Computer Science

Degree options in the Faculty of Science

MSci (Integrated Masters degree)
Computer Science

BSc (Joint Honours degrees)
Computer Science and one of:
Economics Philosophy
Management Physics P*
Management Science Psychology
Mathematics M* Statistics M*

BSc (Single Honours degree)
Computer Science

M* Requires A* in Mathematics at A-Level.
P* Requires Physics and Mathematics – A at Higher, A at A-Level, HL6 at IB.

Likely grades considered for an offer

We consider all aspects of every application, including context, equivalent qualifications and the Personal Statement and offers may be higher or lower than the grades stated here.

Preference may be given to candidates offering strong science qualifications.

First year entry (see specific subject footnotes above)
SQA Highers: AAAB including A in Mathematics and a Higher in Biology (or Human Biology), Chemistry, Computing Science or equivalent, Geography, Physics, or Psychology
GCE A-Levels: AAA including Mathematics
International Baccalaureate Points: 38 including a 6 in Mathematics at HL (if offered by your school) or SL (if HL not offered by your school)

Second year entry (see specific subject footnotes above)
Direct entry to second year is available for well-qualified applicants. An accelerated programme with extra tutorial support enables a student to graduate with a BSc in three years, or an MSci in four years. Applicants should have some experience in computer programming and may be asked to demonstrate this. Please contact the School for more information.

SQA Highers: AAAB including A in Mathematics and one of Biology (or Human Biology), Chemistry, Computing Science or equivalent, Geography, Physics, or Psychology. Plus AB at Advanced Higher in Mathematics and one of the Higher subjects above and evidence of previous programming experience
GCE A-Levels: AAA including Mathematics and Biology, Chemistry, Computing Science or equivalent, Geography, Geology, Physics, Psychology, and evidence of previous programming experience
International Baccalaureate Points: 39 including a 6 in Mathematics at HL, and evidence of previous programming experience

For full Faculty entrance requirements, see page 53.
“The emphasis on practical work throughout the Computer Science degree, coupled with the ability to focus on areas of interest in Honours years, massively equips students to pursue a career in research or industry after graduating. The approachable and knowledgeable staff are always willing to help, and there is a close-knit community fostered by the Computing Society and the shared labs. This homely environment combined with the world-class academics and research-led teaching means choosing St Andrews was the best decision for me.”

Aniqa (Dundee, Scotland)

Why study Computer Science here?

- Our student:staff ratio is excellent at 11.8:1 (as of 2016-2017).
- Overall satisfaction in Computer Science at 97% in the National Student Survey of 2016.
- In contrast to many ‘leading research universities’, almost all of our lecturers, readers and professors teach and tutor undergraduates every year.
- Students are actively involved in research, through internships and project modules, and often publish in major international conferences.
- Many students spend summers as interns within companies including Adobe, Facebook and Google.
- Students are on first-name terms with staff, through small tutorial groups and labs.
- The student-run St Andrews Computing Society (StACS) offers a very active social group for students interested in computer science. The StACS Facebook page (@StACompSoc) records many of the group’s recent activities, such as sponsored hackathons and pub quizzes, as well as ‘Teach me X’ workshops.
- In addition to StACS events the School organises regular social events, including the Honours Reading Party in the Highlands, School BBQs and pizza and gaming sessions.
- Students often win Scottish, UK and international awards for their coursework such as the TARGET IT and Computer Science Undergraduate of the Year Award.
- World-leading research in human-computer interaction, artificial intelligence, cloud computing and more, is embedded into our teaching at all levels.

Facilities and resources

Practical and small-group teaching takes place within the two Computer Science buildings, with larger lectures in dedicated facilities in adjacent science buildings. You will have 24-hour access to our laboratories (including kitchen facilities), which were refurbished in 2014 and 2016 and are filled with up-to-date Mac, Linux and Windows-based computers.

BSc or MSc?

If you wish to study even more advanced topics in Computer Science, then the MSci (Honours) in Computer Science may be for you. This Integrated Masters degree takes place over five years, with an option for direct entry into the second year. Qualified students can therefore graduate with a Masters degree in four years. The first three years of the MSci are shared with the BSc programmes. In the final two years, you can choose among modules at 4000- and 5000- (Masters) level, enabling both breadth and depth across the discipline. The final year is spent taking 5000-level modules as well as an advanced project. This may take the form of a project within the School, an industrial placement or a research internship, enabling MSci students to build skills that are useful for both academic and industrial careers.

What will I study?

The University of St Andrews is a world-class learning community in which top-level research influences educational design and practice, and all programmes are reviewed and updated on a regular basis. We are currently reviewing and modernising the undergraduate curriculum in the School of Computer Science. The information below is an example of what the curriculum covered in 2016-2017. When the curriculum has been approved, full details will be available online under Subject information – 2018 entry: www.st-andrews.ac.uk/study/ug/prospectus

The School offers single-subject BSc and MSci Honours degrees in Computer Science, plus a range of BSc Joint Honours degrees with other subjects. Our Honours degree programmes are designed to ground you in both the theory and practice of computer science. You will learn how to think and solve problems logically (‘computational thinking’), understand the fundamental principles of how computing systems work, and be exposed to significant new technologies. In the first two years you will learn the basic concepts behind computer science and several different programming languages, and thanks to our flexible degree structure have the opportunity to study modules in other subjects. In two (or three) Honours years you will learn about advanced and cutting-edge topics at the frontier of our subject. A flexible degree structure means that it is possible to change your degree direction during the first two years, while direct second year entry is also possible to any of our BSc or MSci Honours degree programmes. Student satisfaction with our degree offerings is very high.

Computer Science at St Andrews allows you to study in a friendly and intimate environment. Our excellent staff:student ratio and small group teaching will put you on a first-name basis with internationally-renowned researchers and teachers. Ongoing research projects include GAP, a widely-used free software package for applying computers to research problems in pure mathematics. The Human-Computer Interaction group’s work in gesture-based interactions and fonts for representing data, have received much press interest in publications such as New Scientist and Wired. The constraint solver Minion, developed at St Andrews, has been used for applications as diverse as parsing the Sanskrit language, debugging programs, scheduling protein assay equipment, and even for setting crosswords on the web. Research on Open Virtual Worlds has included virtual reconstructions of St Andrews Cathedral, Linlithgow Palace and the Acropolis Basilica in Sparta, which have been used for education and research. This world-class research is applied to teaching at all levels, for example, in Junior Honours projects on sensor networks, Senior Honours projects on natural language processing or constraint programming, or even second-year programming exercises on analysing Twitter datasets from the London Olympics.
Computer Science
(continued)

First two years of Computer Science

<table>
<thead>
<tr>
<th>Semester 1</th>
<th>Semester 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS1002 Object-Oriented Programming (core)</td>
<td>CS1003 Programming with Data (core)</td>
</tr>
<tr>
<td>CS1005 Computer Science in Everyday Life or a 20-credit module in another subject</td>
<td>CS1006 Programming Projects or a 20-credit module in another subject</td>
</tr>
</tbody>
</table>

Second year
Four modules each of 30 credits

<table>
<thead>
<tr>
<th>Semester 1</th>
<th>Semester 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS2001 Foundations of Computation (or CS2101 Foundations of Computation (Accelerated) for second-year entrants)</td>
<td>CS2002 Computer Systems (core)</td>
</tr>
<tr>
<td>or a 30-credit module in another subject</td>
<td>or a 30-credit module in another subject</td>
</tr>
<tr>
<td>CS2003 The Internet and the Web: Concepts and Programming or a 30-credit module in another subject</td>
<td>CS2006 Advanced Programming Projects or a 30-credit module in another subject</td>
</tr>
</tbody>
</table>

Computer Science element of your Honours degree

First year (2 x 20-credit modules required)
First year computer scientists take two compulsory modules: Object-Oriented Programming (CS1002), which introduces the basics of programming and object-orientation in the Java language, and Programming with Data (CS1003), which introduces programming for processing data. We also offer two optional 20-credit modules: Computer Science in Everyday Life (CS1005), which provide a broad introduction to computer science issues in a variety of areas ranging from digital cameras to cloud computing, and Programming Projects (CS1006) which gives the opportunity to build sophisticated programs including games and some basic artificial intelligence.

Second year (2 x 30-credit modules required)
Second year has two core modules: Foundations of Computation (CS2001) and Computer Systems (CS2002), which are taken by all Computer Science students. The optional The Internet and the Web: Concepts and Programming (CS2003) covers the design of networked internet applications, while the popular Advanced Programming Projects (CS2006) provides a highly-practical introduction to functional and dynamic programming in the Python and Haskell languages. Subject to satisfactory performance in the second year, you can progress to a single-subject BSc or MSci Honours degree, or a joint BSc Honours degree in Computer Science with another subject.

Honours (third, fourth and optionally fifth years)
The Honours degree programmes are designed with the following aims:

- To provide you with a thorough grounding in the theoretical and practical principles of computer science and to show how computing techniques can be used to analyse problems.
- To provide you with in-depth knowledge of computer science, as well as equipping you with a range of transferable skills.
- To encourage you to explore rigorously the core principles of the subject and to give you an understanding of its intellectual frontiers.

In the two years of the BSc Honours programme, you can choose from a wide range of options. As of the academic year 2016-2017 these include:

- Artificial Intelligence
- Component Technology
- Computational Complexity
- Computer Architecture
- Computer Graphics
- Computer Security
- Concurrency and Multi-Core Architectures
- Constraint Programming
- Data Communications and Networks
- Data Encoding
- Databases
- Distributed Systems
- Human Computer Interaction
- Logic and Software Verification
- Operating Systems
- Programming Language Design and Implementation
- Video Games

Please note – the availability of all modules mentioned above is subject to change according to staff availability or curriculum review (see Curriculum development page 7).
“Coming to study Computer Science at St Andrews was by far the best decision I have ever made. I have never had a time so rewarding and enjoyable in my entire life, whether it be studying the subject that I love or taking part in all the huge variety of things which go on in this small corner of North East Fife. The School of Computer Science is small and homely, making every student feel very welcome regardless of what programming experience they have beforehand, and there is always help available if required.”

Mark (Dumbarton, Scotland)

In your final BSc year, and the MSci year, you can also choose from our wide range of Masters modules and our newest modules including Critical Systems Engineering, Language and Computation, User-Centred Interaction Design and Information Visualisation and Visual Analytics). Other popular Honours modules include the interdisciplinary Communication and Teaching in Science (ID4001), where students are placed in a local primary or secondary school to design and deliver lessons.

Projects
In the Junior Honours year, you undertake a 30-credit team project, with the whole class divided into small co-operating teams. In Senior Honours, BSc Single Honours students undertake a 30-credit (30 or 15 credits for Joint Honours students) individual project with a member of staff, based on personal or research interests. The MSci year involves an entire semester dedicated to an advanced individual 60-credit project, which may be taken in the School or optionally in industry. Individual projects are of a very high standard, often winning prizes, for instance the International Undergraduates Awards in 2015, and the Lockheed Martin Software Engineering Award in both 2014 and 2015.

Reading Party
All Honours students attend a Reading Party in their Junior Honours year. This typically takes place in a large country house in the Highlands, where you and the rest of the Honours class spend three days giving presentations, taking part in outdoor and indoor activities, and generally socialising with other students and staff.

Internships
As an Honours student you may choose to spend one, two, or even three, of your summers in an internship. These may be in the UK, Europe, the US or beyond. In the summers of 2013 to 2016, our students could be found at internships with Accenture, Adobe, AIG, Credit Suisse, Facebook, Google, J P Morgan, McLaren, Palantir, PlanForCloud, Skyscanner, Thales and elsewhere. The School and the University also offer various paid research internships whereby a student can work closely with a research group for eight to ten weeks.

Typical class sizes and teaching information
First year: lectures 72 - 170, labs up to 100, tutorials 6 - 7
Second year: lectures 70 - 104, labs up to 100, tutorials 6 - 7
Honours: lectures, labs and tutorials 9 - 69

We use a wide variety of teaching methods in addition to traditional lectures, with an emphasis on personal and small group teaching. The majority of our students graduate attaining a First Class or Upper Second Class Honours degree.

Typical methods of assessment
Most modules in the School are assessed by at least 40% coursework (with the balance of assessment in the form of written examinations). Project modules are assessed entirely by coursework.

Study abroad
You may apply to study abroad under the University’s St Andrews Abroad programme. See page 22.

Careers
All of our degrees allow graduates to enter into technical, academic, financial or commercial posts at both national and international levels. Employers regard our Computer Science graduates as technically and intellectually capable. A number of employers visit us on a regular basis, including Amazon, Apple, BT, Google, IBM, Skyscanner and Sword Ciboodle. Other recent employers include Accenture, Adobe, CloudSoft, Deloitte, Sky, Dresdner Kleinwort, KPMG, RBS, Thomson Reuters, Logica, Wolfson MicroElectronics, Metaswitch Networks and the Ministry of Defence.

Many of our students enter postgraduate study here at St Andrews (a St Andrews Recent Graduate Discount is available) and at other universities in the UK and abroad, while others enter careers in teaching. Several of our students have also started their own companies. You can follow the activities of our staff, students and alumni using our Twitter lists: @StAndrewsCS/lists

See also page 46 for details of the University’s Careers Centre.

“The School of Computer Science is open and friendly. Its relatively small size enables the students to have close contact with staff members and be treated as an individual. The programme is very flexible, allowing each student to focus on areas they find most interesting. It’s a great place to study and socialise, with the lab open 24 hours.”

Paula (Gdansk, Poland)