Letter of recommendation for Lachlan McPheat to attend ACT 2019.

Dear Organisers,

I am writing to express my strongest support of Lachlan McPheat's application to attend ACT 2019, in Oxford.

Lachlan's Background:
Lachlan is applying to do his PhD, starting September 2019, under my supervision in the School of Electronic Engineering and Computer Science, Queen Mary University of London. He has done an undergraduate degree in Maths in the University of Edinburgh, where he got a distinction and took courses from people known to the school, such as Tom Leinster. He then did a Part III Maths Masters degree in Cambridge University from which he has recently successfully graduated. We have just recommended him for a Turing Scholarship and a school scholarship, and he is applying for a Swedish Academy of Sciences scholarship.

Relevance of ACT to Lachlan's Career and Research Expertise:
Lachlan is a young talented and passionate student, with excellent background in mathematics and willingness to apply his formal knowledge to Natural Language Processing. He is in particular very fond of applied category theory and wants to use it to extend the categorial models of compositional distributional semantics, developed by Clark, Coecke, and myself. These models use the theory of categories to introduce grammatical structure into vector space models of word meaning. The latter are common NLP tools that model contextual meaning in large quantities of textual data. Our models extend the vector representations of words to tensors, such as matrices for adjectives, cubes and hypercubes for intransitive and transitive verbs, but they fall short when it comes to modelling dialogue interactions and the naturally occurring data that comes from it. Lachlan wants to work in this area and I am teaching a course in ACT 2019 on this exact topic. Furthermore, I believe Lachlan can use this opportunity to extend his applied categorical knowledge to autopoiesis via David Spivak's course and to quantum computation via Miriam Backens's course, both of which are relevant to the subject of his PhD topic and his research interests. I also think he will enjoy and learn a lot from interactions with other lectures and students of the school. I can but offer my strongest support of his application.

Please do not hesitate to contact me if further information is required.

Sincerely Yours,

Dr. Mehrnoosh Sadrzadeh,
mehrnoosh.sadrzadeh@qmul.ac.uk
24th of January 2019,
London, UK.

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ACT2019 School Application

Lachlan McPheat

Academic background:

My background in category theory begins with a frustration of having to be lectured more than three sets of isomorphism theorems. I read Tom Leinster's *Basic Category Theory* in an attempt to understand abelian categories to just learn these theorems once. This happened during my penultimate year of my undergraduate degree in mathematics at Edinburgh University, and since then I have studied Part III of the mathematical tripos at Cambridge University where I took Peter Johnstone's course in Category Theory. Since graduating from Cambridge I have taken an interest in applied category theory, in particular the research coming from the Oxford Quantum Group (mainly in natural language processing and quantum informatics). I am now applying for a PhD in Natural Language Processing with Dr Mehrnoosh Sadrzadeh, who recommended I apply for a place at this school.

PhD timeline and summary:

I have yet to start my PhD, but if all goes to plan it should be finished in the summer of 2023. My PhD will investigate compositionality in vector models of sentence and dialogue data, and then compare these to Deep Neural Network models of sentence and dialogue data.

Project preferences:

1) Sadrzadeh
2) Spivak
3) Fritz
4) Milewski
5) Hofstra
6) Backens

I will easily be able to commit to coming to Oxford.

CV Lachlan McPheat

lachlanmcp@gmail.com • +44 (0) 744 6767 196 • Dual Swedish and Australian citizenship

Education

2017 - 2018

University of Cambridge, UK
MASt Pure Mathematics (aka "Part III mathematics")
Studied pure algebra, representation theory and category theory. Wrote an essay on algebraic deformation theory (described below).

2013 - 2017

University of Edinburgh, UK
BSc (Hons) Mathematics 1:1
Studied pure and applied mathematics (notable topics covered: statistics, numerical methods, image processing, group theory, representation theory, algebraic geometry, measure theory, differential equations). Also took courses in functional programming, logic, physics, Danish and Arabic.

2015 - 2016

University of Sydney, Australia
(International Exchange Programme)

2009 - 2012

International English Gymnasium on Södermalm (IEGS), Stockholm
Natural Sciences Program 18,5/20 GPA

Research Experience

2017 - 2018

Deformations of Algebras (mark: 75/100, quality mark: $\alpha-$)
Essay contributing to my masters, supervised by Dr Chris Brookes
University of Cambridge
Literature review on algebraic deformation theory - presenting elementary connections between homological algebra and deformation theory.

2016 - 2017

The Cremona Group (mark: 85/100)
Bachelor's thesis supervised by professor Ivan Cheltsov
University of Edinburgh
A collaboratively written thesis investigating the structure of the group of (bi)rational automorphisms of the complex projective plane, sketched the proof of Noether's factorisation theorem and developed scripts in Maple to demonstrate it in practice.

Summer 2016

London Mathematical Society Summer School in Canterbury
2 week workshop introducing the top penultimate year mathematics undergraduates in the UK to current research trends and topics in mathematics.
My place at the school was funded by Edinburgh University and London Mathematical Society.

2015 - 2016

Essential Surfaces in Knot Complements
School of Mathematics Vacation Scholarship funded project
Supervised by Prof. Stephan Tillmann
University of Sydney
Worked in a group research project investigating algorithms in knot theory using Python-based language Regina and algebraic topology.

Merits

Award

University of Edinburgh
William and Isabella Dick prize for distinguished performance in examinations taken in mathematics in the 2014-15 academic year.

National level swimmer

SK Neptun, Stockholm
University of Edinburgh Performance Swim Team, Edinburgh
Competed at a Swedish national level during 2009 - 2013. Placed 4th in the 2013 Swedish junior national championships.
Represented Edinburgh University at British University and College Sports cup (BUCS) in Sheffield 2013.

Skills

Programming

3+ years experience: Matlab, Mathematica, Maple
1-2 years experience: GAP, Python, Haskell

Languages

- Native languages: Swedish and English
- Proficient: Spanish, Danish, Norwegian
- Basic proficiency: Japanese, German, Icelandic

Other Experience

Model

Cambridge University Charity Fashion Show, Cambridge
2017 - 2018
Supported the charity A21 through a fashion show organised by students at Cambridge University with collections from young British designers.

WWOOF
(Willing Workers On Organic Farms)

Awaroa Organic Vineyard, Waiheke Island, New Zealand
September - October 2018
Volunteered in various roles in the vineyard, including cleaning, racking and tasting.

Internship

Come on Out Japan, Tokyo
Summer 2018
Responsible for providing a safe environment to encourage Japanese high school students to practice their spoken English via discussions and presentations on global citizenship and study abroad.

Mathematics Tutor

Mathematics Peer Assisted Learning Scheme, University of Edinburgh
Academic years 2014-15 and 2016-17
Responsible for helping first year students solve problems in introductory linear algebra and calculus via facilitation and collaboration.

Conflict Mediator

Sydney University Student Housing Cooperative, Australia
2015 - 2016
Took the role of an impartial third party to help solve interpersonal conflicts within the cooperative. Helped determine room allocation for long term members in the cooperative.

Assistant Manager

Bonne Mécanique cykeldepå, Stockholm
Summers 2014, 2015
Helped the founders of Bonne Mécanique establish their café. Responsible for pricing and sourcing items of the menu and service.

Catering Team Leader

Edinburgh University Student Association, Edinburgh
2016 - 2017
Managed a team of 10 catering team members during the Edinburgh Fringe festival and smaller teams otherwise. Responsible for quality control of service and correct handling of transactions.

Catering Team Member

Edinburgh University Student Association, Edinburgh
2014 - 2015
Served hot and cold food and beverages in multiple licensed venues across Edinburgh.

ACT2019 School Application

Statement of interest

Lachlan McPheat

To whom it may concern,

I would like to participate in the ACT2019 school to further my passion for category theory, however there are also some more practical reasons for why I wish to participate. The most important one being that Mehrnoosh Sadrzadeh's proposed project for the school is exactly where my proposed PhD project with Mehrnoosh will begin. Studying for this project alongside others would give me a well-rounded foundation to build on in my PhD.

Another practical reason for my participation is that I have a knowledge gap between mathematics and computer science. My academic background is almost exclusively in pure mathematics, hence participating in Mehrnoosh's project alongside people with more diverse backgrounds would let me bridge this gap. Hopefully I could do the same for participants with a weaker mathematical background. Specifically, it is mentioned in the project description that we aim to "experiment" and "create toy models", which I need and want to do, but have not yet done, in a computer scientific setting.

As I hope to research using category theory in my career, the ACT2019 school would be a great opportunity to establish a professional network in this field. My professional network at the moment consists of algebraists and logicians, so this school would be a great chance for me to meet and work alongside people with complementary backgrounds to my own, and thus broaden my professional network.

In summary, I ought to participate in the ACT2019 school since Mehrnoosh's proposed project is identical to the start of my PhD, and because my background is purely mathematical and so I need exposure to computer science - just as there will be computer scientists at the ACT2019 school needing more mathematical discourse, which I would happily provide.

Yours sincerely,
Lachlan