University of Oxford Department of Computer Science

Job description and selection criteria

Job title	Research Associate on AXIS3 project
Division	MPLS
Department	Computer Science
Location	Wolfson Building, Parks Road, Oxford.
Grade and salary	Grade 7: £32,817 – £35,845 p.a.
Hours	Full Time
Contract type	Fixed-term until 30 September 2022
Reporting to	Professors Sadie Creese and Michael Goldsmith
Vacancy Reference	149201
Additional Information	Whilst the role is a grade 7 position, we would be willing to consider candidates with potential but less experience who are seeking a development opportunity, for which an initial appointment would be at grade 6 (£29,176 - £34,804 p.a.) with the responsibilities adjusted accordingly (for Grade 6, you would be expected to hold a doctoral degree in Computer Science or be close to completion). This would be discussed with applicants at interview/appointment where appropriate.

The role

Reporting to the Principal Investigator, the post holder will be a member of the Cybersecurity Analytics Research Group within the Department of Computer Science with responsibility for carrying out research within a team of a large project, as follows:

As the volume of cyber-attacks continues to rise and also the levels of harm suffered from them, it is becoming critical that organisations can demonstrate that reasonable efforts are being undertaken to reduce cyber-risk. However, the risk responses and controls typically viewed as necessary, and even essential, by the professional and expert community are generally not underpinned by any framework that facilitates rigorous reasoning, qualification or quantification of the benefits resulting from their deployment. This means that the real

value of compliance, or variability of compliance, to risk-control standards is not well reasoned or measurable in a scientific, unambiguous or verifiable sense.

Academics within Oxford's Computer Science Department have partnered with AXIS Capital to tackle this challenge and probe the effectiveness of current defences against cyber-attacks, and the standards set by international bodies which businesses use to measure the sufficiency of their cyber security efforts. While Phase 2 of the project focused on analysing cyber value-at-risk (CVaR), specifically by building analytical tool support so that CVaR and other core concepts of the Model might be calculated or estimated and the consequences analysed, the current Phase 3 concentrates on refining the CVaR model and testing its predictive capabilities when used to model organisations' potential exposure to loss from cyber-attacks, even after using risk controls (including security technologies and processes).

The project also involves consideration of emerging technologies and the ability of controls to cope with associated threat capability enhancements, as well as the development of methods for reasoning about aggregated and systemic risk across multiple organisations and supply chains.

The post holder will contribute to the experimentation using the CVaR model, construct system simulations to test hypotheses and analyse results. They will conduct experiments designed to explore the effectiveness of technological risk controls, with a view to enhancing the data available to the research community. They will also contribute to the construction of simulations and other models designed to explore the potential for systemic cyber-risk, and the relative importance and effectiveness of different cybersecurity policies and behaviours. They will consult with the expert and stakeholder community to evolve and validate findings, and will be involved in the production of academic research papers for publication, as well as white papers for the business and policy-maker communities.

Research topic	Refining Cyber Value-at-Risk
Principal Investigator / supervisor	Sadie Creese
Funding partner	AXIS Capital

Responsibilities

- Perform experimentation with the CVaR model and tool by applying the method to modelling actual organisations, producing loss range predictions (for specific threats) and assessing accuracy based on actual incidents.
- Conduct research into the performance of risk controls in order to estimate the probability of effectiveness of any specific control, and combinations of controls, for varied system configurations.
- Develop agent-based simulations to model systems of organisations and threats, in order to understand potential for systemic cyber-risk, and explore the application of a CVaR modelling approach for aggregated risk across systems.
- Collaborate in the preparation of research publications, book chapters and white papers.
- Contribute to discussions and share research findings with colleagues in the Group, Department, across Oxford, partner institutions, and research groups. Present conference papers.
- Co-supervise student projects associated with the Cybersecurity Analytics Group.

Selection criteria

Essential selection criteria include:

- Hold a relevant PhD or DPhil (Computer Science or a related subject), (or close to completion) together with relevant experience in implementing rapid prototyping of software, modelling systems and agent-based simulations.
- Possess sufficient specialist knowledge in the cybersecurity discipline to work within this project and other established research programmes of the group.
- Knowledge of operational security measures specifically including intrusion detection technologies, access control technologies and the controls contained in the NIST Cybersecurity Framework.
- A background in probability theory and statistics.
- Ability to manage own academic research and associated activities.
- Excellent communication skills, including the ability to write for publication, present research proposals and results, and represent the research group at meetings. Demonstrated in part with previous experience of contributing to high quality academic research publications, and presentations of results at academic conferences.

Desirable criteria include

- A working knowledge of the snort tool and rule design.
- Thematic coding analysis and experience with interviews.
- Ability to deploy and configure network intrusion detection technologies, design and implement software sensors to detect risk control configuration, and to utilise open-source security tools.

Pre-employment screening

All offers of employment are made subject to standard pre-employment screening, as applicable to the post.

If you are offered the post, you will be asked to provide proof of your right-to-work, your identity, and we will contact the referees you have nominated. You will also be asked to complete a health declaration (so that you can tell us about any health conditions or disabilities so that we can discuss appropriate adjustments with you), and a declaration of any unspent criminal convictions.

We advise all applicants to read the candidate notes on the University's pre-employment screening procedures, found at: www.ox.ac.uk/about/jobs/preemploymentscreening/.

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 spin-outs, 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

Department of Computer Science

The Department of Computer Science was established in 1957, making it one of the longest-established Computer Science departments in the country. It is one of the UK's leading Computer Science Departments (ranked first in a number of international rankings). The UK Research Excellence Framework (REF) in December 2014 resulted in 74 members of the Department having 53% of their research activity ranked in the top category of 4* (world-leading). Overall, we received an average of 3.34 across the Department (3* being internationally excellent). A significant majority of the Department are active in externally sponsored research, with both government and industrial funding. At present, there are 69 members of academic staff and almost 100 research staff.

The Department has close links with government, industry, and other departments within the University. Among the latter are Mathematics, Engineering, Physics, Statistics and a number of life sciences departments. The Department is housed across multiple sites within the University's South Parks Road Science Area, facilitating strong collaborative links with research groups and institutes in closely allied areas (including the Oxford Internet Institute and the Oxford e-Research Centre). This is an essentially inter-disciplinary activity which is at present attracting major funding from a number of sources. At present, the Department holds over £50m in external research contracts.

Research in the Department is currently managed in ten themes:

- *Algorithms & Complexity Theory* focusses on determining the inherent difficulty of computational problems, classifying problems according to this inherent difficulty, and designing and analysing algorithms that use computational resources as efficiently as possible;
- *Artificial Intelligence & Machine Learning* focuses on theoretical foundations, multiagent systems, deep learning and computational linguistics;
- *Automated Verification* investigates theory and practice of formal verification and correct-by-construction synthesis for software and hardware systems;
- *Computational Biology & Health Informatics* is concerned with computational approaches for biomedical research and healthcare innovation;
- *Cyber-Physical Systems* is focusing on intelligent and autonomous sensor systems with applications in positioning, healthcare, environmental monitoring and smart cities;
- *Foundations, Structures and Quantum* embraces interdisciplinary research, and has a particular interest in structural foundations of quantum computation;
- *Human-Centred Computing* covers human-computer interaction, social computing and world-wide web;
- *Information Systems* covers databases, knowledge representation and reasoning;
- *Programming Languages* covers functional programming, program analysis, and programming language foundations;
- *Security* specialises in cybersecurity, protocol analysis, systems security, trusted computing, human-centred security, and networking.

For more information, please visit: http://www.cs.ox.ac.uk/.

The Mathematical, Physical, and Life Sciences Division (MPLS)

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. In the results of the six-yearly UK-wide assessment of university research, REF2014, the MPLS division received the highest overall grade point average (GPA) and the highest GPA for outputs. We received the highest proportion of 4* outputs, and the highest proportion of 4* activity overall. More than 50 per cent of MPLS activity was assessed as world leading.

The MPLS Division's 10 departments and 3 interdisciplinary units 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 addresses major societal and technological challenges 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 FR.Eng) 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 eight Athena Swan Awards (4 Silver and 4 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 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 (http://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: http://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. Please provide details of two referees and indicate whether we can contact them now.

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 department(s).

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 receive an automated email from our e-recruitment system to confirm receipt of your application. **Please check your spam/junk mail** if you do not receive this email.

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.

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 and 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.
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/.

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/.

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/.

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.

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/.

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.