Computer Science allows us to abstract, reason, represent, visualise, model and understand the world. It also allows us to build tools to change it.

*Professor Russell Beale*
Contents

Computer Science 4
Summary of Postgraduate Degree Programmes 5
Studying Computer Science at Birmingham 6
Birmingham City 8
MSc Advanced Computer Science 10
MSc Computer Science 12
MSc Computer Security 14
MSc Human Computer Interaction 16
MSc Robotics 18
MRes Natural Computation 20
PhD/MSc by Research Computer Science 22
Scholarships and bursaries 23
Careers support and employability 24
Application and admissions 26
Useful contacts 27

Learn more

Postgraduate Student Admissions Team
Tel: +44 (0)121 415 8742
Email: Postgraduate Taught
mac-admissions@cs.bham.ac.uk
Postgraduate Research
compsci-phd@contacts.bham.ac.uk

www.cs.bham.ac.uk

Come along to an Open Day:
www.birmingham.ac.uk/opendsys

Follow us on facebook
www.facebook.com/uobcompsci

Follow us on twitter @uobcompsci
Welcome

I am delighted that you are considering postgraduate study at Birmingham. Birmingham is a research-led university, and postgraduate students are central to our learning community. Our wide portfolio of research makes Birmingham one of the most popular universities for postgraduate study in the UK, and we hope that you will find this brochure of use when making your decision on where to study.

The School of Computer Science was established in the late 1950s and became one of the first academic departments in the UK to undertake research and teaching in this area. Some 50 years later, we now provide specialist teaching and conduct world-leading research in fundamental and applied computer science, artificial intelligence, optimisation, computer security, medical imaging, software engineering, human computer interaction and robotics. We are proud to deliver outstanding postgraduate education that offers a range of exciting career opportunities for students from around the world.

In 2013 the School achieved an overall satisfaction rating of 95% (NSS* 2013), and The Guardian University Guide 2014 ranked the University of Birmingham 1st in the UK league tables for CS and IT.

We are eager to receive applications from highly motivated and well qualified graduates and hope that you will find all of the information you need.

Professor Jonathan Rowe
Head of the School of Computer Science

*National Student’s Survey
Computer Science

It may be a bit of a cliché, but computing moves so fast it’s hard to pin it down exactly. Ever more challenging market demands mean that technology never stands still and that makes for a dynamic sector offering exciting careers with excellent rewards for the successful.

The term ‘computing’ covers every kind of digital technology that we use to create, store, communicate, exchange and use information. As such, it is the foundation for small and large businesses to build their strategies and grow. It is also the key to making our personal lives easier and more fun: mobile phones, online shopping, MP3 players... we owe them all and a lot more besides, to computer science.

What can I do with a postgraduate degree in computer science?
Our postgraduates find themselves in a variety of environments within academia, research, industry, government and private organisations. The following is a short list of research and vocational areas:

- **Artificial Intelligence**: developing computers that simulate human learning and reasoning ability
- **Information Technology**: developing and managing information systems that support a business or organisation
- **Software Engineering**: developing methods for producing software systems on time, within budget and with few or no defects
- **Theoretical Computer Science**: investigating the fundamental theories of how computers solve problems and applying the results to other areas of computer science
- **Operating Systems and Networks**: developing the basic software computers use to organise themselves or to communicate with other computers
- **Software Applications**: applying computing and technology to solving problems outside the computer field, eg, in education or medicine
- **Computer Security**: covers all the processes and mechanisms by which computer-based equipment, information and services are protected from unintended and unauthorised access, change or destruction

Where can I work?
You could join a technology consultancy firm like Accenture, PwC, CHP Consulting, LogicaCMG, BAE Systems, PA Consulting, Capgemini or one of the global IT giants, such as Microsoft, Google, Oracle, Hewlett Packard, IBM, Cisco Systems, Apple among many others. There are a huge number of IT-focused UK companies, not to mention opportunities in investment, retail banking and financial computing and analytics (such as Goldman Sachs, Deloitte, J.P. Morgan, Morgan Stanley, Bank of England, Bank of America, HSBC, Barclays, RBS); telecommunications companies (such as BT, Vodafone, Orange, AT&T); IT for retail businesses (such as eBay, Amazon, Tesco, Argos, Expedia) and public sector organisations (such as NHS, GCHQ, Home Office). Some students choose careers in teaching, research or technology development at universities both in the UK and overseas. There is a great deal of potential for postgraduates looking to put their computing skills to good use.

What skills will I develop?
We will broaden your knowledge of selected areas of computing by a combination of taught modules and individual project work, supervised by research active members of staff who will help you to develop appropriate investigation and study skills. Your course will give you a disciplined approach to analysing problems and the ability to design creative solutions, whilst critically evaluating the results. You will also develop management skills such as communication, teamwork, time management and report writing. Through further study at an advanced level, postgraduates get into the habit of questioning and conceptualising, and these practices transfer well into the workplace.

Your prospective employers will be interested in both the technical skills (such as programming) you develop and your transferable skills such as writing reports and giving presentations.

What does the future hold?
Your career prospects are good and computing graduates with a good degree are in demand. Plus, with the number of computer science graduates from the UK diminishing at the same time as jobs are increasing, students with a postgraduate degree have an excellent chance of securing employment.
Computing crosses boundaries between mathematics, science, engineering and business. It also takes in important competencies that lie at the very foundation of professional practice.

Our portfolio of computer science programmes takes into consideration the broad nature of the discipline, so we offer a wide range of courses to meet the diverse requirements of our students, as follows:

**Taught programmes**

**MSc Advanced Computer Science**
This degree is advanced programme which draws upon the school’s international research reputation. It is designed to prepare graduates for a career in academic or industrial research in computer science. It offers a broad range of advanced taught modules from which students can select the areas they are most interested in. Knowledge is also deepened through individually supervised research in one of the many research areas of the school. For more details see page 10.

**MSc Computer Science**
This one year programme offers graduates of a non-computing discipline an education in developing an expertise in computing. Often referred to as a ‘conversion course’, it is the longest running programme of its kind in the UK and contains significant programming component. It is designed to give you a grounding in both the fundamentals of computer science and practical software development skills with a choice of in-depth optional modules. For more details see page 12.

**MSc Computer Security**
Graduates will gain an understanding of the computer security technologies that underpin products. The degree covers the theory and practice of designing and building secure systems. It provides a firm grounding in cryptography, network security, and secure programming. For more details see page 14.

**MSc Human Computer Interaction**
Human Computer Interaction is one of the most important aspects in any successful computer system and also provides great opportunities for innovation and creativity. In this course you will cover the underpinning theories, methodologies and practice of the discipline. You will also have the opportunity to broaden your studies through optional modules in areas such as Robotics, Security or Neural Computation. The course builds upon the world class research of the HCI Centre through project work and is designed to prepare you for a career in research or in industry or commerce. For more details see page 16.

**MSc Robotics**
This programme is intended for graduates of numerate disciplines allied to robotics, including electronic engineering, computer science, mechanical engineering, physics and mathematics. Students will learn theories of intelligent robotic control and software tools required to implement standard algorithms in mobile robots and robot manipulators. Graduates of the programme will either work in industry or pursue a research degree in robotics. For more details see page 18.

**MRes Natural Computation**
The MRes in Natural Computation is a one-year full-time degree for students who have found their undergraduate study stimulating and want to learn in-depth about this emerging interdisciplinary field. For more details see page 20.

**Research programmes**

**PhD/MSc by Research Computer Science**
For students wishing to pursue careers in research and academia, we offer supervision for an MSc by Research or PhD in Computer Science. For more details see page 22.

A MSc by Research (two year) degree will demonstrate possession of the skills necessary to carry out supervised research. A PhD (three year) programme will demonstrate the ability of the student to conduct original research. A PhD provides the opportunity to develop expertise in a specific area of interest and to gain the skills needed for independent research. Students become part of the existing research community and benefit from the experience and knowledge obtained from on-going research projects in the School. Research students are organised into research themes outlined on page 22.
Studying Computer Science at Birmingham

Birmingham has a history of research excellence, a stunning campus with exceptional facilities, and a culturally diverse academic community, all set within one of the most vibrant cities in Europe. Birmingham is one of the leading universities in the country for postgraduate study in computer science.

Choosing the right university is one of the most important and exciting decisions you will make. It will shape your future and directly affect your career path. To make the best decision for you there are a number of factors you need to consider:

**Teaching quality**

Computer Science teaching in Birmingham is considered to be excellent by both students, and independent reviewers.

The Guardian University Guide 2015 has ranked our School fifth out of all UK institutions offering Computer Science and IT. The Complete University Guide 2015 has also placed our School as one of the top ten Computer Science departments in the UK, ranking us highly for student satisfaction, research and graduate prospects.

We have the highest possible rating for our computer science teaching (from the QAA – Quality Assurance Agency for Higher Education) and we are currently ranked in equal 7th position by the 2008 Research Assessment Exercise (RAE) for the quality of our ‘world-leading’ research.

**Research excellence**

Our academic community consists of people who are working at the forefront of knowledge in their subject. This benefits you directly, giving you the exciting chance to learn from innovative developments as they are being made.

In the UK Research Assessment Exercise (2008), 30% of our research activity was rated internationally leading (the highest possible rating), and 45% internationally excellent (the second highest rating). We are also home to the Centre of Excellence for Research in Computational Intelligence and Applications (CERCIA). We collaborate with many multi-national companies and hold over £12 million in externally funded contracts and grants.

**School facilities**

As a student in the School you will be based within a purpose built multi-million pound building, which offers 24-hour swipe card access to an impressive range of state-of-the-art facilities. These include:

- Dedicated laboratories for Computer Science students
- A teaching laboratory for robotics
- Research laboratories for Medical Imaging and Intelligent Robotics
- A full wireless network
- A subject-specific library
- A student common room and five departmental seminar and meeting rooms

**Student support**

We are dedicated to ensuring our students have an enjoyable and beneficial time with us. All our students have their own academic advisor who they meet with on a regular basis to discuss progress. The School has a helpful welfare tutoring service and an international students’ tutor. Additionally, the student/staff committee provides a useful forum for raising issues and the school’s student society, COGS, offers student support and organises varied social events.

**Business and industry links**

The School has taken the time to build strong local and national relationships with major industrial players from the public and private sector. Just a few of these include Accenture, Goldman Sachs, HP, IBM and Logica. We also boast research partnerships with many blue-chip companies including: BT Exact, Honda, HP, IBM, QinetiQ, Marconi, Rolls Royce, Severn Trent and Sony.

**Award-winning development**

At the School of Computer Science we are not just renowned for teaching and research excellence. We also produce award-winning software for the real world. The Autotrain project at Birmingham develops e-training for the automotive sector and has won an award for best practice in Europe by the Bertelsmann Foundation and AOL Time Warner. We are also proud to have developed a revolutionary award winning method for diagnosing skin cancer.

**The campus**

The Edgbaston campus is a safe, friendly environment with an impressive mixture of sculptures, striking Edwardian and modern buildings as well as a range of facilities for students. Set within 250 acres of parkland, it is a stunning place to be. Lawns, mature trees and pedestrian walkways contribute to the peaceful atmosphere on campus. Convenient facilities include bars, cafes, shops, a hair salon, a concert hall, banks, an art gallery, a medical practice and a nursery. We even have our own train station, and the city centre can be reached in under 10 minutes.
An international university
The School of Computer Science has around 150 international students from all over the world. Birmingham has over 7,500 students drawn from nearly 150 different countries; it is home to one of the largest communities of international students in the UK. The University is also a founder member of Universitas 21, an international network of 27 leading research-intensive universities in 17 countries.

Accommodation services
The University has a large amount of accommodation although most of our research students prefer to make their own arrangements for accommodation. First-year international postgraduate students who are new to Birmingham are guaranteed a place in University accommodation, subject to certain conditions. For more information visit www.birmingham.ac.uk/postgraduate/acmodation

Facilities
The University is investing £175 million over the next five years to transform our famous Edgbaston campus with new facilities that will be for the benefit of our students, staff and visitors. The University will deliver the city’s first 50 metre swimming pool in a brand new sports centre, create an outstanding academic library with a cultural student hub and open up a striking green park at the heart of the campus. The University is also investing in brand new Halls of Residence at our Student Village and will continue its commitment to high-quality design and sustainable regeneration. Learn more: www.birmingham.ac.uk/university/building

Seminar series
The School runs several seminar series throughout the year. They range from computer science seminars which are intended for a general audience, through the Theory of Computer Science seminars to the ‘Oven’ which is a very informal series in which staff and research students present work in progress. Seminars offered by other departments on the University campus are also open for you to attend.

Graduate School
Most of your work and your social contacts are likely to be based in your school, department or research group. However, as a postgraduate student at Birmingham you will be a member of the University’s Graduate School. The aim of the Graduate School is to ensure that the environment in which graduate students work meets their social and academic needs. It provides a University-wide network for postgraduate students. For more information visit www.graduateschool.bham.ac.uk
Birmingham City

Birmingham has been transformed into a city for young professionals and is one of Europe's most exciting destinations. It is more than somewhere to study; it is somewhere to build a successful career.

Birmingham is a modern, fascinating city. Famous for its historical industrial past it is now a centre of arts and culture, commerce and entertainment, with a vibrant and diverse community. Birmingham is home to the largest financial services and creative sectors outside London. The thriving business community offers you a wealth of opportunities when you join the job market, and around 40% of Birmingham graduates choose to make their home here after leaving university.

For more information on student life in Birmingham, visit: www.visitbirmingham.com/what-to-do/for-students where real Birmingham students will give you their opinions on everything from nightlife to culture and relaxation. View photos, read blogs watch films and sign up for their newsletter.

Modern city
Around £9 billion has already been ploughed into the city centre over the past 20 years and Birmingham continues to attract significant investment. The landscape of the area has changed significantly and more areas of the city are regularly being regenerated and transformed.

Birmingham is home to one of Europe’s largest shopping centres; the award-winning Bullring, with over 160 shops, restaurants and bars, including the iconic Selfridges building. It is also home to the Mailbox, a unique development that brings together designer fashion and lifestyle shops, luxury apartments, hotels and an array of restaurants and café bars. The Mailbox is also home to BBC Midlands’ television and radio. The city has also invested in a brand new central New Street station, serving over 140,000 passengers a day. Birmingham has excellent transport links to other parts of the UK, is a half an hour taxi ride to Birmingham International Airport and is only 90 minutes away from London via train.

Shopping, entertainment and culture in Birmingham
Although Birmingham is facing the future, it is still proud to showcase its past. The city
Factfile: The city of Birmingham

- A £96 billion regional economy makes the city a major engine of UK growth outside of London
- Birmingham is the ‘youngest’ city in Europe, with under 25s accounting for nearly 40% of its population
- Birmingham is home to some of the largest clinical trials clusters in the UK – helping to transform world-class cancer research into improved patient survival
- The Forensic Science Service pioneered the use of large scale DNA profiling and set up the world’s first DNA database from their laboratories in Birmingham
- Birmingham have over 8,000 acres of parks and open space, making it one of the greenest cities in the UK
- Sustainability: 80% of Birmingham’s new buildings are regarded as ‘Excellent’ by the environmental measurement rating BREEAM
- Air, road and rail connections provide access to 400 million people across Europe

Information courtesy of Marketing Birmingham.

was the hub of the industrial revolution and areas such as the historic Jewellery Quarter keep traditions alive. The canals are now fringed with bars and restaurants, and many visitors are excited by the city’s bustling nightlife.

There are more than 500 restaurants offering a vast range of international cuisine. After enjoying a meal, you could go for drinks or watch some of the best comedians on the circuit at the Glee Club. If you prefer live music, Birmingham has a number of leading venues for bands and local talent, including the National Indoor Arena and the NEC.

Birmingham is also home to one of the UK’s finest concert halls, Symphony Hall, where the City of Birmingham Symphony Orchestra is based, and Birmingham Hippodrome, where the Birmingham Royal Ballet is based. The city centre also has three other theatres and a number of cinemas, including the 30-screen ‘Vue’ at Star City, which shows the latest Asian and mainstream films under one roof.

In 2013 the new Library of Birmingham opened in Centenary Square. The library is 31,000 square metres, making it one of the largest public libraries in the world. Connected with Birmingham Repertory Theatre (The REP) there are always events and shows happening. Visit www.libraryofbirmingham.com for more information.

**Sporting city**

Birmingham is home to Premier League football clubs Aston Villa and Birmingham City and in recent years it has staged more sporting championships than any other UK city. The Warwickshire County Cricket ground, close to the University in Edgbaston, regularly hosts test matches and international tournaments including the Cricket World Cup. The city also boasts many golf courses, including The Belfry, which has hosted the Ryder Cup four times.

** Welcoming city**

There is something for everyone in Birmingham and you will get a warm welcome in one of the most culturally diverse cities in Britain. People from all over the world live, work and play here as part of a citywide community which has been harmonious and tolerant over many years. Our long record of industry and innovation contributes to the exciting and dynamic atmosphere of our historic city.
MSc Advanced Computer Science
www.birmingham.ac.uk/adv-computer-science

Subject at a glance
Mode(s) of Study Full-time
Duration 1 year
Entry Requirements 2:1 (Hons) degree in Computing or a closely related discipline plus a solid foundation in programming
Start Date September
Admissions Tutor Dr Hayo Thielecke
Tel: +44 (0)121 415 8742
Email: msc-admissions@cs.bham.ac.uk

The programme aims to:

- Allow graduates with a previous degree in computing to broaden their knowledge of leading areas of computing through the choice of options from a range of advanced taught modules
- Allow students to deepen their knowledge of selected areas of computing by individual project work supervised by research-active members of staff and to develop appropriate research skills. The final four months of the programme are spent on a summer project
- Provide a solid foundation for all graduates to pursue a career in the software industry with a particular focus on research and development, or the pursuit of further studies (such as a PhD)

Overview
This degree is an advanced programme which draws upon the school’s international research reputation. It is designed to prepare graduates for a career in academic or industrial research in computer science. It offers a broad range of advanced taught modules from which students can select the areas they are most interested in. Knowledge is also deepened through individually supervised research in one of the many research areas of the school.

This is a one-year, full-time degree. In the first eight months of the degree, students study taught modules, chosen from a wide range of topics. In the final four months, students work on their summer project and dissertation, individually supervised by a member of the research-active staff in the school.

Career prospects
The importance of project work, together with a very wide range of options available to you makes this MSc unusually suited as a preparation for a research career in computer science. Students graduating from this programme usually have developed a taste for working on difficult problems and look for a career where they will be able to apply their enhanced analytical and technical skills. Some students go on to a PhD, either at Birmingham, elsewhere in the UK or abroad. Other graduates move into industry, typically taking technically demanding jobs.

Programme structure

<table>
<thead>
<tr>
<th>Semester 1</th>
<th>Semester 2</th>
<th>June–September</th>
</tr>
</thead>
<tbody>
<tr>
<td>Taught modules chosen from options</td>
<td>Taught modules chosen from options</td>
<td>Project and Dissertation</td>
</tr>
</tbody>
</table>

School of Computer Science
Core module descriptions
The programme is taught in two semesters followed by a summer project.

Optional modules
This MSc has an unusually wide choice of modules from which students can choose freely. Options include specialised modules on topics such as Computer Security, Human Computer Interaction, and Robotics, in addition to Masters-level courses on core Computer science.

Detailed module descriptions are available at: www.cs.bham.ac.uk/internal/programmes/current/MScACS.html

Summer project
The four summer months are spent working on the project and dissertation. These projects are often of an extremely high level and quality, as a result of the advanced focus of the programme and the high level of qualifications we ask of students joining this programme.

Examinations and assessments
Each project is assessed by the supervisor and a moderator. Taught modules are assessed in a variety of ways: summer written examination, practical assessment during the semester, or a mixture of both.

Entry requirements
The entry requirements for this course are high, as we only admit students with a solid foundation in Computer Science. Our minimum requirement is an Upper Second class degree in a computing or mathematics related discipline or an international equivalent. As a guide, you should be in at least the top 15% of your academic year. Students who have not studied in English must pass a recognised English test.

Graduate profile
Alexander Darer (2013)
PhD Cyber Security Student, University of Oxford

'I studied at the University of Birmingham for 4 years and during that time I discovered the areas of computer science I wanted to further my understanding in. I am now studying a field which spans a wide variety of different disciplines; cyber security encompasses much more than just computer security, but social science, political science etc. This means that there are so many different avenues for pursuing different areas of research and there is always something exciting occurring within the field itself!

The best part of the MSc Advanced Computer Science was the fact I had the opportunity to explore areas of research I hadn’t looked into before and there are so many brilliant people (supervisors and students) at the University of Birmingham who will guide you as you progress.'

Read Alexander’s full profile – www.birmingham.ac.uk/alexander-darer
MSc Computer Science
www.birmingham.ac.uk/msc-computer-science

Subject at a glance
Mode(s) of Study: Full-time
Duration: 1 year
Entry Requirements: 2:2 (Hons) degree or equivalent in any subject
Start Date: September
Admissions Tutor: Dr Jim Yandle
Tel: +44 (0)121 415 8742
Email: msc-admissions@cs.bham.ac.uk

The programme aims to provide:
- A solid foundation for a career or further study in computing/IT
- Coverage of the core areas of computer science
- A solid grounding in the theoretical underpinnings of contemporary developments in computer science
- A choice of options to reflect the student’s interests and first degree
- A solid grounding in practical software development skills

Overview
The MSc Computer Science is a one-year programme that allows graduates of non-computing disciplines to develop expertise in computing. Often referred to as a ‘conversion’ course, it is the longest running programme of this kind in the UK (since 1969).

The programme is different to IT programmes, in that it is a technical degree with a significant programming component. It is designed to give you a grounding in both the fundamentals of computer science and practical software development skills and choice of in-depth modules as optional modules. Students from all backgrounds are welcome to apply, but a certain amount of background in mathematics and scientific subjects, for example at ‘advanced’ high school level, would facilitate mastering the new Computer Science subjects.

The mixture of core computing modules and a range of flexible options reflecting your interests and first degree provide a solid foundation for a career in computing or for further study.

Career prospects
Most students graduating from this programme move into industry to work on software development. Others use their new computing skills to enhance their employment prospects in work related to their first degree. Each year, some students join sales and software support teams in industry and commerce or start their own companies and a few join our PhD programme.

Core module descriptions
Software workshop
A major part of the first semester is devoted to the Software Workshop to introduce and develop object-oriented design and programming skills. The core of Java programming is covered in lectures but most of your learning will come from tutorials and practical sessions built around a series of assignments. These assignments begin with fairly small individual exercises and move onto larger tasks involving design and testing of your programs. In the second semester the exercises are, of course, more advanced and typically finish with a group project involving a networked Java application linking to a remote database system, for instance an online bookshop.

Fundamentals of Computer Science:
Four modules explore some of the fundamentals of computer science, both hardware and software. Topics will include: introduction to hardware, operating systems, networking, programming languages, data types and algorithms, the software lifecycle, stages of the lifecycle, case studies, relational theory, relational algebra, query languages, data design. The necessary mathematical background will be developed alongside its application in databases. Students will be introduced to an existing database system.

Specialist modules
Human-Computer Interaction covers the principles meant for building computing systems that interact with human users in a synergistic way. It draws on foundations in human psychology and graphic design and develops interaction models.

Introduction to Artificial Intelligence introduces the subject of how we can build computing systems that incorporate some aspects of intelligent behaviour such as logical reasoning, problem solving and automatic learning.

Programme structure

<table>
<thead>
<tr>
<th>Semester 1</th>
<th>Semester 2</th>
<th>June–September</th>
</tr>
</thead>
<tbody>
<tr>
<td>Software Workshop</td>
<td>Software Workshop</td>
<td>Software Project and Dissertation</td>
</tr>
<tr>
<td>Fundamentals of Computer Science</td>
<td>Fundamentals of Computer Science</td>
<td></td>
</tr>
<tr>
<td>Human Computer Interaction</td>
<td>Artificial Intelligence</td>
<td></td>
</tr>
<tr>
<td>Optional module</td>
<td>Operating Systems and Networks</td>
<td></td>
</tr>
</tbody>
</table>
Operating Systems and Networks gives an overview of the design of computer operating systems and computer networks. It also provides an opportunity for hands-on lab sessions for learning about a selection of essential Operating Systems and Network skills.

Optional modules
All students select at least one optional module. In addition, students that may have taken any of the compulsory modules in their previous curriculum or have specific interest in some subject may opt to take additional optional modules. The modules available vary from year-to-year. The range of modules include: Software Project Management, Commercial Computing, Cryptography, Evaluation Methods and Statistics, Intelligent Data Analysis, Introduction to Neural Computation and Machine Learning.

An option checker, together with the module descriptions are available at: www.cs.bham.ac.uk/internal/programmes/current/MScCS.html

Summer project
The four summer months are spent working on your project. Projects vary from applied software engineering through to work that is linked to our research groups. The common factor is that almost all projects involve the development of a large software system. Usually, projects are selected from a list of topics proposed by the teaching staff (possibly on behalf of an external customer) or students can suggest their own project, providing it is appropriate.

Examinations and assessments
The Software Workshop is currently assessed by assignments in the practical sessions, team project as well as a final examination. Taught modules are assessed in a variety of ways: summer written examination, practical assessment or a mixture of both. The project is assessed by a report, supported by a practical demonstration.

Entry requirements
This degree will allow graduates to gain an understanding of the fundamentals of computer science and practical software development skills that prepares them to become computer professionals. The minimum entry requirement for admission is a Lower Second class degree (or an international equivalent). Applications are accepted from able graduates from all subject areas. Students who have not studied in English must pass a recognised English test.

Student profile
Ashley Robertson
MSc Computer Science Student (2014)

‘I applied to study for an MSc Computer Science because I wanted to move into a career in the field after studying Mathematics at undergraduate level. I chose to study the degree at the University of Birmingham as the department had a great reputation and was ranked first in the country in some league tables. Both the University and the School also have good connections with many top employers, providing me with a great opportunity to find the right job for me when I graduate.

The best thing about the programme is the ability to cater to students with no previous knowledge of Computer Science, whilst also challenging and expanding the knowledge of students who may have some previous experience in the subject. This is great for anyone looking to get a well-rounded education in Computer Science in only a year.’

Read Ashley’s full profile – www.birmingham.ac.uk/ashley-robertson

Owen Davies (2011)
Position: C++ Programmer
Employer: Delcam

The MSc Computer Science was an excellent blend of practical programming skills with theoretical background. The best thing about my current job is the problem solving aspect of programming, the excitement of figuring out the answer to the problem you’ve been banging your head against.

Read Owen’s full profile – www.birmingham.ac.uk/owen-davies
Subject at a glance

Mode(s) of Study: Full-time
Duration: 1 year
Entry Requirements: 2:1 (Hons) degree in a computing or closely related discipline; including object-oriented programming and data structures and algorithms
Start Date: September
Admissions Tutor: Dr Shishir Nagaraja
Tel: +44 (0)121 415 8742
Email: msc-admissions@cs.bham.ac.uk

Programme Structure

<table>
<thead>
<tr>
<th>Semester 1</th>
<th>Semester 2</th>
<th>June–September</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer Security</td>
<td>Network Security</td>
<td>Research Project and Dissertation</td>
</tr>
<tr>
<td>Cryptography</td>
<td>Secure Programming</td>
<td></td>
</tr>
<tr>
<td>Options</td>
<td>Options</td>
<td></td>
</tr>
</tbody>
</table>

The programme aims to:

- Allow students to obtain knowledge and expertise to evaluate, design and build secure computer systems
- Provide exposure to and experience with technologies and standards for such systems
- Provide a solid foundation for graduates to pursue a career in the software industry or research

Overview

Computer security aims to protect assets against threats through the identification and mediation of risks. It attempts to preserve the confidentiality, integrity and availability of a user’s interaction with data, services and devices.

Last year, two-thirds of UK businesses suffered at least one pre-meditated or malicious incident. The average cost of an organisation’s most serious security incident was roughly £10,000 and in large companies this figure was closer to £120,000. Around 50% of these incidents were due to infection by a computer virus, despite the vast majority of companies using anti-virus software (Statistics from British Chambers of Commerce).

Computer security is about designing systems which resist attack. As computers become ever more prevalent and ever more connected with each other, the opportunities for attackers become greater; and the need to resist them becomes more urgent.

Computing infrastructure is now vital for communication, government, commerce and control of our physical environment. Graduates who understand computer security technologies and best practice in the industry are in great demand.

The MSc in Computer Security is a one year full-time programme for students who have graduated in a computing-related discipline and want to learn advanced computer security technologies. It covers the theory and practice of designing and building secure systems. It provides a firm grounding in cryptography, network security, and secure programming, as well as having modules in topics such as operating systems, safety critical systems, distributed systems, and databases. The programme gives practical experience with technologies and tool kits for building internet-based software. The programme covers security in mobile and pervasive systems, and security in consumer systems such as copy protection mechanisms for entertainment content and software. Fundamental questions such as how one should balance ones individual need for privacy with another’s wish for security are also addressed. All students undertake a large, individually supervised project in the final four months of the course.

Industrial relevance of the MSc Computer Security is guaranteed by an Industrial Panel consisting of key industrialists who have influenced the development of the curriculum. Our programme includes a selection of speakers from industry (some of them members of the panel) giving lectures on current practice.

Career prospects

Graduates of this degree are provided with the knowledge to become leaders in the field of computer security and to understand and apply the technologies that will be developed in the future. They are equipped to move into the software and IT industry to work on secure software development, or to become computer security consultants. They may also choose to move on to PhD research, either at Birmingham or elsewhere in the UK and abroad, to shape the technologies that will be developed in future.
The growing need for specialists in computer security has been repeatedly highlighted in government reports the world over.

**Core module descriptions**

**Computer Security**
Introduces a range of topics in computer security. After presenting the theory of computer security, it covers common ways to attack systems and the best counter measures.

**Cryptography**
Presents the fundamentals of cryptography, as well as its applications and issues concerning how cryptography is used in practice.

**Network Security**
Introduces the threats and attacks which may be perpetrated on computer networks, and some of the mechanisms designed to address them. Some technology case studies are presented and evaluated.

**Secure Programming**
Presents secure programming principles and architectures with a focus on Java. It introduces other secure platforms such as smart cards and trusted platforms.

**Summer project**
The four summer months are spent working on an extended project under the supervision of one of the school’s computer security researchers. This typically involves designing and implementing a secure system, or looking for security holes in an existing system. Past projects have examined the security of RFID, bank cards, built security checking tools, and implemented new security features for iPhone.

**Optional modules**
Students select 4 optional modules. The modules presented will vary from year-to-year. The range of modules include:

- Advanced Topics in Functional Programming
- Advanced Human Computer Interaction
- Commercial Computing
- Compiler and Languages
- Evaluation Methods and Statistics
- Enterprise Systems
- Individual Study 2
- Internet Security Seminar
- Machine Learning
- Networks
- Operating Systems
- Distributed and Parallel Computing
- Principles of Programming Languages
- Graphics 2
- Intelligent Data Analysis

An option checker, together with the optional module descriptions are available at: [www.cs.bham.ac.uk/\~internal/programmes/current/MScCSec.html](http://www.cs.bham.ac.uk/~internal/programmes/current/MScCSec.html)

**Examinations and assessments**
As you would expect, assessment is by both practical and written coursework and examination. The project is assessed on the basis of a practical demonstration and a written report; the Internet Computing Workshop is assessed by practical work, including a substantial group project.

**Entry requirements**
Our minimum entry requirement is an Upper Second Class degree or an international equivalent in Computing or a closely related discipline. If your degree has a GPA score, we consider applicants with a GPA of 3.5/4.0. Your first degree must be in one of the computing disciplines. The entrants must have a solid foundation in programming and knowledge of data structures and algorithms. In particular, knowledge of object-oriented programming will be a strong asset. Students who have not studied in English must pass a recognised English test.

---

**Graduate profile**

**Funmi Onolaja (2008)**

**Position:** Security Consultant

**Employer:** Accenture

'I chose the University of Birmingham after doing some research on league table rankings. The School of Computer Science had a very high ranking with a good reputation. I have completed both my Masters degree in Computer Security and my PhD in Computer Science at the University. My advice to current students would be to make the most of the resources available to you at University. Ask questions to your lecturers and tutors if you are unclear about something.'
MSc Human Computer Interaction
www.birmingham.ac.uk/mschci

The programme aims to:

Our aim is to provide a flexible programme of study to suit your background, interests and ambitions. In particular, we want to:

- Provide students with the core knowledge and skills to design, build and evaluate HCI systems
- Allow students to develop a deep understanding and expertise in the specialist sub-area of HCI where they want to focus
- Equip students to undertake a successful career in commercial HCI design or development
- Prepare students for a career in Research and Development in HCI

Overview
The discipline of Human Computer Interaction is about many things: it is about the interface that a system provides (and, therefore, is the most important and most complex component of most systems) but it is also about so much more. We need to understand the people that use the systems and their abilities and constraints. We need to understand how to build systems that really work and also how to evaluate them. We also need to be able to think creatively in order to build innovative solutions to new problems and emerging applications and domains – to be able to solve the problems of tomorrow’s world rather than just those of today.

This course covers the underpinning theories, methodologies and practices of HCI. It includes specialist modules in application domains.

Through course and project work your degree is intimately integrated into the research of the University’s HCI Centre.

This is a one year, full-time course consisting of 180 credits. Students will spend a good proportion of time studying taught modules the core principles, theories, methodologies and application areas of the discipline will be covered. There will also be an opportunity to take optional modules in other areas. You will also have the chance to undertake one or two mini-projects (as part of your optional module choices). Here you will work one-to-one with one of our research-active staff to explore an area in great depth – analysing the problem and existing solutions, developing new ideas and building or evaluating prototype systems.

You will develop your skills in analysis, research, and technology, and also in presenting and explaining your work clearly and effectively.

The final four months will be spent extending the work of one of your mini projects, again with expert one to one supervision.

The course will be taught through a variety of methods. There will be some small lecture classes, problem-based workshops and also one-to-one supervision. There will be some group work as part of the taught modules.

There may be opportunities for some industry-based project work. Perhaps most importantly, you will be part of a small, highly qualified group of students working closely with researchers within the HCI Centre.

Career prospects
HCI spans all stages of the technological lifecycle from the conceptual planning required to design an interactive system, to evaluating the ways in which technology supports people’s practices. The application of HCI is relevant to a number of industries including health care, games and entertainment and mobile communication.

Graduates of this degree will have the skills to take a wide range of roles in industry such as user experience, interactive design or information architecture. Through the course you will not only have become a specialist in HCI but also have built the skills of analysing and researching new problems, of constructing creative and innovative solutions and of presenting and explaining your work clearly and effectively.
Graduates of this programme are well prepared to continue their studies through research for a PhD. Many students choose this stream, but the demand for experts in Human Computer Interaction are such that the opportunities for successful careers in industry and commerce are also great and tempting.

Core modules
The core modules aim to provide all students with the key knowledge to build a successful career in HCI. These will cover:
- The theoretical underpinning of HCI such as cognitive models and the constraints that human performance places on HCI systems
- Techniques for HCI evaluations: designing and conducting experiments, analysis of results
- HCI design methodologies
- Application areas such as Mobile and Context Aware systems, Affective Interfaces

Optional modules
Students are able to take optional modules (including mini-projects) outside of the core HCI programme. These can allow you to focus your studies more deeply into an area in which you are especially interested, for instance, speech, natural language. They also allow you to explore other parts of Computer Science. Some students will be interested in areas such as Robotics, Security or Neural Computation – either as an application area for their HCI work or as an enabling technology. We also offer other optional modules, ranging from Commercial Computing, Cryptography, Machine Learning to Interactive Systems Design. The full list of taught and optional modules is available here: www.cs.bham.ac.uk/internal/programmes/current/MScHCI.html

Research skills
This module provides you with the basis of transferable knowledge and skills necessary for a successful career in industry or academia, with a particular orientation to computing-based disciplines. You will learn how to find and critically evaluate previous work as well as how to present your proposals and results effectively.

Mini projects
Each student undertakes a piece of research work related to HCI that can be seen as preparation for a possible final summer project under the supervision of a research-active member of academic staff. Supervision and the written report should address the development of skills in defining aims, objectives and plans; project and time management skills; systematic literature searching and written and verbal communication skills.

More than anything else, these mini-projects allow you to explore and develop new ideas and approaches and help you to explore a particular area in great depth.

There is no requirement for a mini-project to include development of software.

Projects are either negotiated from a list of academic staff’s interests or are developed from a student’s original idea.

Examinations and assessments
As you would expect, assessment is by both practical and written coursework and examination. The project is assessed on the basis of a practical demonstration and a written report.

Entry requirements
The minimum requirement is an upper second class degree. Most students will have either a first class or a high upper second class degree. You should, typically, be in the top 15% of your year. Most students will have a background in Computer Science or Computer Engineering, but we will also consider students from other disciplines (eg. Psychology or Design) who will then follow a modified programme.

It is through the mini-projects and the final project that you can really develop the skills, knowledge and expertise that you need. Projects can be very varied. They may be design focussed where you concentrate on building your skills for designing and building real-world systems. They may focus on the experimental evaluation of systems. It might also be that the work is research oriented – trying to develop novel techniques or understanding fundamental principles. The emphasis will depend upon your interests and the project will be developed in collaboration with your supervisor.

Students should demonstrate an ability to define aims, objectives and plans, manage their project and time, use the results of systematic literature searches and communicate in writing and verbally. You don’t need, necessarily, to develop a program as part of the project, although that is usual.

Projects can be very varied. They may be design focussed where you concentrate on building your skills for designing and building real-world systems. They may focus on the experimental evaluation of systems. It might also be that the work is research oriented – trying to develop novel techniques or understanding fundamental principles. The emphasis will depend upon your interests and the project will be developed in collaboration with your supervisor.

Examinations and assessments
As you would expect, assessment is by both practical and written coursework and examination. The project is assessed on the basis of a practical demonstration and a written report.

Entry requirements
The minimum requirement is an upper second class degree. Most students will have either a first class or a high upper second class degree. You should, typically, be in the top 15% of your year. Most students will have a background in Computer Science or Computer Engineering, but we will also consider students from other disciplines (eg. Psychology or Design) who will then follow a modified programme.
MSc Robotics
www.birmingham.ac.uk/mscrobotics

Subject at a glance
Mode(s) of Study
Full-time
Duration
1 year
Entry Requirements
2:1 (Hons) degree in a relevant subject (Computer Science, Electronic Engineering, Physics, Mathematics or Mechanical Engineering), plus programming experience
Start Date
September
Admissions Tutor
Dr Michael Mistry
Tel: +44 (0)121 415 8742
Email: msc-admissions@cs.bham.ac.uk

This programme aims to:
- Provide students with the theoretical and practical underpinnings of robotics science and technology, focusing on key concepts in perception, control, and autonomy.
- Allow students to deepen their knowledge and obtain practical skills in selected areas of robotics through individual project work supervised by research-active members of staff.
- Prepare students for a successful career in industrial/commercial robotics engineering or in robotics research and development.

Overview
The MSc in Robotics is a one-year full-time degree for graduates of numerate disciplines allied to robotics, including electronic engineering, computer science, mechanical engineering, physics and mathematics. Students will learn theories of intelligent robotic control and software tools required to implement standard algorithms in mobile robots and robot manipulators. Entrants to the programme should have a good level of mathematical ability in probability theory, linear algebra, and mathematical analysis, and the ability to program in either C/C++ or Java.

You will take three compulsory modules in which you will study robotics to an advanced level. You will also work on at least one mini-project. Here you will work one-to-one with one of our research-active staff to explore an area in great depth – analysing the problem and existing solutions, developing new ideas and building or evaluating prototype systems. You will develop your skills in analysis, research, technology and also in presenting and explaining your work clearly and effectively.

In addition, you will be able to take several optional taught modules from various fields. All students work on a research project in an area of robotics over the summer, again with expert one-to-one supervision.

The course will be taught through a variety of methods. There will be some small lecture classes, problem-based workshops and also one-to-one supervision. There will also be some group work as part of the taught modules. There may be opportunities for some industry-based project work. Perhaps most importantly, you will be part of a small, highly qualified group of students working closely with researchers within the robotics lab.

Career prospects
Through the course you will become a specialist in robotics. Graduates from this programme will be well-equipped for software development roles in the robotics industry or research and development roles, or to go on to pursue a research degree in robotics.

Programme structure

<table>
<thead>
<tr>
<th>Semester 1</th>
<th>Semester 2</th>
<th>June–September</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Semester</td>
<td>Second Semester</td>
<td>Final project and Dissertation</td>
</tr>
<tr>
<td>Mini Project (optional)/Optional Modules</td>
<td>Mini Project</td>
<td></td>
</tr>
<tr>
<td>Research Skills</td>
<td>Core and Optional Modules</td>
<td></td>
</tr>
<tr>
<td>Core Modules</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Programme structure

In addition, you will be able to take several optional taught modules from various fields. All students work on a research project in an area of robotics over the summer, again with expert one-to-one supervision.

The course will be taught through a variety of methods. There will be some small lecture classes, problem-based workshops and also one-to-one supervision. There will also be some group work as part of the taught modules. There may be opportunities for some industry-based project work. Perhaps most importantly, you will be part of a small, highly qualified group of students working closely with researchers within the robotics lab.

Career prospects
Through the course you will become a specialist in robotics. Graduates from this programme will be well-equipped for software development roles in the robotics industry or research and development roles, or to go on to pursue a research degree in robotics.
Core module descriptions

**Advanced Robotics**
Concerned with robot motion in a physical world, this module introduces the concepts and tools for modeling, simulating, and controlling dynamic robots. In a series of lectures we will study the fundamentals of manipulation including kinematics, dynamics, and control. Lab exercises will reinforce learned concepts by means of evaluation on a (real/simulated) physical robot.

**Intelligent Robotics**
This module is designed to give an appreciation of the issues that arise when designing complete, physically embodied autonomous agents. Some of the most popular methods for controlling autonomous mobile robots are introduced and hands on experience of engineering design is given. Lab exercises, lectures and workshops encourage independent thought on possible cognitive architectures for autonomous agents.

**Robot Vision**
Vision is one of the major senses enabling humans to act (and interact) in (ever) changing environments. In a similar vein, computer vision should play an equally important role in relation to intelligent robotics. This module focuses on the fundamental computational principles that enable conversion of an array of picture elements into structural and semantic entities necessary to accomplish various perceptual tasks. In a series of lectures, we will study the problems of low level image processing, recognition, categorisation, stereo vision, motion analysis, tracking and active vision. The lectures will be accompanied by a series of laboratory exercises where many of these computational models will be designed, implemented and tested in real-world scenarios.

Optional modules
Students select up to three optional modules. The modules presented will vary from year-to-year. The range of modules include: Advanced Robotics, Computational Vision, Graphics 2, Intelligent Data Analysis, Intelligent Robotics, Introduction to Evolutionary Computation, Introduction to Neural Computation, Machine Learning, First semester mini-project and Second semester mini-project.

An option checker, together with the optional module descriptions are available at: www.cs.bham.ac.uk/internal/programmes/current/MScRob.html

**Final project**
Over the summer students work on a project which allows them to demonstrate professional competence in a substantial robotics-related task and to apply material learned in other components of the degree programme. Projects are chosen from staff suggestions or are developed from the student’s original idea. The project may be completed in industry in the form of a work placement under the lead supervision of an academic member of staff from the School.

Examinations and assessments
Assessment is by both practical and written coursework and examination. Projects are assessed on the basis of a practical demonstration and a written report.

Entry requirements
The minimum entry requirement is an Upper Second Class degree or an international equivalent in Computer Science. Degrees in Electronic Engineering, Physics, Mathematics, Mechanical Engineering, or other numerate disciplines will be acceptable only if the student can show programming experience equivalent to that in a BSc Computer Science in either Java or C/C++.

---

**Student profile**

Emmanuel Johnson
MSc Robotics Student (2014)

‘I applied to the MSc Robotics programme because it allowed me to study specifically what I was interested in. Most Schools around the world do not offer degrees in Robotics. The best part of my programme is the professors. They are experts in Robotics and they make themselves accessible. This allows you to gain the knowledge not offered in textbooks or online. They provide the support and insight I think all students need when trying to build their knowledge-base in any domain of robotics.

If you are looking to work and learn from some of the best, then the University of Birmingham is the place for you. Understand that obtaining a MSc in Robotics will not be easy but will prepare you to tackle some interesting robotics problems.’

Read Emmanuel’s full profile – www.birmingham.ac.uk/emmanuel-johnson
MRes Natural Computation

Subject at a glance

- Mode(s) of Study: Full-time
- Duration: 1 year
- Entry Requirements: 2:1 (Hons) degree as a minimum
- Start Date: September
- Admissions Tutor: Dr Shan He
  - Tel: +44 (0)121 415 8742
  - Email: msc-admissions@cs.bham.ac.uk

The programme aims to:

The MRes is a Masters degree by research. This means that you are taught core principles and then develop these skills by doing interesting, innovative research, supported by academic staff and peers. This is structured so that you learn how to plan, organise and manage your time; you learn what it is to be a scientific researcher; you help contribute to the development of new knowledge; you learn intellectual skills such as argumentation, exposition, and reasoning; and you develop as an individual by improving your communication skills, writing, collaborative working and creativity.

The programme is designed for highly competent students who are keen on research-oriented Masters programmes. It consists of a mini-project and a major research project, which will be two-thirds of the entire Masters programme. You will also study essential Research Skills, and a further 20 credits of optional modules from the following list:

- Introduction to Evolutionary Computation
- Introduction to Neural Computation
- Intelligent Robotics (Extended)
- Intelligent Data Analysis (Extended)

An option checker, together with the optional module descriptions are available at: www.cs.bham.ac.uk/internal/programmes/current/MResNC.html

Programme structure

<table>
<thead>
<tr>
<th>Semester 1</th>
<th>Semester 2</th>
<th>June–September</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Semester Mini Project</td>
<td>Options</td>
<td>Research Project and Thesis</td>
</tr>
<tr>
<td>Research Skills</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Options</td>
<td>Research Project and Thesis</td>
<td></td>
</tr>
<tr>
<td>Research Project and Thesis</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Natural computation is the study of computational systems that use ideas and gain inspiration from natural systems, including biological, ecological and physical systems. It is an emerging interdisciplinary area in which appropriate techniques and methods are studied for dealing with large, complex, and dynamic problems.

The aims of this programme are to:
- Meet the increasing need from industry for graduates equipped with knowledge of natural computation techniques.
- Provide a solid foundation in natural computation for graduates to pursue a research and development career in industry or to pursue further studies (eg. PhD).
- Give up-to-date coverage of current topics in natural computation (such as evolutionary algorithms, co-evolution, evolutionary design, nature-inspired optimisation techniques, evolutionary games, novel learning algorithms, artificial neural networks, theory of natural computation).

Career prospects
We have strong links with industry, especially through CERCIA, including Honda, BT, Thales, Unilever, GSK, Rolls Royce, etc. We encourage MRes students to carry out their research projects in collaboration with our industrial partners. Opportunities exist for students to do their project work within a company.

First semester mini project
This module consists of a research project on the in-depth investigation of a chosen topic coming from industry (strongly encouraged) or academe.

Research skills
This module provides you with the basis of transferable knowledge and skills necessary for a successful research-oriented career in industry or academia, with a particular orientation to computing-based disciplines.

Research project
The research project consists of solving a substantial problem using natural computation techniques (including hybrid techniques). Industrial co-supervisors will be used whenever appropriate. The research project requires you to apply the knowledge and skills you acquired in the programme to solve a difficult problem.

Examinations and assessments
The taught modules will be assessed by a mixture of written examinations and continuous assessment. The first semester mini-project will be assessed by a written report. You will write up your research project in the form of a thesis, which will be examined by an internal and an external examiner.

Entry requirements
At least an Upper Second Class (2.1) degree or an international equivalent in Computer Science or Engineering with significant computing content. Applicants must possess competent mathematical skills. Students who have not studied in English must pass a recognised English test. This is a highly selective Masters programme and only a limited number of places are available.
PhD/MSc by Research Computer Science

Science today is a collaborative process
At Birmingham, we work closely in small teams of researchers embedded within a broad and lively research culture. This combination means you get the necessary focus, while keeping an eye on the bigger picture in which your work is placed. In consequence, we believe that this school is an outstanding place to complete a research degree.

Nurturing and monitoring PhD students
We offer supervision for the PhD and MSc by Research in Computer Science. Most of our students are full-time, but a small number are part-time, usually working for UK companies. The supervision process usually takes the form of weekly meetings, although the frequency will vary according to need, at which ideas are exchanged, help is offered and written work is discussed.

We give the quality of our supervision and the monitoring of progress special attention. As a consequence of this, we are proud that in the past three years, we have had two winners and one runner-up in the British Computer Society (BCS) Distinguished Dissertation competition for outstanding PhD theses. We are the only computer science department to have achieved this.

Research themes
The staff and research students are loosely organised into informal research themes. Researchers are free to contribute to one or more themes and each theme organises its own activities. Cross-disciplinary research is a major feature of the school. Links exist with, for example, psychology, medicine, language studies and electronic engineering.

Supervision is arranged on an individual basis in order to match closely the interests of the student with those of the supervisor. We can only offer supervision in the areas in which we have academic expertise. These include:

- Artificial Intelligence
- Reasoning and Cognition covers research on architectures for accounting for human mental states and processes as well as recreating them in computer programs.
- Robotics research focuses on intelligent robotics and related areas, including cognitive robotics, learning robots, fault diagnosis, machine learning and sequential decision-making.
- Natural Language Processing includes metaphor understanding; emotion detection; temporal information analysis; speech recognition; corpus analysis.
- Nature-inspired Computation
- Natural Computation covers both basic and applied research in areas including evolutionary computation, neural computation, artificial life, self-organising systems, emergent behaviours, machine perception, evolutionary robotics, complex adaptive systems, swarm intelligence and real-world applications.
- Image Interpretation draws upon multidisciplinary research on computational techniques for image interpretation. The core activities relate to medical imaging and aim to develop diagnostic aids, which quantitatively characterise the properties of body tissues and organs.
- Computing and Systems
- Computer Security concerns techniques such as cryptography and access control to ensure confidentiality and integrity of data, whether in transit or on phones, laptops or servers in the cloud. Our group focuses on designing new systems and analysing existing systems to verify their security priorities. This includes developing mathematical techniques as well as software tools.

Human Computer Interaction promotes leading-edge research and development in theories, designs, methodologies, and systems to support people in whatever they want to achieve. Work includes visualisation, intelligent interaction, data mining, ubiquitous and mobile computing. The group acts as a focal point for research, development and expertise in anything that has the user at the core.

Modelling and Analysis of Systems centres on languages and formalisms for modelling complex systems, particularly those involving randomness, as well as software tools for their analysis. The analysis methods include simulation and verification via model checking.

Software Engineering focuses on methods and techniques for the development of large and complex software and systems, especially in the areas of: cloud, service orientated architectures, software tools and automated code generation. Our research spans over theoretical as well as practical aspects and has resulted in a number of popular software products.

Theoretical Computer Science

Theoretical Computer Science explores fundamental concepts in computation and programming language semantics. This often involves profound and surprising connections between different areas of computer science and mathematics. From category theory to λ-calculus and computational effects, from topology to constructive mathematics, from game semantics to program compilation, our research is diverse and continues to provide new insight and underlying structure.

For more details on our research themes and a list of research group members visit [www.cs.bham.ac.uk/research](http://www.cs.bham.ac.uk/research)
Scholarships and bursaries

Funding for Taught Degrees
Both the University and the School of Computer Science offers scholarships and bursaries annually for both Home/EU and International students wishing to study for a Masters degree in a Computer Science subject. Scholarships are awarded to students who have achieved, or expect to achieve, excellent academic results.

Paul and Yuanbi Ramsay MSc Bursary
For Home/EU students there are two MSc bursaries which cover the full current Home/EU tuition fee. Applicants must be from a low income background or in receipt of benefits. Applications should be made through the Student Funding Office using the form available from the scholarships web page.

International Student Masters Scholarships
A £3,000 scholarship will be awarded to a number of privately funded, full fee paying, international masters students. Applicants must have accepted an unconditional offer on one of the School’s MSc programmes. These scholarships are open to students from outside the European Union. Nomination is by the School of Computer Science only. Please indicate that you wish to be considered when completing your application to study an MSc.

Learn more
www.cs.bham.ac.uk/admissions/postgraduate-taught/scholarships.php

Funding for Research Degrees
Our research students are funded from a variety of sources. We have a number of school scholarships available to our research students. All of our scholarships are by nomination only, and no separate application is required. Other studentships may be available from funding sources under the control of the supervisor, and applicants should discuss this with potential supervisors. The current scholarship opportunities include:

The Li Siguang Scholarship
The University of Birmingham offers 18 PhD scholarships for students from China. For the Li Siguang Scholarship scheme, you first need to apply for a PhD place here. Once you have an unconditional offer for PhD study, you then need to make a separate application to the China Scholarship Council. Further information can be found at www.birmingham.ac.uk/scholarships/lisiguang

Learn more
www.cs.bham.ac.uk/admissions/postgraduate-research/scholarships.php

School of Computer Science Teaching Assistantships
For UK and European students, financial support from the School is normally conditional on the student contributing to the School’s teaching as a teaching assistant. Our teaching assistants are registered for a part-time research degree, working 75% of their time on their research and 25% of their time on teaching duties – which can vary from demonstrating to tutoring and organising schedules. Maintenance payments are based on the EPSRC minimum annual rate. For more information visit www.epsrc.ac.uk

Learn more
www.cs.bham.ac.uk/admissions/postgraduate-research/scholarships.php

Postgraduate Taught
www.birmingham.ac.uk/postgraduate/pgt-fees/index.aspx

Research
www.birmingham.ac.uk/postgraduate/dr-fees/index.aspx
Our careers and employability programme includes recruitment fairs, presentations, workshops and orientation sessions. In addition to the University recruitment fairs which attract a large number of national and international employers to campus, the School of Computer Science organises its own specialist fairs. These are aimed at careers in software, systems, emerging technologies, consultancy, social, cloud and financial computing. We host some of the top national and international firms including Microsoft, IBM, Cisco, Oracle, BAE Systems, PwC, BT, Deloitte, IBM, Goldman Sachs, Morgan Stanley, Facebook, J.P. Morgan, Bank of America, Bank of England, NHS, UBS, Capgemini, Credit Suisse among many others.

The School has also initiated the ‘Employers in Residence’ scheme, where high profile employers set up a recruitment desk in the School providing assistance and guidance on the application process. Employers use this opportunity to promote a vacancy or scheme, recruit on the spot for certain openings, ‘headhunt’ the best students, collect details of interested students and even sometimes to interview candidates from our School. International students from China and India returning home also benefit from events where they have the opportunity to meet representatives from high profile companies in India and China and learn about the latest labour market trends. Leadership training is integrated with the curriculum of our postgraduate courses. We take an active role in a number of community and grand challenge events; recent examples have included the Televised Capgemini India and University of Birmingham Super Techies Show; and the College of Engineering and Physical Sciences Grand Challenge.

We also participate in the Global Challenge Bursary programme, which allows students to apply for up to £9,000* to spend the summer as an intern at a top global company. They also have access to the Gateway bursary scheme, through which the University provides financial support to students undertaking internships or work experience linked to their future career. Students can claim up to £2,000* towards a low or unpaid work experience position taking place in the summer.

A wide range of careers and employability services are also offered by the University, for example, the careers database, featuring over 2,000 graduate job vacancies and internship opportunities targeted at University of Birmingham students. Our students enjoy the support of specialist college internship officers, careers and industrial liaison tutors and advisors for advice on finding jobs and placements, writing CVs and application forms and succeeding in interviews.

Employers of our graduates include Microsoft, IBM, Google, Cisco, Oracle, Apple, HP, Accenture, BT, Cisco, BUPA, European Space Agency, Expedia.com, Goldman Sachs, Logica, Honda, Rolls Royce, QinetiQ, Siemens, Deloitte, Sony, Citi, UBS, PwC, GCHQ, Credit Suisse, BAE Systems, Morgan Stanley, J.P. Morgan, Bank of America, Bank of England among others.

*Subject to review

Robert Savage (2007)
Position: Digital Forensic and E-Disclosure Manager
Employer: CCL Group

‘I graduated with an MSc Computer Security in 2007. I have always had an interest in computers so a degree in Computer Science was the obvious choice for me. During my undergraduate degree I developed an interest in computer security which led me down the route of doing a masters. On graduating from the University of Birmingham I began working at PricewaterhouseCoopers where I was involved in providing digital forensic support to a number of multinational fraud and bribery investigations. I stayed at PwC for 4 years at which point I moved into a 18 month role helping banks and insurers prevent and detect consumer application fraud. I have now been at CCL for 2 years during which time I have been focussed on supporting the development of the Legal and Corporate markets.’

Read Robert’s full profile – www.birmingham.ac.uk/robert-savage
The University of Birmingham has an excellent reputation among employers. The faculty and the infrastructure is world class, fostering research and analytical skills in their graduates. After graduating with Masters in Natural Computation I was offered a research position in another university. It was my responsibility to integrate and apply the concepts of evolutionary computation to their design process. I was involved in the complete life cycle of the project starting from gathering functional requirements, right up to application development and testing. After successful completion of the project I have now moved to a world renowned research organisation working on a cutting edge genomics project (computationally aid the process of annotating the functional role of genes). The ability to relate the field of Natural Computation and its application in various domains including genomics has helped me to succeed in this field.

The way I now deal with challenges, the way I see and interpret the ever-changing world of science and life is incommensurably sharper and more effective thanks to my years at Birmingham. Having worked and studied at universities in six different countries, I rank Birmingham at the top without hesitation.

I am a partner at a specialist technology consultancy called Underscore. We provide consulting, training and software development services, predominantly to companies in finance and media. Following my PhD Computer Science I formed a small software development company with fellow graduate Noel Walsh. We found ourselves taking on work from larger and larger customers, so we formed a partnership with several similar companies to create Underscore. There are now ten partners in the UK and Australia and we have customers all over the world.
Application and admissions

Postgraduate entry requirements
The normal minimum admission requirement for all our postgraduate computer science courses is an upper second class degree, but some courses may relax this requirement and accept a lower second class degree. Please refer to the course entry page for specific entry requirements.

How to apply
Applications for all computer science postgraduate programmes are made directly to the University of Birmingham. We receive a considerable number of applications for our programmes. For this reason, it is best to apply before April for the programme starting in September/October.

We will require:
- An application form
  Applications should be submitted online via the individual course finder page – www.pga.bham.ac.uk. Please search for your programme of study.
- Two references
  You must arrange for two references to be sent to us. These should be two academic references (or if appropriate to the programme applied for, one could be from your employer).

Transcripts of grades or marks
We must receive a list of the subjects you have studied in your previous degrees. This list should include the marks or grades you were given for each subject. If you have not finished your degree, you should send a transcript of the grades you were awarded in the previous years.

English language certificate
If your first language is not English, you will need to offer an acceptable English language qualification. Visit: www.birmingham.ac.uk/postgraduate/requirements-apt/international/index.aspx for a list of acceptable English language qualifications for our degrees and the latest required grades.

Once you have submitted an online application you will be sent details of how to enter your applicant portal. Your portal experience will allow you to send and receive communications to and from the University. You will be able to track the progress of your application at every stage of the admissions process; update your personal information, upload supporting documents, view decisions and accept any offers you may receive.

Once you have applied online, please remember the ID number given to your application.

Closing dates
Although there are no formal closing dates for applications to our postgraduate courses, you are advised to apply by April for entry in Late September/Early October of the same year.

Postgraduate Research Only
- Finding a potential supervisor and identifying your research area
  Before submitting your application you should ensure that our school has an appropriate supervisor for your chosen area of research. www.cs.bham.ac.uk/research
- Search for an advertised postgraduate research opportunity via our Doctoral ReSEARCHER page.
  www.birmingham.ac.uk/students/courses/postgraduate/findaphd.aspx
- Statement of research interests (PhD/MSc by Research Only)
  Successful research students must show that they are capable of original and creative thinking. We ask you to write a research plan which includes the following points:
  1. A description of work that you have done or would like to do. This work should have inspired you to want to study for a research degree.
  2. Briefly describe the way or ways in which this work could be extended to make good research topics.
  3. Using one of these research topics, give a plan for carrying through this research. Your plan should show the detailed stages which have to be carried out and so this part should be at least a page long.
  4. Describe any other work you know of that is related to your proposed work.
  5. Explain how your work would be new and useful to other researchers in your field.

Campus tours
Places are strictly limited and need to be booked one week in advance. To receive an information pack or book a place visit www.birmingham.ac.uk/postgraduate/visit/index.aspx

Fees and finance
The University charges an annual fee which includes tuition, examination and graduation, as well as fees payable to the Guild of Students. Fees are usually paid annually in advance at the start of the programme but it is possible for you to pay by instalments providing certain conditions are met. A small charge is made for this service.

Tuition fees
The standard annual tuition fees for Postgraduate taught (MSc) and Postgraduate Research (PhD/MSc by Research) are available at: www.birmingham.ac.uk/postgraduate/pgt-fees/pgfees.aspx

The University Council reserves the right to revise fees at any time without previous notice. You can check the current University fees on the University website.

The University fees do not take into account the cost of accommodation, living expenses, equipment or books. Please visit the UKCISA’s website www.ukcisa.org.uk and click on ‘funding and cost of living’.

Statement of research interests (PhD/MSc by Research Only)
Successful research students must show that they are capable of original and creative thinking. We ask you to write a research plan which includes the following points:
1. A description of work that you have done or would like to do. This work should have inspired you to want to study for a research degree.
2. Briefly describe the way or ways in which this work could be extended to make good research topics.
3. Using one of these research topics, give a plan for carrying through this research. Your plan should show the detailed stages which have to be carried out and so this part should be at least a page long.
4. Describe any other work you know of that is related to your proposed work.
5. Explain how your work would be new and useful to other researchers in your field.

Campus tours
Places are strictly limited and need to be booked one week in advance. To receive an information pack or book a place visit www.birmingham.ac.uk/postgraduate/visit/index.aspx

Fees and finance
The University charges an annual fee which includes tuition, examination and graduation, as well as fees payable to the Guild of Students. Fees are usually paid annually in advance at the start of the programme but it is possible for you to pay by instalments providing certain conditions are met. A small charge is made for this service.

Tuition fees
The standard annual tuition fees for Postgraduate taught (MSc) and Postgraduate Research (PhD/MSc by Research) are available at: www.birmingham.ac.uk/postgraduate/pgt-fees/pgfees.aspx

The University Council reserves the right to revise fees at any time without previous notice. You can check the current University fees on the University website.

The University fees do not take into account the cost of accommodation, living expenses, equipment or books. Please visit the UKCISA’s website www.ukcisa.org.uk and click on ‘funding and cost of living’.

Statement of research interests (PhD/MSc by Research Only)
Successful research students must show that they are capable of original and creative thinking. We ask you to write a research plan which includes the following points:
1. A description of work that you have done or would like to do. This work should have inspired you to want to study for a research degree.
2. Briefly describe the way or ways in which this work could be extended to make good research topics.
3. Using one of these research topics, give a plan for carrying through this research. Your plan should show the detailed stages which have to be carried out and so this part should be at least a page long.
4. Describe any other work you know of that is related to your proposed work.
5. Explain how your work would be new and useful to other researchers in your field.

Campus tours
Places are strictly limited and need to be booked one week in advance. To receive an information pack or book a place visit www.birmingham.ac.uk/postgraduate/visit/index.aspx

Fees and finance
The University charges an annual fee which includes tuition, examination and graduation, as well as fees payable to the Guild of Students. Fees are usually paid annually in advance at the start of the programme but it is possible for you to pay by instalments providing certain conditions are met. A small charge is made for this service.

Tuition fees
The standard annual tuition fees for Postgraduate taught (MSc) and Postgraduate Research (PhD/MSc by Research) are available at: www.birmingham.ac.uk/postgraduate/pgt-fees/pgfees.aspx

The University Council reserves the right to revise fees at any time without previous notice. You can check the current University fees on the University website.

The University fees do not take into account the cost of accommodation, living expenses, equipment or books. Please visit the UKCISA’s website www.ukcisa.org.uk and click on ‘funding and cost of living’. 
Useful contacts

General enquiries
Postgraduate Admissions Team
School of Computer Science
University of Birmingham
Edgbaston
Birmingham
B15 2TT
United Kingdom
Tel: +44 (0)121 415 8742
Fax: +44 (0)121 414 4281
Email: Postgraduate Taught
      msc-admissions@cs.bham.ac.uk
      Postgraduate Research
      compsci-phd@contacts.bham.ac.uk

For information on:

Accommodation
LIVING
Accommodation Enquiries
Tel: +44 (0)121 414 8000
Email: living@contacts.bham.ac.uk

Student fees
Student Funding Office
Tel: +44 (0)121 414 6073
Email: studentfees@bham.ac.uk

This brochure was written several months in advance of the start of
the academic year. It is intended to provide prospective students with
a general picture of the programmes and courses offered by the School.
Please note that not all programmes or all courses are offered every
year. Also, because our research is constantly exploring new areas
and directions of study some courses may be dropped and new
courses offered in their place.