Job Description

<table>
<thead>
<tr>
<th>Job title</th>
<th>Postdoctoral Researcher in Probability</th>
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<tbody>
<tr>
<td>Division</td>
<td>Mathematical, Physical and Life Sciences</td>
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<tr>
<td>Department</td>
<td>Statistics</td>
</tr>
<tr>
<td>Location</td>
<td>24-29 St Giles’, Oxford OX1 3LB</td>
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<tr>
<td>Grade and salary</td>
<td>Grade 7: £32,817 - £40,322 per annum</td>
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<tr>
<td>Hours</td>
<td>Full time</td>
</tr>
<tr>
<td>Contract type</td>
<td>1 year fixed term</td>
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<tr>
<td>Reporting to</td>
<td>Prof Christina Goldschmidt</td>
</tr>
<tr>
<td>Vacancy reference</td>
<td>144954</td>
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<tr>
<td>Additional information</td>
<td>The start date is flexible, but must be no later than September 2020</td>
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<tr>
<th>Research topic</th>
<th>Random graphs and their scaling limits</th>
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<tbody>
<tr>
<td>Principal Investigator / supervisor</td>
<td>Prof Christina Goldschmidt</td>
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<tr>
<td>Funding partner</td>
<td>The funds supporting this research project are provided by the EPSRC</td>
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</table>

The role

We invite applications for a postdoctoral researcher in probability, specifically to work on random graphs and their scaling limits, as part of an EPSRC Fellowship awarded to Professor Christina Goldschmidt.

The project

The study of random graphs is a well-established field at the interface between probability and combinatorics, with motivation coming not only from real-world modelling of networks, but also from problems in statistical physics and computer science. The theory of scaling limits for these
objects started to develop in the early 1990’s with the introduction of the Brownian continuum random tree by Aldous. This prototypical random R-tree is now known to be the universal scaling limit of a broad family of roughly “uniform-like” random trees. In recent years, there has been a concerted effort to understand the scaling limits of many naturally occurring models of random trees and graphs, including random planar maps. One such result concerns the Erdős-Rényi random graph at the point of the phase transition for the emergence of the giant component, and is the jumping-off point for several of the directions to be explored within the project. Here the scaling limit is a collection of random R-trees (whose law is absolutely continuous with respect to that of the Brownian continuum random tree) in each of which a (random) finite number of vertex-identifications has been made (thereby creating cycles).

The interplay between the discrete random objects and their continuous counterparts in this domain has led to some beautiful mathematics. The scaling limits are themselves fascinating objects: for example, many of them are random fractals, possessing powerful distributional symmetries.

The purpose of this project is to investigate fine properties of various random tree and graph models, to prove new scaling limit results, and to obtain a deeper understanding of existing scaling limit objects. A range of possible directions for the postdoctoral researcher’s work include the following.

1. The scaling limit of the critical Erdős-Rényi random graph is universal, in the sense that there is a family of other critical random graphs for which the same limit holds (up to constant scaling factors). What is the extent of this universality?
2. Outside the universality class of the Erdős-Rényi model, other critical behaviours (often characterised by power-law degree distributions) have recently been investigated, resulting in new scaling limits, but much remains to be understood.
3. Study the critical behaviour of various models of directed random graphs.
4. What are the possible critical behaviours of less standard models of random graphs, for example those generated by Achlioptas processes for a range of rules?
5. Building on the results on the scaling limit of the critical Erdős-Rényi random graph, it is possible to prove a scaling limit for the minimum spanning tree (MST) of the complete graph with i.i.d. random edge-weights. It is natural to conjecture that this result should also be universal.
6. Relatively little is known about the MST scaling limit: it is a binary random R-tree with Minkowski dimension 3 almost surely. Can we characterise its distribution?
7. What are the properties of weighted random trees sampled according to Gibbs-type distributions which interpolate between a uniform random tree and the MST? What are their local limits, or scaling limits?
8. For various models of random R-trees, which stochastic operations leave their laws unchanged?

There is ample scope within the project for the postdoctoral researcher to develop an individual focus according to his or her own research interests and experience.
Responsibilities

The post-holder will be expected to:

• Conduct original research in the area of the project.
• Prepare research papers for publication.
• Disseminate research findings in talks at suitable seminars, workshops and conferences.
• Manage own academic research and administrative activities, involving small scale project management.
• Contribute ideas for new research directions.
• Contribute to the day-to-day activity of the research group through regular interactions and discussion, including with research students.
• Travel to collaborate with research partners such as Prof Louigi Addario-Berry (McGill).

The post may involve some teaching, by agreement between the post-holder and the Department.

Selection criteria

Essential

• A completed, or soon-to-be completed, doctorate in probability theory, probabilistic combinatorics, or containing a significant probabilistic component.

• A documented track record in conducting and completing high-quality research, as evidenced by published peer-reviewed work (appropriate to the experience of the candidate).

• Sufficient specialist knowledge in the discipline to work within established research programmes.

• Ability to communicate results effectively to colleagues.

• Ability to work both independently and in collaboration.

• Ability to plan and organise workload according to priorities and timescales.
• Ability to manage own academic research and associated activities.

• Excellent communication skills, including the ability to write for publication and deliver talks.

• Potential to work as a highly motivated, independent researcher who will develop an outstanding research career.

Desirable

• Experience in one or more of the following areas: stochastic process theory, random graphs, random trees, R-trees, branching processes, random walks, analytic combinatorics, percolation, lace expansion, or any other topics related to the project.

Queries about the post should be addressed to Prof Christina Goldschmidt at goldschm@stats.ox.ac.uk or Prof James Martin at martin@stats.ox.ac.uk.

All enquiries will be treated in strict confidence; they will not form part of the selection decision.

About the University of Oxford

Welcome to the University of Oxford. We aim to lead the world in research and education for the benefit of society both in the UK and globally. Oxford’s researchers engage with academic, commercial and cultural partners across the world to stimulate high-quality research and enable innovation through a broad range of social, policy and economic impacts.

We believe our strengths lie both in empowering individuals and teams to address fundamental questions of global significance, while providing all our staff with a welcoming and inclusive workplace that enables everyone to develop and do their best work. Recognising that diversity is our strength, vital for innovation and creativity, we aspire to build a truly diverse community which values and respects every individual’s unique contribution.

While we have long traditions of scholarship, we are also forward-looking, creative and cutting-edge. Oxford is one of Europe's most entrepreneurial universities. Income from external research contracts in 2016/17 exceeded £564m and we rank first in the UK for university spinouts, with more than 130 companies created to date. We are also recognised as leaders in support for social enterprise.

Join us and you will find a unique, democratic and international community, a great range of staff benefits and access to a vibrant array of cultural activities in the beautiful city of Oxford.

For more information, please visit www.ox.ac.uk/about/organisation.
The Department of Statistics

The Department of Statistics at Oxford carries out world-leading research in computational statistics, machine learning, statistical and population genetics, bioinformatics, core theoretical statistics, and probability. As part of the Oxford Mathematical Sciences submission, the Department was ranked first in the UK in the 2014 REF exercise; this included having the highest proportion and highest volume of research judged to be world-leading or internationally excellent.

This is an exciting time for the Department, which relocated to new premises on St Giles’ in the heart of the University of Oxford in 2015. Our newly-renovated building provides state-of-the-art teaching facilities and modern space to facilitate collaboration and integration, creating a highly visible centre for Statistics in Oxford.

The Department’s research grant portfolio is currently over £8.3m. Industrial partners from Pharma, Finance and the Information sector all also support research in the Department.

The Department's research excellence has been recognised both collectively through success in REF 2014 and individually. Awards include Fellowships of the Royal Society to Professors Christl Donnelly, Peter Donnelly, Alison Etheridge, and Gilean McVean, FMedSci to Professors Christl Donnelly, Peter Donnelly, and Gilean McVean and the Weldon Memorial Prize to Professors Peter Donnelly and Gilean McVean, the Guy Medal in Bronze to Professor Chris Holmes, the Francis Crick Prize Lecture, and the Genetics Society Balfour Prize to Professor Simon Myers. Professor Gesine Reinert and Professor Christina Goldschmidt have been elected an Institute of Mathematical Statistics Fellow, and Professor Etheridge was awarded an OBE in the 2017 birthday honours for services to science, in addition to being President of the Institute of Mathematical Statistics 2017–2018. Professor Christl Donnelly was awarded a CBE in the 2018 New Year's honours for services to epidemiology and the control of infectious diseases.

The Department recently launched Oxford University Statistical Consulting, which provides comprehensive statistical consultancy services to both internal departments and external businesses. It operates across a wide range of sectors and offers experience in all aspects of data-based research, allowing businesses and academics to access our world-leading statistical research in computational statistics, statistical methodology, applied probability, bioinformatics and mathematical genetics.

The Department of Statistics offers an undergraduate degree (BA or MMath) in Mathematics and Statistics and an MSc in Mathematical Science (OMMS), both joint with the Mathematical Institute, and an MSc in Statistical Science, as well as a lively and stimulating environment for postgraduate researchers (DPhil or MSc by Research). The Department leads two Centres for Doctoral Training (CDTs): the EPSRC/MRC CDT in Systems Approaches to Biomedical Science and the EPSRC-MRC CDT in Next Generation Statistical Science (OxWaSP), a joint programme in Statistics with the University of Warwick, and is the partner institution for the
EPSRC CDT in Modern Statistics and Statistical Machine Learning (StatML) which is led by Imperial College London. The Department is also part of the National Academy for PhD Training in Statistics, which provides graduate training in fundamental areas of Statistics and Applied Probability. Our students go on to work in a wide range of occupational sectors throughout the world, including higher education.

The Department leads and participates in many interdisciplinary research centres, including the Big Data Institute, part of the Li Ka Shing Centre for Health Information and Discovery, where Professor McVean is Director, and the Wellcome Trust Centre for Human Genetics, where Professor Myers is a Researcher. We are a founding partner in the Alan Turing Institute (ATI), the UK’s national data science centre, which brings together world-leading expertise in the emerging field of data science. Professor Holmes has recently been appointed the Health Lead at the ATI and six other members of the Department currently hold Turing Fellowships.

The Department continues to grow and is now flourishing in its new home under the leadership of Professor Alison Etheridge.

For more information please visit: www.stats.ox.ac.uk.

The Department of Statistics holds a bronze Athena Swan award to recognise advancement of gender equality: representation, progression and success for all.

The Mathematical, Physical and Life Sciences Division

The Mathematical, Physical, and Life Sciences (MPLS) Division is one of the four academic divisions of the University. Oxford is widely recognised as one of the world's leading science universities. The disciplines within the MPLS Division regularly appear at the highest levels in world rankings and have been evaluated as conducting world-leading and internationally excellent research in UK research assessments, and Mathematical, physical and life sciences research at Oxford is the best in the country according to the 2014 Research Excellence Framework (REF) assessment exercise carried out by HEFCE.

The MPLS Division is home to the non-medical sciences at Oxford and its 10 academic departments span the full spectrum of the mathematical, computational, physical, engineering and life sciences, and undertake both fundamental research and cutting-edge applied work. Our research tackles major societal and technological challenges – whether developing new energy solutions or improved cancer treatments, understanding climate change processes, or helping to preserve biodiversity, and is increasingly focused on key interdisciplinary issues. We collaborate closely with colleagues in Oxford across the medical sciences, social sciences and humanities, and with other universities, research organisations and industrial partners across the globe in pursuit of innovative research geared to address critical and fundamental scientific questions.

MPLS is proud to be the home of some of the most creative and innovative scientific thinkers and leaders working in academe. Our senior researchers have been awarded some of the
most significant scientific honours (including Nobel prizes and prestigious titles such as FRS and FReG) and we have a strong tradition of attracting and nurturing the very best early career researchers who regularly secure prestigious fellowships. The Division is also the proud holder of ten Athena Swan Awards (3 Silver and 7 Bronze) illustrating our commitment to ensure good practice and to encourage women in science at all levels in the division.

We have around 6,000 full and part-time students (including approximately 2000 graduate students) and play a major role in training the next generation of leading scientists. Oxford's international reputation for excellence in teaching is reflected in its position at the top of the major league tables and subject assessments. MPLS academics educate students of high academic merit and potential from all over the world. Through a mixture of lectures, practical work and the distinctive college tutorial system, students develop their ability to solve major mathematical, scientific and engineering problems.

MPLS is dedicated to bringing the wonder and potential of science to the attention of audiences far beyond the world of academia. We have a strong commitment to supporting public engagement in science through initiatives including the Oxford Sparks portal (www.oxfordsparks.net) and a large variety of outreach activities; these are crucial activities given so many societal and technological issues demand an understanding of the science that underpins them. We also endeavour to bring the potential of our scientific efforts forward for practical and beneficial application to the real world and our desire is to link our best scientific minds with industry and public policy makers.

For more information about the MPLS division, please visit: www.mpls.ox.ac.uk

How to apply

Before submitting an application, you may find it helpful to read the ‘Tips on applying for a job at the University of Oxford’ document, at www.ox.ac.uk/about/jobs/supportandtechnical/.

If you would like to apply, click on the Apply Now button on the ‘Job Details’ page and follow the on-screen instructions to register as a new user or log-in if you have applied previously. When prompted, please provide details of two referees. Applicants should ask their referees to send their letters of reference directly to the Personnel Administrator by email to jobs@stats.ox.ac.uk by the closing date quoting the vacancy reference 144954. One referee should preferably be the applicant’s current, or most recent, supervisor.

You will also be asked to upload a CV and a supporting statement. The supporting statement must explain how you meet each of the selection criteria for the post using examples of your skills and experience. This may include experience gained in employment, education, or during career breaks (such as time out to care for dependants).

Your application will be judged solely on the basis of how you demonstrate that you meet the selection criteria stated in the job description.
Please upload all documents as PDF files with your name and the document type in the filename.

All applications must be received by midday on the closing date stated in the online advertisement.

**Information for priority candidates**

A priority candidate is a University employee who is seeking redeployment because they have been advised that they are at risk of redundancy, or on grounds of ill-health/disability. Priority candidates are issued with a redeployment letter by their employing departments.

If you are a priority candidate, please ensure that you attach your redeployment letter to your application (or email it to the contact address on the advert if the application form used for the vacancy does not allow attachments).

Should you experience any difficulties using the online application system, please email recruitment.support@admin.ox.ac.uk. Further help and support is available from www.ox.ac.uk/about_the_university/jobs/support/. To return to the online application at any stage, please go to: www.recruit.ox.ac.uk.

Please note that you will be notified of the progress of your application by automatic emails from our e-recruitment system. Please check your spam/junk mail regularly to ensure that you receive all emails.

**Important information for candidates**

**Data Privacy**

Please note that any personal data submitted to the University as part of the job application process will be processed in accordance with the GDPR and related UK data protection legislation. For further information, please see the University’s Privacy Notice for Job Applicants at: www.admin.ox.ac.uk/councilsec/compliance/gdpr/privacynotices/job/. The University’s Policy on Data Protection is available at: www.admin.ox.ac.uk/councilsec/compliance/gdpr/universitypolicyondataprotection/.

**The University’s policy on retirement**

The University operates an Employer Justified Retirement Age (EJRA) for all academic posts and some academic-related posts. The University has adopted an EJRA of 30 September before the 69th birthday for all academic and academic-related staff in posts at grade 8 and above. The justification for this is explained at: www.admin.ox.ac.uk/personnel/end/retirement/acrelretire8+/

For existing employees, any employment beyond the retirement age is subject to approval through the procedures: www.admin.ox.ac.uk/personnel/end/retirement/acrelretire8+.
There is no normal or fixed age at which staff in posts at grades 1–7 have to retire. Staff at these grades may elect to retire in accordance with the rules of the applicable pension scheme, as may be amended from time to time.

**Equality of Opportunity**

Entry into employment with the University and progression within employment will be determined only by personal merit and the application of criteria which are related to the duties of each particular post and the relevant salary structure. In all cases, ability to perform the job will be the primary consideration. No applicant or member of staff shall be discriminated against because of age, disability, gender reassignment, marriage or civil partnership, pregnancy or maternity, race, religion or belief, sex, or sexual orientation.
## Benefits of working at the University

### Employee benefits

University employees enjoy 38 days’ paid holiday, generous pension schemes, travel discounts, and a variety of professional development opportunities. Our range of other employee benefits and discounts also includes free entry to the Botanic Gardens and University colleges, and discounts at University museums. See [www.admin.ox.ac.uk/personnel/staffinfo/benefits](http://www.admin.ox.ac.uk/personnel/staffinfo/benefits).

### University Club and sports facilities

Membership of the University Club is free for all University staff. The University Club offers social, sporting, and hospitality facilities. Staff can also use the University Sports Centre on Iffley Road at discounted rates, including a fitness centre, powerlifting room, and swimming pool. See [www.club.ox.ac.uk](http://www.club.ox.ac.uk) and [www.sport.ox.ac.uk/oxford-university-sports-facilities](http://www.sport.ox.ac.uk/oxford-university-sports-facilities).

### Information for staff new to Oxford

If you are relocating to Oxfordshire from overseas or elsewhere in the UK, the University's Welcome Service website includes practical information about settling in the area, including advice on relocation, accommodation, and local schools. See [www.welcome.ox.ac.uk](http://www.welcome.ox.ac.uk). There is also a visa loan scheme to cover the costs of UK visa applications for staff and their dependents. See [www.admin.ox.ac.uk/personnel/permits/reimburse&loanscheme/](http://www.admin.ox.ac.uk/personnel/permits/reimburse&loanscheme/).

### Family-friendly benefits

With one of the most generous family leave schemes in the Higher Education sector, and a range of flexible working options, Oxford aims to be a family-friendly employer. We also subscribe to My Family Care, a service that provides practical advice and support for employees who have caring responsibilities. The service offers a free telephone advice line, and the ability to book emergency back-up care for children, adult dependents and elderly relatives. See [www.admin.ox.ac.uk/personnel/staffinfo/benefits/family/mfc/](http://www.admin.ox.ac.uk/personnel/staffinfo/benefits/family/mfc/).

### Childcare

The University has excellent childcare services, including five University nurseries as well as University-supported places at many other private nurseries. For full details, including how to apply and the costs, see [www.admin.ox.ac.uk/childcare/](http://www.admin.ox.ac.uk/childcare/).

### Disabled staff

We are committed to supporting members of staff with disabilities or long-term health conditions. For further details, including information about how to make contact, in confidence, with the University’s Staff Disability Advisor, see [www.admin.ox.ac.uk/eop/disab/staff](http://www.admin.ox.ac.uk/eop/disab/staff).

### Staff networks

The University has a number of staff networks including the Oxford Research Staff Society, BME staff network, LGBT+ staff network and a disabled staff network. You can find more information at [www.admin.ox.ac.uk/eop/inpractice/networks/](http://www.admin.ox.ac.uk/eop/inpractice/networks/).
The University of Oxford Newcomers' Club

The University of Oxford Newcomers' Club is an organisation run by volunteers that aims to assist the partners of new staff settle into Oxford, and provides them with an opportunity to meet people and make connections in the local area. See [www.newcomers.ox.ac.uk](http://www.newcomers.ox.ac.uk).