Gmail **Applied Category Theory <act2019school@gmail.com>**

Recommendation for Nathan Bedell

1 message

Mislove, Michael W <mislove@tulane.edu> Mon, Jan 28, 2019 at 9:56 AM
To: "act2019school@gmail.com" <act2019school@gmail.com>
Cc: "Mislove, Michael W" <mislove@tulane.edu>

To Whom it May Concern:

I am writing to support the application of Nathan Bedell to participate in the 2019 Applied Category Theory School. Nathan is a second year mathematics PhD student here at Tulane. Nathan came to Tulane with a strong background in category theory, and as been developing a substantial Masters thesis on the subject of graded categories. This is largely original work on his part - he has been working on this on his own, coming to me only for comments about his results and suggestions of additional ideas to consider. He came to us with a more advanced knowledge of category theory than any entering PhD student I can recall, and he has shown himself to be an independent researcher capable of formulating and deriving interesting results. The ACT School is clearly directly related to his research interests - there are many areas of category theory with which I am unfamiliar, and it will be important for Nathan to have an opportunity to be exposed to lectures on advanced topics. I recommend him to you in the highest terms.

Thanks, and best regards,
Mike Mislove

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Nathan Bedell
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To the organizers of the 2019 ACT school:

I am currently a Ph.D. student in mathematics at Tulane University, with an expected graduation date of Spring 2022. As part of the program, I am also working on a M.S. in mathematics, which I plan on completing this Spring, with a thesis entitled "Graded and Dynamic Categories". In this work, I study the theory of categories where the morphisms all carry a "grade" coming from a poset, and where functors (in a sense which I make precise in my thesis) weakly preserve the grades. Some of the applications of this theory are in the semantics of functional programming programming languages with security annotations (such as in the experimental language Granule). This framework can also be viewed, perhaps more speculatively, as a way of studying "dynamic categories" – that is, categories that vary over time, or some other parameter (and thus may be thought of as sort of categorified Kripke frames).

Much of the hope of this work of mine, which I hope to expound upon in my Ph.D. thesis, revolves around the further applications of graded categories. If categories can be viewed as a collection of structures (objects) whose properties can be understood solely through their relationships with other other objects via the morphisms in the category, the theory of graded categories is intended to be a general approach to applying the same philosophy to *evolving* structures. Thus, it is not difficult to imagine applications of this framework to biology, economics, or even linguistics, where one often deals with such structures. And thus, I am interested in attending the 2019 ACT school, because it will give me the opportunity to get a taste of the field of applied category theory, so that I might learn from some of the techniques of established researchers in the field, and apply them to my own research goals.

Thus, while I would like to work on any of the listed projects at the ACT school, in terms of my own personal interests, and the relevance to my own research, the topics that stood out to me the most are the following:

1. Partial evaluations, the bar construction, and second-order stochastic dominance
2. Complexity classes, computation, and Turing categories
3. Formal and experimental methods to reason about dialogue and discourse using categorical models of vector spaces
4. Traversal optics and profunctors

In terms of the dates listed, I am 100% confident that I could attend the Oxford portion of the program if accepted. The only potential issue would be with funding – but if there is not sufficient funding for the program itself, I do have other funding that I could potentially make use of from both my adviser and my department.

Thank you for your consideration, and I look forward to hearing from you.
– Nathan Bedell

Nathan BeDell – nbedell@tulane.edu

Education and Employment:

1. **Liberty University**, 2013 – 2016.
   Graduated magna cum laude with a B.S. of Mathematics and a minor in Computer Science.
2. **Augusta University**, Jun. – Aug. 2018.
   Research assistant, Department of Computer Science.
3. **Tulane University**, 2017 –
   Ph.D. student in Mathematics.

Research:

1. **Graded and Dynamic Categories**, Master's thesis, in preparation.
2. **A Categorical Analysis of Graded Type Theory**, with Harley Eades III, in preparation.
3. **On Absolute and Relative Notions**, in preparation.
4. **Doing Logarithms over an Associative Algebra**, ArXiV preprint.
5. **Introduction to the Theory of A-ODEs**, with James S. Cook, in preparation.

Talks given:

1. 2017 Joint Mathematics Meeting, "Logarithms over a Real Associative Algebra."
2. 2017 Category Theory Oktoberfest, "Category Theory and Cardinality," at Carnegie Mellon University.

Teaching/Seminars

1. Participated in the Category and Categorical Logic Seminar, Fall 2017, Tulane University.
2. Participated in and co-organized the Applied Category Theory Seminar, Summer 2018, Augusta University.
3. TA for Consolidated Calculus, Fall 2017, Tulane University.
4. TA for Calculus I, Spring 2018 and Fall 2019, Tulane University.