Computer Science @ Cambridge
What is CS?
The Computer Lab past and present
The aims of our course
The course ("Tripos") structure
The first year options
Employment prospects
The CS application process
Interviews and tests
Where to get more info
What is CS?
# The Subject

## Combines Elements of...

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Why Study it here?

All the usual Cambridge advantages apply: the College structure, the supervision system, the learning environment, the smart peers

But Computer Science here is particularly special: there is a rich history both in the technology and the teaching of the subject.
We started as a part of the Mathematics Department in 1937
Back then we were the Mathematical Laboratory because the term “computer science” hadn't been invented

The world's first usable computer (EDSAC) was built here
First Job Queue too..!
An (Abridged) Timeline


- We are founded (1937)
- Oxford Computing Lab (1957)
- School of Computing at Manchester (1964)
- EECS at MIT (1975)
Department Highlights


First CS Dept  
First stored-program Computer (EDSAC)  
EDSAC2  
First CS Qualification (Diploma)  
Full CS Degree  
Xen spinout  
Raspberry Pi
Our Undergraduate Degree
(the “Computer Science Tripos”)
Our Aims

To give an understanding of fundamental **principles** that will outlast today's **technology**

To produce graduates who **create** the future not just cope with it
## The Course

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<td>Theory</td>
<td>Free choice of</td>
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<td>Systems</td>
<td>advanced</td>
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<td>Personal project</td>
</tr>
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<td>[Option]</td>
<td>Group Project</td>
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**B.A.**
The Course

Year 1

Part IA
- Fundamentals
- Programming
- Electronics
- Maths
  [+Option]

Year 2

Part IB
- Theory
- Systems
- Hardware
- Programming
- Group Project

Year 3

Part II
- Free choice of advanced topics
- Personal project

Year 4 (Optional)

Part III
- Free choice of research topics
- Research project

B.A.
M.Eng.
The Course

Year 1
- Part IA
  - Fundamentals
  - Programming
  - Electronics
  - Maths
  [+Option]

Year 2
- Part IB
  - Theory
  - Systems
  - Hardware
  - Programming
  - Group Project

Year 3
- Part II
  - Free choice of advanced topics
  - Personal project

Year 4 (Optional)
- Part III
  - Research project

B.A.

M.Eng.

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Our First Year Options

There are always four exam papers to sit

You spend a quarter of your first year studying material for each paper
Our First Year Options

- Runs for first time in October 2016
- Three CS papers coupled to one maths
- The material covers graphics, databases and machine learning
- Intended for those with prior experience
Our First Year Options

> Lets you study two CS papers, one maths and a Natural Sciences subject of your choice

> Physics, Chemistry, Evolution & Behaviour, Geology, Physiology of Organisms, Social Psychology
Our First Year Options

- Lets you study two CS papers, one maths and a Natural Sciences subject of your choice
- Physics, Chemistry, Evolution & Behaviour, Geology, Physiology of Organisms, Social Psychology
- You can switch into the NST subject in the second year without any penalty (nice option, rarely used)
Our First Year Options

- Lets you study two CS papers and two Maths papers from the Mathematical Sciences Tripos.
- Good way to do more maths in IA if you are more theory-oriented. But it's not an easy option.
- You cannot switch to mathematics in the second year.
Our First Year Options

- **CST 75%**
  - CST 1
  - CST 2
  - CST 3
  - NST Maths

- **CST 50% NST/PSY**
  - CST 1
  - CST 2
  - NST Maths
  - NST Option

- **CST 50% Maths**
  - CST 1
  - CST 2
  - MST 1
  - MST 2

> **CST**: CST 75%

> **CST 50% NST/PSY**: Adds STEP Maths Requirement

> Good way to do more maths in IA if you are more theory-oriented.

> You cannot switch to mathematics in the second year.

www.cl.cam.ac.uk/admissions
2015 Choices

www.cl.cam.ac.uk/admissions
Implications for Future Years

CST exam papers

75%

Year 1
P1
P2
P3
Year 2
P4
P5
P6
Year 3
P7
P8
P9
P10

50%

Year 1
Year 2
Year 3
Implications for Future Years

75% CST exam papers

Plus the maths paper

Year 1
P1 P2 P3 P4 P5 P6

75% CST exam papers

Maths, NST
Maths, Psy
Maths, Maths

CST exam papers

Year 2
P7 P8 P9 P10

Everyone is assessed on 11 exam papers across the three year B.A.

50% CST exam papers

Plus two more papers:
Maths, NST
Maths, Psy
Maths, Maths

Year 3
CS as an NST Option

You can select CST Paper 1 as an option within Natural Sciences.

It is possible to catch up CS Paper 2 in your summer vacation and switch to Computer Science in your second year (and some do).
Practical skills

Year 1
Weekly practicals to consolidate lecture material

Year 2
Weekly practicals to consolidate lecture material
**Group Project** (team work)

Year 3
**Personal project**

Year 4
**Research project**
Some modules associated with additional practicals
Languages aren't important.

**Principles** are.

**As of 2015:**
Java, C/C++ for imperative programming
ML for functional programming
Prolog for logic programming
Verilog for hardware programming
You DON'T need programming experience

We teach from the ground up.

However, if you've never programmed before, how do you know you'll enjoy a degree that uses it?

A survey of our first years...

- No experience (39%)
- Not much experience (24%)
- Some experience (18%)
- Quite a lot of experience (14%)
- Programming expert (2%)
Employment Prospects
The course gives vital skills for every sector. Good computer scientists go on to a multitude of careers: IT, business, politics, finance, science, engineering, education, arts
Very sought-after graduates

Jobs galore!

Our annual recruitment fair attracts 50+ companies, each looking to recruit 3 or 4 graduates on average

We only produce ~95 graduates in total!

Some of the 2015 Companies

Google, ARM, Amazon, Disney, Barclays, Cisco, BT, Mozilla, MathWorks, Citrix, Frontier, Red Gate, Red Gate, Morgan Stanley

www.cl.cam.ac.uk/admissions
Applications Process
The Process

- Apply via UCAS: October
- Supplementary Questionnaire: November/December
- Written Test (CSAT): Interview Day (Early December)
- Two Technical Interviews: Interview Day (Early December)
- Admissions Pool: Early January

www.cl.cam.ac.uk/admissions
Application Numbers

#Applications vs Yeargroup size from 1999 to 2015

- Applications: 500 to 800
- Yeargroup size: 100 to 150

Source: www.cl.cam.ac.uk/admissions
The University is a combination of:

**Colleges** – these admit and look after students both in terms of welfare and academics. They arrange the supervisions we are famous for

**Departments** – these set syllabuses, provide lectures and handle exams. They also perform research (their 'day job')

**Administration** – there is a large number of admin-related entities: everything from finance to entrepreneurship to IT to dental services
Important College Roles

**Fellow** – these are the academics that govern each College. There are typically one or two per subject per College and they oversee the teaching of that subject there.

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**Admissions Tutor** – One per College. Makes the final decision on who gets in or pooled based on the recommendations of the DoSes.
Choosing a College for CS

Colleges are responsible for academic guidance, supervisions and pastoral care
They provide diverse communities where you build life-long friends and associations
The best College for you is an individual choice

Modern or classical buildings?
Centre or out of town?
Large or small CS cohort?
More formal or more relaxed feel?
How active is the DoS in teaching?
What do past and present students say?

We can't tell you which College is right for you (sorry!). Visit them and talk to the Fellows, staff and students there.
Every application is individual but usually all of these factors contribute to our decisions:

- Exam predictions and results
- Interviews
- Personal statement
- Special circumstances (if any)
- School references
- CSAT performance
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Prerequisites

**A*A*A at A-Level**

**A-Level Maths**

is absolutely essential

**Further Maths**

AS is essential (if your school offers it)
A2 is desirable
AEA/Step is useful

Not doing Further? We recommend doing at least AS Further in your A2 year
Other A-Levels

Physical sciences

- Very useful and desirable at admissions
- Prerequisites for some first year options

Electronics

- Relevant and useful

But not as desirable as maths and physical sciences so please don't drop these in favour of electronics
Other A-Levels

Computing

NOT a prerequisite

Good way to show interest in the subject and to “try before you buy”

However, the syllabuses overlap with our first year

We generally don't recommend dropping maths or a physical science in favour of Computing in the A2 year: often better to drop Computing in A2
Every application is individual but usually all of these factors contribute to our decisions:

- Exam predictions and results
- Interviews
- Personal statement
- School references
- Special circumstances (if any)
- CSAT performance
~25 minutes each

Questions related to CS but will not assume actual CS knowledge (unless we know you have it)

Questions start simple and ratchet up in difficulty. Our interest is in when you leave your comfort zone

Correct answers (and there may be multiple) aren't as important as you might think

We are assessing your logical thinking and problem solving abilities and your motivation to study CS
Every application is individual but usually all of these factors contribute to our decisions:

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The CSAT

Computer Science Admissions Test

It's there to help you!
Another opportunity to shine, besides the interview.
Another opportunity to shine, besides the interview.

Our interest: what you can do (not what you can’t). We want you to do well (it’s not there to catch you out).
Another opportunity to shine, besides the interview.

Our interest: what you can do (not what you can’t). We want you to do well (it’s not there to catch you out).

Your choice of questions! Like pure maths more than algorithmic problems? No problem. Show us what you enjoy!
Another opportunity to shine, besides the interview.

Our interest: what you *can* do (not what you can’t). We want you to do *well* (it’s not there to catch you out).

Your *choice* of questions! Like pure maths more than algorithmic problems? No problem. Show us what *you* enjoy!

No pass mark. We consider the *positive* aspects.
We have a CSAT stand upstairs in the Intel Lab today. Ask us anything about the CSAT.

www.cl.cam.ac.uk/csat
Instructions:

- The test duration is 100 minutes. Section A has 8 questions. Section B has 12 questions.
- Questions in Section B are more difficult and worth more marks.
- All questions attempted are marked. We will consider your best 5 questions from each section.
- Write your solutions on the paper provided and clearly mark the question number you are solving. Solutions should be complete and clear, but they need not be thorough (e.g. skip induction proofs).
- Calculators, phones, watches, other electronic devices or other paper are not permitted.
- All paper must be handed in at the end of the test.

It is recommended that you:
- take 5 minutes first to read through all questions,
- start with Section A,
- spend less than 5 minutes on a question in Section A and
- aim for 5 questions in each section.

Good luck!
Q1. You have a 12×12 cm piece of paper and you cut away a square of side $x$ from each corner. What is the maximum volume (without a lid) that can be obtained by folding up the flaps?
CSAT Fun!

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![Diagram of a piece of paper with a square cut from each corner, labeled x and 12.]}

Q2. How many triangles can you build with vertices lying on a 4×4 grid of points?
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Q2. How many triangles can you build with vertices lying on a $4 \times 4$ grid of points?

The first 10 correct answers presented at the CSAT stand win a limited edition t-shirt!
What Now?

**Upstairs** you will find:

- DoSes to answer those burning questions
- Past students to get the real story from
- The CSAT stand
- Overviews of the syllabus
- Examples of student projects
More info...

University

Prospectus
Website (www.cam.ac.uk)

Colleges

Websites
DoSes, Admissions Tutors
Open days

Department

Ask us upstairs today!
undergraduate.admissions@cl.cam.ac.uk
Website

www.cl.cam.ac.uk/admissions
Computer Science @ Cambridge

www.cl.cam.ac.uk/admissions
Today

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The aims of our course
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Why Study it here?

All the usual Cambridge advantages apply: the College structure, the supervision system, the learning environment, the smart peers

But Computer Science here is particularly special: there is a rich history both in the technology and the teaching of the subject
79 Years Ago...

We started as a part of the Mathematics Department in 1937.
Back then we were the Mathematical Laboratory because the term “computer science” hadn't been invented.

The world’s first usable computer (EDSAC) was built here.
First Job Queue too..!
An (Abridged) Timeline

1930: We are founded (1937)
1964: School of Computing at Manchester (1964)
1975: EECS at MIT (1975)
Department Highlights

- First CS Dept
- First stored-program Computer (EDSAC)
- EDSAC2
- Full CS Degree
- First CS Qualification (Diploma)
- Xen spinout
- Raspberry Pi

Timeline:
- 1930
- 1940
- 1950
- 1960
- 1970
- 1980
- 1990
- 2000
- 2010
- 2020
Our Undergraduate Degree
(the “Computer Science Tripos”)
Our Aims

To give an understanding of fundamental principles that will outlast today's technology.

To produce graduates who create the future not just cope with it.

Computer Science is not generally well understood. Part of the problem is that the science gets confused with the vocational qualifications. We do not aim to teach people how to use today's technology, or even the tools that underpin today's technologies.

Instead, we want to teach you how to create tomorrow's technologies and its associated tools.
Point out the odd nomenclature (IA, IB etc)

I usually emphasise that:

- IA is about bringing everyone up to the same level and laying the foundations
- IB covers the core of Computer Science, as determined by various accrediting bodies (BCS, IEEE, etc)
- II allows you to specialise

Part III is integrated (i.e. you remain an undergraduate, which is good for minimising fees!). HOWEVER, unlike other subjects, the barrier for entry is high (a First in the third year). 10-15% of our undergrads go on to do it currently.
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There are always **four** exam papers to sit.

You spend a quarter of your first year studying material for each paper.

Each paper is associated with 3 lectures per week and (usually) one supervision.
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Our First Year Options

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- You cannot switch to mathematics in the second year

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This is potentially confusing, but it boils down to either taking paper 3 in the first or second year, and correspondingly paper 7 in the second or third year.

Paper 10 will only be taken by those who do 75% and will actually draw certain courses from part III. Those who stay on to do Part III would not be able to repeat those courses, but there is such a large selection available this should be fine.
Implications for Future Years

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You can select CST Paper 1 as an option within Natural Sciences. It is possible to catch up CS Paper 2 in your summer vacation and switch to Computer Science in your second year (and some do).

Emphasise that this is not a recommended route to study CS.
Emphases that we try to teach programming skills practically

The group project are often a highlight for graduates. The year is split into small groups (5 or 6 usually) and they have to work as a team to complete a project. They are effectively acting as a mini consultancy. Projects are often proposed by industry, who act as clients.

The images show some of this years' group projects that might be worth mentioning. There is a data analysis tool that uses Oculus Rift to provide 3D graphs that can be navigated around; a smartwatch prototype to allow runners to share information about running routes; a boat control unit for deaf and blind sailors; and a “facebook for video”.

It's worth explaining that the personal project is something done individually and can be proposed by the student. It is supervised by a member of staff.

The Part III project is more substantial and has a research element to it.
Languages aren't important.

**Principles** are.

**As of 2015:**
Java, C/C++ for imperative programming
ML for functional programming
Prolog for logic programming
Verilog for hardware programming

For some reason some students seem to judge CS courses by the languages they teach. This slide is so we can explain how silly that is.

I always say that, should a new language appear that we deem to be better to teach a specific concept with, we would just switch.
Although we don't require it for admission, it would be odd to have had no programming experience at all in today's world. Point out that they can easily get some experience before they apply.
Employment Prospects
Half the students go to jobs in IT. The others go into a range of jobs that span a huge number of domains.

Ultimately we teach them how to solve problems efficiently
Very sought-after graduates

Jobs galore!

Our annual recruitment fair attracts 50+ companies, each looking to recruit 3 or 4 graduates on average.

We only produce ~95 graduates in total!

Some of the 2015 Companies

Google, ARM, Amazon, Disney, Barclays, Cisco, BT, Mozilla, MathWorks, Citrix, Frontier, Red Gate, Morgan Stanley

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## Admissions is Done by the Colleges

The University is a combination of:

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Every application is individual but usually all of these factors contribute to our decisions:

- Exam predictions and results
- Interviews
- Personal statement
- School references
- Special circumstances (if any)
- CSAT performance

This is a small but important point – it's easy for them to come away with the idea that everything depends on the interview performance or the CSAT score.
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<td>AEA/Step is useful</td>
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Not doing Further? We recommend doing at least AS Further in your A2 year

www.cl.cam.ac.uk/admissions

Mathematics is the language of Computer Science
Other A-Levels

Physical sciences
- Very useful and desirable at admissions
- Prerequisites for some first year options

Electronics
- Relevant and useful
- But not as desirable as maths and physical sciences so please don't drop these in favour of electronics

www.cl.cam.ac.uk/admissions
Other A-Levels

Computing

NOT a prerequisite
Good way to show interest in the subject and to “try before you buy”
However, the syllabuses overlap with our first year
We generally don’t recommend dropping maths or a physical science in favour of Computing in the A2 year: often better to drop Computing in A2

This can be a bit controversial, especially because some other Universities might prefer Computing over more maths. Basically our message is: do as much maths as you can as your first priority.
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- Interviews
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The CSAT

Computer Science Admissions Test

It’s there to help you!

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Another opportunity to shine, besides the interview.
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Our interest: what you can do (not what you can’t). We want you to do well (it’s not there to catch you out).
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Your *choice* of questions! Like pure maths more than algorithmic problems? No problem. Show us what *you* enjoy!
The CSAT

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No pass mark. We consider the positive aspects.

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We have a CSAT stand upstairs in the Intel Lab today. Ask us anything about the CSAT.
## CSAT Rubric

### Instructions:

- The test duration is 100 minutes. Section A has 8 questions. Section B has 12 questions.
- Questions in Section B are more difficult and worth more marks.
- All questions attempted are marked. We will consider your best 5 questions from each section.
- Write your solutions on the paper provided and clearly mark the question number you are solving. Solutions should be complete and clear, but they need not be thorough (e.g., skip induction proofs).
- Calculators, phones, watches, other electronic devices or other paper are not permitted.
- All paper must be handed in at the end of the test.

### It is recommended that you:

- take 5 minutes first to read through all questions,
- start with Section A,
- spend less than 5 minutes on a question in Section A and
- aim for 3 questions in each section.

Good luck!
Q1. You have a 12×12 cm piece of paper and you cut away a square of side \( x \) from each corner. What is the maximum volume (without a lid) that can be obtained by folding up the flaps?
CSAT Fun!

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Q2. How many triangles can you build with vertices lying on a 4×4 grid of points?
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The first 10 correct answers presented at the CSAT stand win a limited edition t-shirt!

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What Now?

**Upstairs** you will find:

- DoSes to answer those burning questions
- Past students to get the real story from
- The CSAT stand
- Overviews of the syllabus
- Examples of student projects
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