science (accepted)*

3. Nathann Cohen. A Doubling Construction for 3-Uniform Friendship Hypergraphs with the Universal Pairs Property. *Journal of Combinatorial Designs*, 24(7):336–339, July 2016

4. Jørgen Bang-Jensen, Nathann Cohen, and Frédéric Havet. Finding good 2-partitions of digraphs II. Enumerable properties. *Journal of Theoretical Computer Science (TCS)*, 640:1–19, August 2016

5. Valentin Borozan, Gerard Jennhwa Chang, Nathann Cohen, Shinya Fujita, Narayanan Narayanan N Narayanan, Reza Naserasr, and Petru Valicov. From Edge-Coloring to Strong Edge-Coloring. *Electronic Journal of Combinatorics*, 22(2):P2.9, April 2015

6. Nathann Cohen and Zsolt Tuza. Induced Decompositions of Highly Dense Graphs. *Journal of Graph Theory*, 78(2):97–107, January 2015

7. Nathann Cohen, David Coudert, and Aurélien Lancin. On computing the Gromov hyperbolicity. *ACM Journal on Experimental Algorithmics*, 20(1):18, 2015

8. Julio Araujo, Nathann Cohen, Susanna F. De Rezende, Frédéric Havet, and Phablo Moura. On the proper orientation number of bipartite graphs. *Journal of Theoretical Computer Science (TCS)*, 566:59–75, February 2015

9. Hosam Abdo, Nathann Cohen, and Darko Dimitrov. Graphs with maximal irregularity. *Filomat*, 28(7):1315–1322, December 2014

10. Vesna Andova, Nathann Cohen, and Ristě Skrekovski. A note on Zagreb indices inequality for trees and unicyclic graphs. *Ars Mathematica Contemporanea*, 5:73–76, November 2011

11. Nathann Cohen, David Coudert, Dorian Mazauric, Napoleao Nepomuceno, and Nicolas Nisse. Tradeoffs in process strategy games with application in the WDM reconfiguration problem. In Paola Boldi and Luisa Gargano, editors, *Fifth International conference on Fun with Algorithms (FUN 2010)*, volume 6099 of *Lecture Notes in Computer Science*, pages 121–132, Ischia, Italy, June 2010. Springer

12. Vesna Andova, Nathann Cohen, and Riste Skrekovski. Graph Classes (Dis)satisfying the Zagreb Indices Inequality. *MATCH Communications in Mathematical and in Computer Chemistry*, 65(3):647–658, 2011

13. Jean-Claude Bermond, Y.M Chee, Nathann Cohen, and X. Zhang. The α-Arboricity of Complete Uniform Hypergraphs. *Siam Journal on Discrete Mathematics*, 25(2):600–610, 2011

14. Nathann Cohen and Frederic Havet. Linear and 2-Frugal Choosability of Graphs of Small Maximum Average Degree. *Graphs and Combinatorics*, 27(6):831–849, 2011

15. Manu Basavaraju, L. Sunil Chandran, Nathann Cohen, Frederic Havet, and Tobias Müller. Acyclic edge-coloring of planar graphs. *Siam Journal on Discrete Mathematics*, 25(2):436–478, 2011

16. Nathann Cohen, Darko Dimitrov, Roi Krakovski, Riste Skrekovski, and Vida Vukašinović. On Wiener index of graphs and their line graphs. *MATCH Communications in Mathematical and in Computer Chemistry*, 64(3):683–698, 2010

17. Nathann Cohen, Fedor Fomin, Gregory Gutin, Eun Jung Kim, Saket Saurabh, and Anders Yeo. Algorithm for finding k-vertex out-trees and its application to k-internal out-branching problem. *Journal of Computer and System Sciences*, 76(7):650 – 662, January 2010

18. Nathann Cohen and Frédéric Havet. Planar graphs with maximum degree $\Delta \geq 9$ are $(\Delta + 1)$-edge-choosable – short proof. *Discrete Mathematics*, 310(21):3049–3051, 2010

19. Julio Araujo, Nathann Cohen, Frédéric Giroire, and Frederic Havet. Good edge-labelling of graphs. volume 35 of *Eletronic Notes in Discrete Mathematics*, pages 275–280, Gramado, Brazil, November 2009. Elsevier

Conferences:

1. Jean-Claude Bermond, Nathann Cohen, David Coudert, Dimitrios Letsios, Ioannis Milis, Stéphane Pérennes, and Vassilis Zissimopoulos. Bin packing with colocations. In *Workshop on Approximation and Online Algorithms 2016 (accepted)*, August 2016

2. Nathann Cohen, Mathieu Hilaire, Nicolas Martins, Nicolas Nisse, and Stéphane Pérennes. Spy-Game on graphs. In *8th International Conference on Fun with Algorithms, FUN 2016*, volume 49, 2016

3. Nathann Cohen, Daniel Gonçalves, Kim Eun Jung, Christophe Paul, Ignasi Sau, Dimitrios M. M. Thilikos, and Mathias Weller. A Polynomial-Time Algorithm for Outerplanar Diameter Improvement. In *International Computer Science Symposium in Russia - CRS*, volume 9139 of *Lecture Notes in Computer Science*, Irkutsk, Russia, 2015

4. Jean-Alexandre Angles d'Auriac, Nathann Cohen, Hakim Maftouhi, Ararat Harutyunyan, Sylvain Legay, and Yannis Manoussakis. Connected Tropical Subgraphs in Vertex-Colored Graphs. In *9th International colloquium on graph theory and combinatorics*, Grenoble, France, June 2014

5. Julio Araujo, Nathann Cohen, Susanna de Rezende, Frédéric Havet, and Phablo Moura. On the proper orientation number of bipartite graphs. In *9th International colloquium on graph theory and combinatorics*, Grenoble, France, June 2014

6. Nathann Cohen, David Coudert, and Aurélien Lancin. Algorithme exact et approché pour le calcul de l'hyperbolicité d'un graphe. In Nicolas Nisse, Franck Rousseau, and Yann Busnel, editors, *15èmes Rencontres Francophones sur les Aspects Algorithmiques des Télécommunications (AlgoTel)*, pages 1–4, Pornic, France, May 2013

7. Julio Araujo, Nathann Cohen, Frédéric Giroire, and Frederic Havet. Good edge-labelling of graphs. volume 35 of *Eletronic Notes in Discrete Mathematics*, pages 275–280, Gramado, Brazil, November 2009. Elsevier

8. Andrei Asinowski, Jean Cardinal, Nathann Cohen, Sébastien Collette, Thomas Hackl, Michael Hoffmann, Kolja Knauer, Stefan Langerman, Michal Lasoń, Piotr Micek, Guenter Rote, and Torsten Ueckerdt. Coloring Hypergraphs Induced by Dynamic Point Sets and Bottomless Rectangles. In *WADS 2013*, pages 73–84, Canada, August 2013

9. Nathann Cohen, David Coudert, Dorian Mazauric, Napoleao Nepomuceno, and Nicolas Nisse. Tradeoffs in process strategy games with application in the WDM reconfiguration problem. In Paola Boldi and Luisa Gargano, editors, *Fifth International conference on Fun with Algorithms (FUN 2010)*, volume 6099 of *Lecture Notes in Computer Science*, pages 121–132, Ischia, Italy, June 2010. Springer

10. Nathann Cohen, David Coudert, Dorian Mazauric, Napoleão Nepomuceno, and Nicolas Nisse. Tradeoffs in routing reconfiguration problems. In Maria Gradinariu Potop-Butucaru et Hervé Rivano, editor, *12èmes Rencontres Francophones sur les Aspects Algorithmiques de Télécommunications (AlgoTel)*, 2010

Books:

1. Alexandre Casamayou, Nathann Cohen, Guillaume Connan, Thierry Dumont, Laurent Fousse, Francois Maltey, Matthias Meulien, Marc Mezzarobba, Clément Pernet, Nicolas M. Thiéry, and Paul Zimmermann. *Calcul mathématique avec Sage*. CreateSpace, 2013. electronic version available under Creative Commons license