Jessica Ryan

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Research Interests

My main research interests are in **algorithmic graph theory** and **computational complexity**, with a particular focus on parameterised complexity and problems with real-word applications. I am also interested in graph matching problems and graph theory more generally.

For my PhD project, I am developing efficient algorithms for analysing **multi-layered networks**. Multi-layered networks allow us to model different kinds of relationships between entities, or relationships that exist at different points in time. Indeed, most real world networks are inherently multi-layered. In the past, multi-layer networks have typically been analysed by ignoring these different kinds of connections, or by considering each type of connection in a separate network. A major advantage of this approach is that there exist efficient algorithms for answering various questions about single-layer networks. Many similar questions about multi-layer networks are known to be NP-hard. However, analysing the system as a multi-layer network gives us a richer and more precise representation of the data, leading to more accurate analyses.

I am developing *parameterised algorithms* for studying multi-layer networks. That is, for a given NP-hard problem, I develop algorithms which perform efficiently on multi-layer networks with specific structural properties. This approach is known as *parameterised complexity*. An algorithm which is efficient for fixed values of some parameter of the input is called a *fixed-parameter tractable (FPT) algorithm*.

Awards and Scholarships

- Won the annual Haya Freedman Prize for the best dissertation produced by a student on the MSc in Applicable Mathematics at the London School of Economics from a cohort of 31 students.
- o Awarded a **PhD Studentship** (£56244) by the Engineering and Physical Sciences Research Council (EPSRC).
- o Successfully applied for a **Travel Scholarship** (\$900) from TCS Women to attend the 50th Annual ACM Symposium on the Theory of Computing (STOC 2018) in Los Angeles, California.
- o Obtained **funding from the Sigma Network** (£2400) in 2015 to develop online mathematics revision resources for economics undergraduate students after proposing the idea to Newcastle University's E-Learning Unit.
- o Secured a **Vacation Research Scholarship** (£1456) from Newcastle University to work on a mathematical modelling research project during the summer of 2014.

Education

PhD in Computer Science

University of Glasgow 2017 – 2020

Award: EPSRC PhD Scholarship

Thesis Title: Parameterised Algorithms for Edge-Coloured Graphs

Supervisors: Dr Kitty Meeks and Prof. David Manlove

MSc in Applicable Mathematics - Graduated with Distinction

London School of Economics and Political Science 2015 – 2016

Award: Haya Freedman Prize for the best dissertation in mathematics

Thesis Title: Covering Edge-Coloured Graphs by Monochromatic Paths and Cycles

BSc (Hons) in Economics and Mathematics

Newcastle University 2012 – 2015

Award: Newcastle University Vacation Research Scholarship

Technology Summary

Coding: Java, T-SQL

o Environments: Windows, Linux, Microsoft SQL Server

Presentations

Random Graphs and Random Processes workshop

Subgraph Counting in Practice

King's College London

9th April 2019

STOC 2018 Los Angeles, California

25 - 29 June 2018 Subgraph Counting in Practice (Poster)

25th Postgraduate Combinatorial Conference **London School of Economics**

Partitioning edge-coloured graphs into monochromatic subgraphs 4 - 6 June 2018

2018 Colloquia in Combinatorics London

Counting Subgraphs Efficiently (Poster) 8 - 9 May 2018

University of Glasgow **FATA Research Seminar** Counting Subgraphs Efficiently 10th April 2018

CETL-MSOR Conference 2015 University of Greenwich, London

Online Maths Revision Resources for Economics Students 8 - 9 September 2015

Academic Events Attended

AlgoUK Workshop, Liverpool University (September 2018)

- One-Day Meeting in Combinatorics, University of Oxford (May 2018)
- o Glasgow Workshop on Mechanism Design and Behavioural Economics, University of Glasgow (May 2018)
- Scottish Combinatorics Meeting 2018, University of Edinburgh (April 2018)
- o AlgoUK Workshop, King's College London (February 2018)
- MATCH-UP 2017, Microsoft Research New England (April 2017)

Employment

University of Glasgow Glasgow, UK Course Demonstrator January - May 2019

o Assist in lab demonstration classes for Algorithms and Data Structures master's degree course.

CoderDojo Glasgow, UK

October 2018 - present Coding Teacher

Inspire and encourage children to learn to code.

o Organise and teach coding sessions in Scratch, Java, Python and HTML.

Inform Information Systems Limited Maidenhead

Software Developer o Implemented multiple software systems from planning and design phase through

to post go live with a strict deadline.

- O Developed the company's first automated software test scripts.
- o Taught colleagues how to write automated test scripts in Java.
- Created an automated email alert system for monitoring SQL Server job failures.

Newcastle University Newcastle June - September 2015

Mathematics and Statistics Summer Internship

 Awarded funding to develop online mathematics revision resources for economics undergraduate students after proposing the idea to the university's E-Learning Unit.

Newcastle University Newcastle

Mathematics and Statistics Summer Research Internship June - August 2014

Obtained funding to work on a mathematical modelling research project.

February - October 2017