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Soham Chowdhury

Background

- 2018– **B.Sc. (Hons) in Mathematics**, *Scottish Church College*, Kolkata.
- 2017 **Selected to attend “Modern Mathematics” International Summer School 2017**, *Jacobs University*, Bremen, Germany.
Did not attend owing to an overlap with other academic commitments.
- 2016 **Canada/USA Mathcamp**, Colby College, Waterville, ME.
Attended a six-week summer program on a full merit scholarship.
- Wrote an **expository paper** under my academic advisor David Roe, presenting the results of Artin–Whaples 1945, “Axiomatic characterization of fields by the product formula for valuations”, on the number-theoretic analogy between number fields and function fields.
 - Took classes on, among other topics,
 - algebraic number theory
 - analytic number theory
 - elliptic curves
 - algebraic topology
 - homotopy limits
- 2015 **Selected to attend Hampshire College Summer Studies in Mathematics**, *Hampshire College*, Amherst, MA.
Did not attend.

Academic interests

- Analogies between number theory and geometry
- Analogies between logic, computation, and categories
- Number theory
- Algebraic and arithmetic geometry
- Algebraic topology
- Category theory and homotopical algebra
- Expressive type systems and program correctness
- Development of interpreters and optimising compilers for functional programming languages

Languages

English Fluent

Bengali Fluent

Hindi Fluent

German Conversational

Soham Chowdhury: other information

January 30, 2019

Relevant background

1. Basic category theory, at the level of the most of Mac Lane’s *Categories for the Working Mathematician*. Yoneda, (co)limits, adjunctions, monads, monoidal categories, abelian categories, diagram-chasing, (snake, four, five)-lemmas, and string diagrams.
2. For *Partial evaluations, the bar construction, and second-order stochastic dominance*: experience writing interpreters and implementations of type systems, practical familiarity with implementing small- and big-step evaluation rules, and experience with metaprogramming in Haskell and Emacs Lisp.
3. For *Traversal optics and profunctors*: proficiency in the programming language Haskell, experience using the Haskell `lens` library, experience developing an in-progress pedagogical reimplement of it¹, and basic familiarity with the theoretical and implementation-level underpinnings of both van Laarhoven and profunctor optics.
4. abstract algebra at the level of Artin’s *Algebra* or Aluffi’s *Algebra: Chapter 0*, including Galois theory; basic homological algebra
5. commutative algebra at the level of the first few chapters of Atiyah–Macdonald’s *Introduction to Commutative Algebra*
6. experience with mathematical writing and exposition, in the form of an expository paper² in number theory presenting the results of Artin and Whaples (“Axiomatic characterization of fields by the product formula for valuations”, 1945) on the number-theoretic analogy between number fields and function fields

Order of project preference

From most to least preferred:

1. Simplifying quantum circuits using the ZX-calculus
2. Toward a mathematical foundation for autopoiesis
3. Complexity classes, computation, and Turing categories
4. Traversal optics and profunctors

¹<https://github.com/mrknao/silica>

²<https://github.com/mrknao/nf-ff/raw/master/main.pdf>

5. Partial evaluations, the bar construction, and second-order stochastic dominance
6. Formal and experimental methods to reason about dialogue and discourse using categorical models of vector spaces

Ability to commit to attending

I will require financial aid for travel and cannot commit to coming to Oxford otherwise.

Why the ACT2019 School interests me

The work that excites me the most occurs at the intersection of apparently unrelated fields, often with category theory serving as a bridge between different worlds. The “project” of the emerging field of applied category theory agrees with this interest, and the ACT2019 School offers me the chance to not only observe such work being done, but to participate in it myself as a researcher working with experts on topics I find it stimulating to think about, and on questions that may inspire further work of my own.

My introduction to pure mathematics consisted of me finding myself led to group theory (through my interest in solving Rubik’s cubes in the fewest moves possible) and categories (through my interest in the categorical underpinnings of how the programming language Haskell improved upon “imperative” control structures). Since then, I’ve gravitated towards certain parts of mainstream pure mathematics, broadly centered around number theory and categories, I’ve always made sure to maintain an interest in (how my studies relate to) logic, applied mathematics, functional programming, physics, economics, and philosophy and the sciences more generally. Many things I have taken an academic interest in since have vindicated this decision: my experience reading type theory papers and implementing type systems in Haskell, for instance, provide motivation for type-theoretic parts of topos theory, which I came to as a student of algebraic geometry looking to understand sheaves. As someone who would like to go on to a career in research, I’m excited to pick up more influences of this nature that can open my eyes to unfamiliar, productive viewpoints on mathematical and scientific topics I am interested in working in.

I’m also looking forward to meeting and working alongside peers with similar goals of becoming categorically-minded generalists who, as was said of algebraic geometers by Mumford, “secretly [plot] to take over the rest of mathematics”, and perhaps also to go on to the rest of the sciences and as many of the other arenas of human endeavour as they can.



To Whom it may Concern

It is my pleasure to recommend Soham Chowdhury unreservedly for the Applied Category Theory 2019 School to be held at the University of Oxford.

Soham is presently a student of B. Sc. Second year with Honours in Mathematics at the Department of Mathematics, Scottish Church College, Kolkata. I know Soham for about a year and a half as a student in my Department. He has always been a motivated student with a clear interest in mathematics and science and a drive to understand things clearly. His participation in lectures has always struck me as being singularly earnest, and he often raises thought-provoking questions that demonstrate the depth to which he engages with the material and creates his own directions of inquiry within the topic.

Soham intends to pursue an academic career in Mathematics after his undergraduate education. I strongly believe that academic experiences of this nature are important in broadening the scope of what a bright young student thinks about, and is important if they are to produce high-quality work of their own later. The ACT2019 School will also give him the chance to explore some areas which are not a part of his undergraduate curriculum (for example category theory, type theory, and logic) in greater depth than independent study alone can provide. He will benefit both personally, as a student of mathematics seeking to expand his knowledge, and professionally as a prospective researcher gaining early research experience as an undergraduate working on advanced topics under a world-class mentor.

I am confident Soham would do very well as a participant in the ACT2019 School, and am happy to recommend him strongly for the School.

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