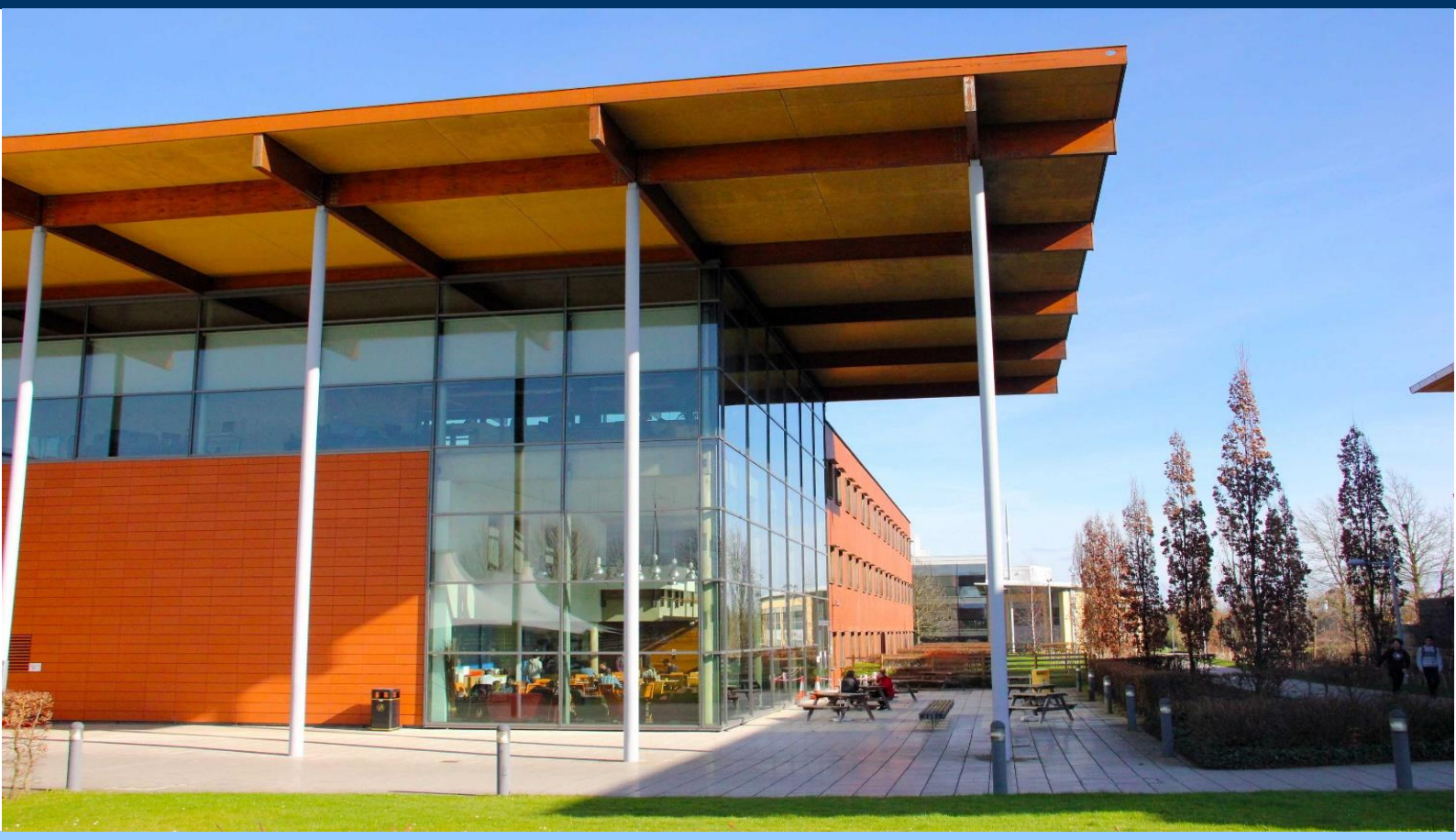
Department of Computer Science and Technology



# PhD in Computer Science

## Course Information for Applicants

UNIVERSITY OF CAMBRIDGE

# *Welcome*

Welcome to the Postgraduate Studies Open Day.

We hope that this brief guide will be of some help but if it you have further questions you are welcome to ask us, Lise Gough, Joy Rook and Marketa Green, the Course Administrators, by email cst-graduate-admissions@cst.cam.ac.uk.

Postgraduate Education Team

## *Contents*


1. DEPARTMENT OF COMPUTER SCIENCE AND TECHNOLOGY ..... - 3 -
2. COURSE FORMAT ..... - 4 -
   - The Basics ..... - 4 -
   - The CPGS ..... - 4 -
   - The Ph.D. examination ..... - 5 -
   - Research Skills Programme ..... - 5 -
3. APPLYING FOR THE PHD ..... - 6 -
   - Applications ..... - 6 -
   - Research Project Proposal ..... - 7 -
   - Funding Competitions ..... - 7 -
4. RESEARCH GROUPS ..... - 8 -
5. STUDENT REPRESENTATION ..... - 10 -
6. WOMEN@CL ..... - 11 -
7. GETTING TO THE LAB ..... - 12 -


# 1. DEPARTMENT OF COMPUTER SCIENCE AND TECHNOLOGY

The Department of Computer Science and Technology was founded in 1937 as the Mathematical Laboratory on the part of the New Museums Site now occupied by the Arup Building. The name was changed to Computer Laboratory in 1969 and the Computing Service was created in 1970 as part of the same department. With effect from 1 October 2017, the name changed to the Department of Computer Science and Technology.

Professor Sir Maurice Wilkes was the Head of Department from 1946 until 1980 when he was succeeded by Professor Roger Needham. In 1996, Roger was appointed Pro-Vice Chancellor of the University. Subsequent heads have been Professor Robin Milner, Professor Ian Leslie, Professor Andy Pitts and currently Professor Andy Hopper.

In 2001 we moved into purpose-built facilities in West Cambridge. Our address is:

Department of Computer Science and Technology
The Computer Laboratory
William Gates Building
15 JJ Thomson Avenue
Cambridge, CB3 0FD

The Department of Computer Science and Technology and is part of the School of Technology along with Engineering, Chemical Engineering and Biotechnology and the Judge Business School. See http://www.tech.cam.ac.uk/Graduate/aboutgrad

The department occupies the ground, first floor and most of the second floor of the William Gates Building. The large central entrance corridor is known as The Street. MPhil students use Teaching Rooms SW01, FS07 and FS09 and the Teaching Laboratory SW02. The Intel Lab in SW11 is a large computer room for undergraduate students.

Research students are typically allocated a desk in a room with two or more other research students or post-doctoral staff near their supervisors during their studies. Rooms are allocated for a period of around three-and-a-half years after which time a student may be moved to the writing-up area if the student has not submitted a PhD dissertation.

Other facilities include a small café on the ground floor which is open 09:30-16:00 Monday to Friday excluding public holidays, and small kitchens around the department. There is also a cafe in the Hauser Forum at the end of JJ Thomson Avenue south of the West Cambridge site. A Sainsbury's supermarket is a ten-minute bike ride away in the new Eddington site, and there is a state-of-the-art Sports Centre on the West Cambridge site.

# 2. COURSE FORMAT

## The Basics

The PhD in Computer Science is a three-year programme of individual research on a topic agreed by the student and the Laboratory, under the guidance of a staff member as the student's supervisor.

All research students are admitted to read for the PhD Degree on a probationary basis and most will be registered for the Certificate of Postgraduate Study (CPGS) in the first instance. During this year students may do some additional coursework and will write a research report that is likely to form the foundation of the eventual PhD dissertation.

## The CPGS

- Research Skills training
- Practical work
- Research report of no more than 10,000 words
- Attendance at research workshops and research seminars.

The CPGS is used as an end of first year assessment exercise. At the end the third full term of the first academic year, a formal assessment of progress is conducted by two independent assessors who make a recommendation about whether a student may be registered, retrospectively, for the PhD Degree. The assessment is based on consideration of the first-year report and thesis proposal, in the form of a single document, and an interview with the assessors. The document is principally a **PhD Proposal** that demonstrates a clear path from the candidate's current position to a complete PhD dissertation at the end of the third year. The document has two purposes:

i. to help the candidate to reflect on and plan their research project and
ii. to allow the Computer Laboratory to assess the student's progress and planned research.

A student who is not recommended to be registered for the PhD will, normally, be awarded the CPGS alone and will leave the University before submitting a PhD dissertation.

Students are expected to complete the substance of their research by the end of their third year, submitting their thesis then or within a few months.

## The Ph.D. examination

The examination for the Ph.D. degree normally consists of two parts:

(1) Scrutiny of a thesis by two Examiners appointed by the Degree Committee, normally one Internal to the University (but not the Supervisor) and one External;
(2) An oral examination involving both examiners and the candidate.

Doctoral degrees are awarded to those who have demonstrated all of the criteria below:

1. a significant contribution to the field of study through the creation and interpretation of new knowledge, connection of previously unrelated facts or the development of new theory or revision of older views;

2. submission of work of a quality in whole or in part of a standard to merit publication (whether or not subsequently published);

3. provides evidence of the acquisition of knowledge and a detailed understanding of applicable techniques for research and advanced academic enquiry;

4. is of a quality and quantity to reflect three years of full-time postgraduate study.

## Research Skills Programme

All students in their first year of research studies will be required to successfully complete the Research Skills Programme. Other courses in the undergraduate Tripos and M.Phil in ACS may also be recommended by the supervisor.

The Research Skills Programme is designed to provide advice on and training in a variety of practical skills required for research. The skills learnt will be useful in the student's individual project, other research-led modules, and in the student's future career.

All students are required to take 12 units in total which includes the core units and a number of optional units.

Core Units

There are 4 - 5 mandatory core units covering topics such as Academic English; Academic Writing; How to prepare a research presentation.

Please note that students who previously took the MPhil in Advanced Computer Science are not required to complete the Core Units.

Optional Units

Students choose units that are most relevant to their research plans, and supplementary to their previous experience. Optional units will not generally require coursework to be

completed or submitted beyond participation in the session itself. Some options will involve practical work, which will be carried out during the session. This will provide an opportunity for students to practice specific skills, but will not be formally assessed.

Examples of units offered in current and previous years are:

- Academic Writing in UK HE
- How to prepare a research presentation
- How to write a good abstract
- How to interpret experimental results
- Research ethics and GDPR
- Mathematical writing skills
- How to nail your literature review
- Working with sensitive data in the wild
- Internet & other standards - how & why to get involved
- Introduction to qualitative research methods
- Motion capture for experimental Robotics Research
- Buzzwords surrounding Data Science

# 3. APPLYING FOR THE PHD

## Applications

Formal application for admission for the PhD degree must be made via the applicant portal http://www.graduate.study.cam.ac.uk/applicant-portal. The deadline for all applications is 30 June. However, if you are applying for funding support, please see the Funding competitions section below for the relevant deadlines. Those who are applying for one of the Computer Laboratory's PhD studentships should use the deadline published on the individual job listing. After starting an application, the supporting documentation and research proposal must be uploaded within 7 days. Please note that your application can only be considered by the department once it is complete.

### Prerequisites

Applicants are expected to have met the following prerequisites:

- a very good degree (in the UK a First Class Honours degree) in Computer Science or a related subject;
- a masters-level degree (or other post-graduate work) is increasingly desirable; some PhD applicants may find prior study of our MPhil in Advanced Computer Science useful;

- a Research Proposal;
- A good IELTS or TOEFL score is also required where an English Language qualification is necessary.

## Research Project Proposal

Students are not assigned to pre-specified projects. They are expected to propose an area or topic, and will be accepted only if an appropriate and willing supervisor is available.

Applicants should therefore prepare a statement of proposed research of no more than 3000 words (in addition to the usual personal statement) indicating their intended topic and research strategy. This should:

- show an understanding of existing work in the field,
- identify an area for new work,
- have concrete goals and deliverables for the first year, and
- indicate that you know how to achieve them.

This could be drafted in collaboration with the intended supervisor and candidates are invited to make informal contact with the Computer Laboratory, either through individual staff members or the Postgraduate Education Manager, before submitting a formal application. Staff members belong to one or more research groups and may be contacted by email in the first instance.

## Funding Competitions

Applicants wishing to be considered for funding competitions should check their eligibility on the University-wide Sources of Funding web page. The deadlines for the Postgraduate Funding competitions can be found on webpage
https://www.graduate.study.cam.ac.uk/finance/funding

It is worth noting that full funding must be secured before starting a course at Cambridge. You will need sufficient funding to cover the University Tuition Fee, and at least the minimum maintenance for three years.

# 4. RESEARCH GROUPS

Students are integrated into the research culture of the Department by joining one of the research groups. Students are expected to attend the Department's and research group's programme of research seminars.

## Artificial Intelligence Group

The work of the Artificial Intelligence Group is multi-disciplinary, spanning genomics and bio-informatics, computational learning theory, computer vision, and informal reasoning. A unifying theme is understanding multi-scale pattern recognition problems, seeking powerful (often statistical) algorithms for modeling and solving them, and for learning from data. The AI Group seeks to find synergies amongst ideas based in statistics, mechanised reasoning, cognitive science, biology, and engineering, and to develop practical applications from them.

## Computer Architecture Group

The Computer Architecture Group's specialty is all aspects of tomorrow's computing hardware including its supporting circuit and compiler technology. Improvements in fabrication technology will ultimately provide the ability to construct computing devices from atomic scale components. These advances may be exploited to provide many orders of magnitude more processing power or equally impressive reductions in power consumption. The group's goal is to investigate how to exploit these advances in order to realise a broad range of efficient, scalable and robust computing platforms. The group's interests and expertise include multi-core processors and compilers, on-chip interconnection networks, novel approaches to system-timing, FPGA architectures, software programmable processing substrates and hardware security. They also have a keen interest in building chip and system prototypes in order to drive and demonstrate our research.

## Digital Technology Group (DTG)

The research conducted within the Digital Technology Group is highly multi-disciplinary in nature. The current research topics include *Computing for the Future of the Planet, Indoor Location and Tracking, Athlete Automatic Coaching, OS Kernel Enhancement, Low-Power Microprocessor Design, Privacy Systems and Policies, Wireless Sensor Networks, Cross-Layer Wireless Access, Cooperative Networks, Wireless Propagation Models for Challenging Environments, Channel Coding and Signal Processing for Wireless communications* and more.

The group has also conducted research into conventional network systems and applications as well as more esoteric network technologies.

## Graphics & Interaction Group (Rainbow)

The interests of the graphics and interaction group span computer graphics, image processing, interaction devices, and interdisciplinary design and is split into 3 sub-groups:

Graphics and imaging

Research in computer graphics started in the late 1960s. Over the decades the focus has moved from considerations of display hardware and hardware architecture (1970s), through rendering algorithms

(1980s), 3D display technologies (1990s) and modelling (2000s), to our current work on new display technologies and imaging.

Interaction and design
Research in the field of human-computer interaction has mainly focused on novel interface techniques that put computing power into the hands of a wider range of users. This work has been complemented by research into theoretical aspects of HCI, including cognitive science and design theory.

Affective computing
With rapid advances in key computing technologies and the heightened user expectation of computers, the development of socially and emotionally adept technologies is becoming a necessity. This group are investigating the inference of people's mental states from facial expressions, vocal nuances, body posture and gesture, and other physiological signals, and also considering the expression of emotions by robots and cartoon avatars.

## Natural Language and Information Processing Group (NLIP)

This research group works on a wide range of topics in Computational Linguistics, Natural Language Processing and Information Retrieval.
Current projects cover all areas of language processing, but especially syntax, semantics and discourse processing, and on a range of information management applications.

## Programming, Logic, and Semantics Group

Research in the Programming, Logic, and Semantics group is centred around the study of programming languages, logics, and mathematical models, addressing hardware, software, and networks. It spans a wide range of applied and theoretical work: programming language design, compilers, and program analysis; the development of interactive theorem provers and automatic proof procedures; the formal verification of computational systems; and semantic models using techniques such as structural operational semantics, type systems, domain theory, category theory, finite model theory and linear logic. Work is in progress on the underlying mathematical structures of these, and on their application to the study of higher-order typed programming languages; object-based languages; low-level machine languages; foundational languages for concurrent, distributed and mobile computation; hardware description languages; security and networking problems; database theory; and computational complexity.

## Security Group

Computer security has been among the Laboratory’s research interests for many years, along with related topics such as cryptology, formal methods, hardware design, biometrics, and the robustness of distributed systems in general.

## Systems Research Group

Systems is the largest research area in the Computer Laboratory, covering hardware, communications hardware and software, operating systems and distributed systems. The group undertakes teaching and research into topics including computer architecture, operating systems design, network monitoring and protocol design, practical distributed systems and mobile communications.

## 5. STUDENT REPRESENTATION

**PhD Students** are represented on the **Faculty of Computer Science and Technology** by a Junior Member. Elections for members are held in the November of each academic year. The Faculty receives the Minutes of the Staff Student Consultative Forum, the Postgraduate Education Committee, the Teaching Committee, and the Forum of Directors of Studies, and itself reports to the General Board of the University. The Faculty Minutes are sent to the Secretary General of the Faculties, the members and to Officers in the department.
The junior members attend the first part of each meeting during which unreserved business is discussed - that's the bulk of the business and includes things like the Head of Department's annual report, accreditation matters, examiners' reports, teaching matters related to the Tripos and M.Phil courses, the use of calculators in exams, new proposals for courses, etc.

Reserved business covers matters referring to named members of staff (e.g. promotions and leave of absence), and such things as the appointment of Examiners and the Form and Conduct of examinations.
Whilst the faculty representative elections are formally independent of the Graduate Union, under the terms of the GU Constitution (which has the approval of the University Council) the elected postgraduate representative is also a voting member of the GU governing council. Further information about the GU Council is available at
http://www.gradunion.cam.ac.uk/gradunion/council/

Faculty meetings are fairly formal and reasonable dress is required!

PhD students are also represented on the **Staff Student Consultative Forum** and the **Postgraduate Students' Forum.** Both of these groups are relatively relaxed occasions and provide the opportunity for student and staff representatives to exchange comments about facilities and teaching.

The **Postgraduate Students' Forum** is made up of research student representatives from research students and the M.Phil course, the Graduate Students Coordinator and a member of the Student Administrative team. The Forum has the opportunity to suggest courses and activities that fall within the remit of the Transferable Skills allocation as well as issues that are particularly relevant to research students in the Faculty. Meetings are held at lunch time once a term and the minutes are received by the Graduate Education Committee and Degree Committee.

The **Staff Student Consultative Forum** (SSCOF) is made up of student representatives from every year of the undergraduate course, a M.Phil student, a research student, and members of the academic, support and Student Administration team. Meetings are held at lunch time twice a term.

Graduate Students also have a representative on the **Postgraduate School of Technology Committee.**

## 6. WOMEN@CL

The purpose of the women@CL network is to put in place a positive action programme for women in computing research, with a particular focus on interdisciplinary research, leadership and enterprise.
The programme consists of career development activities including regional and national workshops, mentoring and networking, with long term goals of:

- providing support for women in computing research;
- stimulating new research by bringing diverse viewpoints and expertise to bear;
- increasing the recruitment and retention of women in computing research careers;
- encouraging and supporting women to aim for early leadership roles;
- increasing women's understanding and participation in entrepreneurial ventures;
- contributing to a positive public perception and image of computer science;
- increasing public engagement in computer science;

The programme consists of a variety of local activities such as women@CL lunch talks that provide role models to our students and early career women, and our national and international activities include events like career development workshops at major conferences, regional technical meetings, and senior women leadership summits. We forge formal connections with existing bodies with similar goals. We also promote successful women and projects by placing articles, profiles and interviews in all forms of media.

*women@CL* events are open to all, women and men. For more information on the meetings and resources for and about women in computing, please visit the *women@CL* webpage http://www.cst.cam.ac.uk/women.

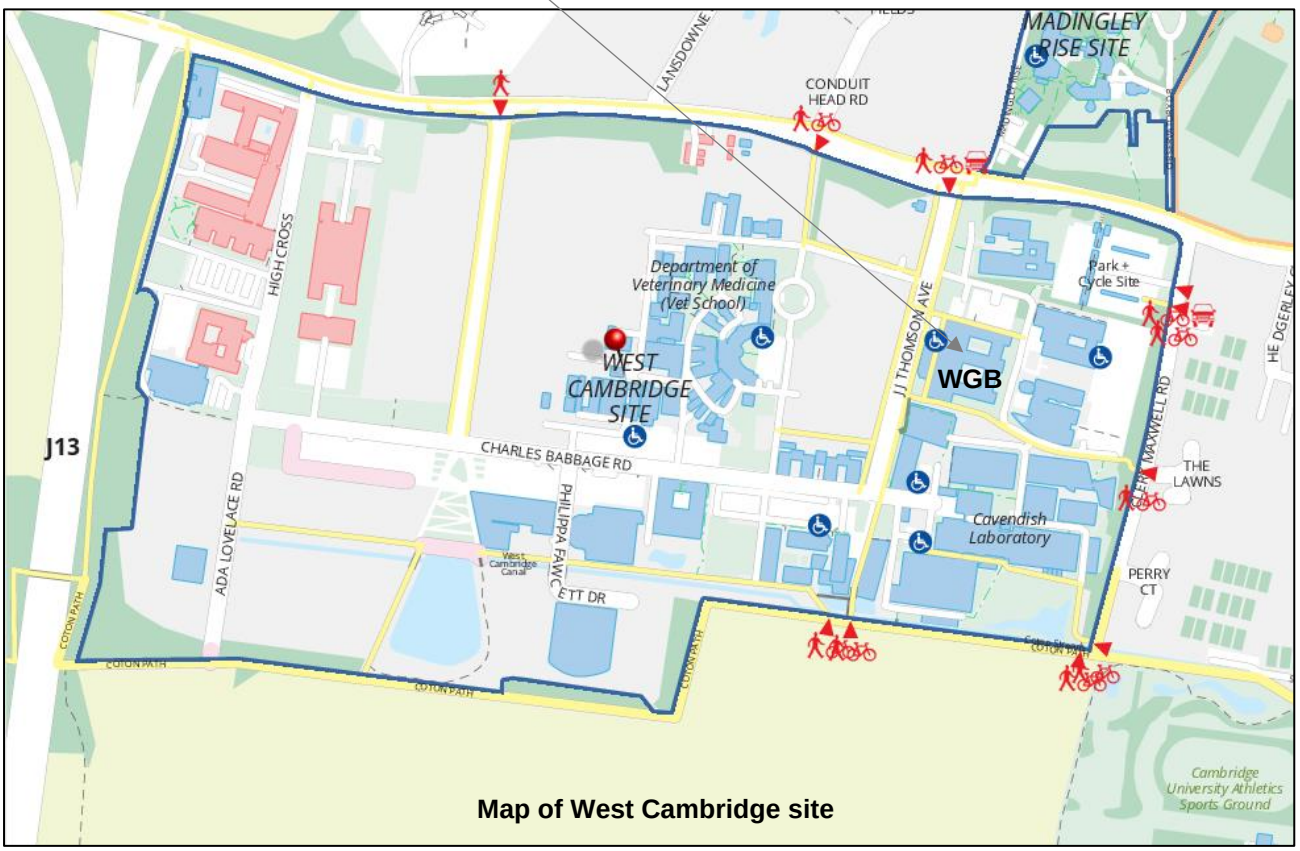
For more information please email clwcladm@hermes.cam.ac.uk

# 7. GETTING TO THE LAB

***Students at the University of Cambridge are not permitted to have cars except under very special circumstances.***

## Walking or cycling

The William Gates Building is 2 km (1.3 miles) west of the city centre. From the city centre go west on Garret Hostel Lane, Burrell's Walk (past the University Library), Adams Road, the Coton Cycle-path, and then turn right into Clerk Maxwell Road then left beside the Centre for Applied Photonics and Electronics to the William Gates Building.




**Map of West Cambridge site**

If you are cycling, please take care. The EMBS has a useful website for cyclists, old and new, at http://www.admin.cam.ac.uk/offices/embs/travel/cycle/. We also strongly recommend purchasing a strong D-lock.

## Buses

Buses **Universal** (substantially reduced fares for University Card holders) and **Citi 4** run from the city centre to the West Cambridge Site. Both buses stop on the West Cambridge Site itself. In the city centre they stop on Silver Street (on the west side of Silver Street Bridge) and Trumpington Street (near the Fitzwilliam Museum and near Pembroke Street). Anyone planning to make three or more journeys in a day on Stagecoach buses (other than the Universal or Citi 4) will find it cheaper to purchase a Dayrider ticket, which can be used on any Stagecoach route within the city.

For more information about these services, see the links from the Bus Services page (http://www.admin.cam.ac.uk/offices/embs/travel/bus/index.html) which is maintained by the Estate Management and Building Service.

Postgraduate Education Office
Department of Computer Science and Technology
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