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Adjoint School, ACT 2019: Application
1 message

Cole Robert Comfort <crcomfor@ucalgary.ca>   Mon, Jan 28, 2019 at 10:03 PM
To: "act2019school@gmail.com" <act2019school@gmail.com>

Hello,

I am writing to apply for the Applied Category Theory 2019 adjoint school. I have attached my CV as a pdf and all of the other relevant information is included in the body of this email. A letter of reference on behalf of my supervisor is forthcoming.

- I am currently Dr. Robin Cockett's student, so naturally, I have taken his course in category theory. I am specifically interested in modelling the categorical semantics of computing using monoidal categories. I have previously classified categories of classical reversible circuits, and I am interested in relating this work to quantum computing via the ZX-calculus.

- I expect to finish my masters degree by April 2019.

  In my thesis, I give complete sets of relations and concrete equivalences for two symmetric monoidal categories generated by reversible logic gates and fixed inputs and postselected measurements in the computational basis.

- I would strongly prefer to participate in the project, "Simplifying quantum circuits using the ZX-calculus."

  My second choice would be the project, "Complexity classes, computation, and Turing categories."

- I would not be able to attend unless I receive full funding.

I would like to attend this adjoint school because of the particular relevance of the ZX-calculus, and its recent developments, to my research.

I have proven various completeness results regarding classical reversible circuits. In particular, I provided a complete set of identities for the symmetric monoidal category generated by the Toffoli gate and state preparation and post-selection in the computational basis; as well as proving that this category is equivalent to the category of partial isomorphims between powers of the two element set. I proved similar results for the controlled-not gate. I want to continue my research on the categorical semantics of circuits in the natural direction of quantum computing.

As you know, the various fragments of the ZX-calculus, and its close relatives, have recently enjoyed many completeness results and simplification techniques. These advances are particularly interesting to me, and I am excited to learn more about them; and

moreover, contribute to this programme.

I am currently in the process of finishing my masters thesis, and I am trying to extend the classically reversible calculi from my previous work to different fragments of the ZX-calculus. I am particularly interested in exploring how the inverse-category structure embedded within the complimentary classical structures of the ZX-calculus can be used to optimise circuits.

I believe that the relevance of my previous research and its relative separation from the ZX-calculus community would be an asset in this adjoint school.

This school would benefit my career because it would foster international collaboration with similarly-minded researchers.

Thank you for considering me for the adjoint school,
Cole Comfort

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CURRICULUM VITÆ – COLE COMFORT

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PERSONAL INFORMATION

Full Name:	Cole Robert Comfort
Home Address:	56 Simcoe Pl SW Calgary, Alberta T3H 4T8 Canada
Work Address:	ICT Room 618A 856 Campus Pl NW Calgary, Alberta T2N 4V8 Canada
Phone:	+1 403 804 3948
Email:	crcomfor@ucalgary.ca

EDUCATION

Thesis Based Master of Science, Computer Science *September 2017–June 2019 (expected)*

University of Calgary, Alberta, Canada
Supervisor: Dr. Robin Cockett
Expected GPA: 4.000/4.000

Bachelor of Science (Honours) First Class, Computer Science *September 2013–June 2017*

University of Calgary, Alberta, Canada
Minor: Pure Mathematics
Concentration: Algorithms and Complexity Theory
Supervisor: Dr. Robin Cockett, Thesis Title: *The Category CNOT*
GPA Received: 3.735/4.000

RESEARCH INTERESTS

Interested in category theory, quantum computing, quantum foundations, and their intesection: categorical quantum mechanics.

EMPLOYMENT

Research Assistant *September 2017–ongoing*

Department of Computer Science, University of Calgary, Alberta, Canada

RESEARCH FUNDING

Mitacs Globalink Research Award *September 2018-December 2018*

Project Title: Investigating Infinite Dimensional Models of Quantum Computation

Visited the University of Oxford From September 1st to November 30th, 2018 under the supervision of Dr. Bob Coecke.

Visited the University of Edinburgh From December 1st to 14th, 2018 under the supervision of Dr. Chris Heunen.

Queen Elizabeth II Graduate (Master's) Research Scholarship, 2018. Government of Alberta

Project Title: Identifying Quantum Circuits Generated by the Toffoli Gate

Queen Elizabeth II Graduate (Master's) Scholarship, 2017. Government of Alberta

Graduate Research Award, two units, 2017–2018. University of Calgary

TEACHING ACTIVITIES

Teaching Assistant   *Winter Term 2019*
Department of Computer Science, University of Calgary, Alberta, Canada
Course: CPSC 313, Introduction to Computability

Teaching Assistant   *Winter Term 2018*
Department of Computer Science, University of Calgary, Alberta, Canada
Course: CPSC 411, Compiler Construction

Teaching Assistant   *Fall Term 2017*
Department of Computer Science, University of Calgary, Alberta, Canada
Course: CPSC 521, Foundations of Functional Programming

PRESENTATIONS

The category TOF. 15th International Conference on Quantum Physics and Logic. Halifax, Canada. June 2018.

The category TOF. 26th Foundational Methods in Computer Science Workshop. Mount Allison, Canada. May 2018.

The Category CNOT. 14th International Conference on Quantum Physics and Logic. Nijmegen, Netherlands. July 2017.

The Category CNOT. 25th Foundational Methods in Computer Science Workshop. Ottawa, Canada. June 2017.

The Category CNOT. Calgary Applied and Industrial Mathematical Sciences Conference. Calgary, Canada. May 2017

PUBLICATIONS (ALPHABETICAL ORDER OF AUTHORSHIP)

Conference Publications:

Cockett R, Comfort C, **The category TOF.** To appear in the *Proceedings of the 15th International Conference on Quantum Physics and Logic*, Halifax, June 2018. Edited by Selinger P, Chiribella G. Available at: `http://eptcs.web.cse.unsw.edu.au/paper.cgi?QPL2018:54`.

Cockett R, Comfort C, Srinivasan P, **The Category CNOT.** In the *Proceedings of the 14th International Conference on Quantum Physics and Logic*, Nijmegen, July 2017. p. 258–293, Electronic Proceedings in Theoretical Computer Science. Edited by Coecke B, Kissinger A. Available at: `doi:10.4204/EPTCS.266.18`.

Preprints:

Cockett R, Comfort C, Srinivasan P, **Dagger linear logic for categorical quantum mechanics.** ArXiv preprint. September 2018. Available at: `https://arxiv.org/abs/1809.00275`.

Gmail

Applied Category Theory <act2019school@gmail.com>

Supporting letter for Cole Comfort

1 message

Robin Cockett <robin@ucalgary.ca>
To: "act2019school@gmail.com" <act2019school@gmail.com>
Cc: Cole Robert Comfort <crcomfor@ucalgary.ca>

Tue, Jan 29, 2019 at 7:34 PM

Dear all at ACT2019,

Cole is a valued MSc. student of mine at the university of Calgary whose area of interest is Category Theory and, in particular, Categorical Quantum Mechanics. He has already made a couple of contributions to this latter field (determining the reversible identities for CNOT and TOFFOLI).

I believe Cole intends to continue to do a PhD. (probably not in Calgary!) and he is particularly interested in the more applied areas of category theory. Thus, the chance to attend the ACT2019 school is very well-suited to his aspirations and he is well-prepared for it as he has been exposed -- and has used -- basic category theory. Furthermore, he already knows the ZX-calculus.

I highly recommend him to you.

-robin

(Robin Cockett
 Computer Science
 University of Calgary)