

Nathanaël Courant

Student – École Normale Supérieure

Education

- 2016–2018 **Computer science research master's degree (MPRI)**, *École Normale Supérieure*, Paris.
M1 research internship with Natarajan Shankar; M2 research internship with Xavier Leroy. Admitted with average mark 19.46/20, ranked 1st.
- 2015–2016 **Bachelor's degree**, *École Normale Supérieure*, Paris.
3rd year of Bachelor's degree in both computer science and mathematics. Research internship with Caterina Urban.
- 2013–2015 **"Classes préparatoires"**, *Lycée du Parc*, Lyon.
Preparation to national competitive exams to "Grandes Écoles". Mathematics, physics and computer science; equivalent to first two years of Bachelor's degree.
- 2013 **High school diploma**, *Lycée la Martinière Monplaisir*, Lyon.
Average mark: 17.7/20.

Publications

- 2017 **TACAS 2017**, Nathanaël Courant, Caterina Urban.
Precise Widening Operators for Proving Termination by Abstract Interpretation

Achievements

- 2015–2017 **ACM-ICPC SWERC (Southwestern Europe Regional Contest)**.
Team "ENS Ulm 1"; ranked 3rd in 2015, ranked 1st and selected for the 2017 world finals in 2016 (ranked 34th), ranked 1st and selected for the 2018 world finals in 2017 (ranked 56th).
- 2016 **Google Code Jam**.
Selected for the final round; ranked 18th.
- 2016 **Google Hash Code**.
Team "OCaml4Ever"; ranked 9th.
- 2015 **École Normale Supérieure (Paris) national competitive examination**.
Ranked 2nd; also ranked 1st on the entrance examinations of École Normale Supérieure of Lyon and Rennes, 6th at École Normale Supérieure of Cachan, and 7th at École Polytechnique.
- 2014–2016 **Prologin**.
Prologin is a French programming contest. Ranked 1st in 2016, 10th in 2015 and 4th in 2014.
- 2013 **International Mathematical Olympiad**.
Member of the French team. Was awarded a silver medal.

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2013 **Concours général des lycées (National competition).**
1st prize in physics and in engineering sciences, 2nd prize in mathematics.

Skills

Languages French (native language), English (fluent), German (intermediate).
Programming languages *In order of decreasing proficiency:* Python, OCaml, Coq, Lua, C/C++, and some experience with other languages, including: Scheme, x86-64 and ARM assembly, Forth.

Programming experience

Major projects

- A verified code generator for the polyhedral model, that generates an AST for scanning many polyhedra, written and proved in Coq.
- At the time of writing, solved all 641 project Euler problems.
- A compiler from a small purely functional language to C, including algebraic datatypes, algebraic effects with multi-shot continuations, a garbage collector, and a static type system that checks the effects.
- A verified code generator, from a small functional language to an imperative language, including proof of correctness of reference-counting and destructive updates, written and proved in PVS.
- A compiler from a subset of Scala to x86-64 assembly, written in OCaml.
- A netlist-to-C compiler and a CPU written in this netlist language. The compiler was written in OCaml, the CPU generated with Python.
- A minimalistic OS to boot a Raspberry Pi on, written in C, C++ and ARM assembly.
- Implementing a fully Forth-83-compliant system, written in Python and Forth.
- Proving the theorem of quadratic reciprocity using Coq.
- Core developer of Minetest, an open-source video game.

Other projects Minor school projects, coding some games when younger, ...

Theoretical knowledge

Computer science Compilation, semantics, typing, λ -calculus, linear logic, abstract interpretation, algorithms, computability, complexity, category theory, machine learning, convex optimization, and cryptography.
Mathematics Measure theory, basic algebra, topology, complex analysis, probabilities.