DEPARTMENT OF
COMPUTER SCIENCE

UNDERGRADUATE COURSE HANDBOOK

PART C

For students entering the fourth year of their course in 2022

Computer Science
Computer Science & Philosophy
Mathematics & Computer Science

2022

Version 1.1

Welcome

This is a supplement to the Computer Science Handbook. It is designed to give you all the course-specific information you will need in your fourth year, complete with all important deadlines.

Please don't hesitate to get in touch with one of the academic admin staff at academic.administrator@cs.ox.ac.uk if you have any questions.

Contents

Disclaimer

This handbook supplement applies to students entering the fourth year of their degree in Computer Science, Mathematics & Computer Science or Computer Science & Philosophy in Michaelmas term 2021. The information in this handbook may be different for students starting their fourth year in other years.

The Examination Regulations relating to this course will be available online at

Honour School of Computer Science

Honour School of Mathematics and Computer Science

Honour School of Computer Science and Philosophy

If there is a conflict between information in this handbook and the Examination Regulations then you should follow the Examination Regulations. If you have any concerns please contact the academic admin team at academic.administrator@cs.ox.ac.uk.

The information in this handbook is accurate as at October 2021. It may be necessary for changes to be made in certain circumstances, as explained at www.ox.ac.uk/coursechanges webpage. If such changes are made the department will publish a new version of this handbook, together with a list of the changes, and you will be informed.

Version	Action	Date
Version 1.0	Published start of MT22	
Version 1.1	Minor amendment to recommended patterns of teaching	2nd Week, MT22

1 Courses

Please find information on Course Aims and Intended Learning Outcomes for each degree in the Undergraduate Course Handbook for the Preliminary Examinations.

For all undergraduate courses, you will have been entered initially for the 4-year degree, and will need to decide early in your third year whether you wish to carry on into the fourth year or leave at the end of the third year with a BA.

Please be aware that, to proceed into Part C, you will need to have an average of 2:1 or higher in Parts A and B together.

Please note that the Computer Science courses in Part C are 50% bigger than those in earlier years, i.e. while you were expected to study for each 3rd year course for about 10 hours per week, you will now be required to invest about 15 hours of study a week for each course. Computer Science lecturers expect you to complete this extra work in a variety of ways, e.g. some will give 16 lectures but will require you to undertake extra reading, classes and/or practicals, whereas others will be giving 24 lectures, and others still will be doing something in between. Please look at each synopsis for details.

Please find information on the Computer Science Project on the departmental website.

1.1 Computer Science

The Department of Computer Science offers the following degrees in Computer Science at undergraduate level:

- BA – Computer Science, 3-year
- MCompSci – Computer Science, 4-year

In the fourth year of Computer Science you are required to take five courses and complete a Computer Science project. The courses are chosen from a schedule called C1, which is published at http://www.cs.ox.ac.uk/teaching/bacompsci/PartC/.

1.2 Mathematics & Computer Science

The Department of Computer Science offers the following joint degrees with the Department of Mathematics:

- BA – Mathematics and Computer Science, 3-year
- MMathCompSci – Mathematics and Computer Science, 4-year

In the fourth year of Mathematics and Computer Science you are required to complete either five courses and a Computer Science project *or* six courses and a Mathematics dissertation. The courses are chosen from Schedule C1 and Schedule C2. There is no restriction on the number of courses chosen from each schedule. Note that if you choose to submit a Mathematics dissertation, you must also choose at least two other Mathematics courses.

Details on Mathematics courses currently offered to fourth year students can be found here.

You can find out more about the Mathematics dissertation here.

1.3 Computer Science and Philosophy

The Department of Computer Science offers the following joint degrees with the Faculty of Philosophy:

- BA – Computer Science and Philosophy, 3-year
- MCompPhil. – Computer Science and Philosophy, 4-year

In the fourth year of Computer Science and Philosophy, you must complete between 24 and 26 units; the unit values of the different options are as follows:

- each Philosophy paper or thesis is worth 8 units;
- each Computer Science taught course is worth 3 units;
- a Computer Science project is worth 9 units.

Choices are subject to the following constraints:

- you may take at most six Computer Science taught courses;
- you may not take both a Philosophy thesis and a Computer Science project.

Computer Science courses are chosen from Schedule C1.

Philosophy options can be chosen from any courses of 101-120, 122, 124, 125, 127-129, 137-139, 198 and 199 as described on the Philosophy Faculty Website which you have not offered in Part B. With the exception of 198 and 199, each Philosophy course will be assessed by a 3-hour written examination together with an essay of at most 5,000 words. The special subject paper 198 is examined in different ways according to the special subject, and the method of assessment will specified when the special subjects available for your year are advertised. 199 is the Philosophy thesis. More information about the format of the written exams will be issued later in the year.

Rules for Philosophy theses in part C are described in the Examination Regulations except that the word limit is 20,000 words. More advice on Philosophy essays and theses will be issued later in the year.

The effect of these rules is that you should take one of the following combinations:

- three Philosophy papers (maybe including a thesis) (24 units);
- two Philosophy papers (maybe including a thesis) and either three CS courses or a CS project (25 units);
- one Philosophy paper (or thesis), and six CS courses (26 units);
- one Philosophy paper, three CS courses and a CS project (26 units);
- five CS courses and a CS project (24 units).

The full listings of Philosophy courses available to Computer Science and Philosophy students can be found at here.

Guidance on Fourth Year Philosophy theses

Computer Science & Philosophy candidates may offer a Philosophy thesis in Part C. **The deadline for seeking approval of your proposed topic for a Philosophy thesis is Friday of Week 4 of the Michaelmas term preceding the examination**. The application for approval of topic is submitted to the Director of Undergraduate Studies, Faculty of Philosophy, c/o the Undergraduate Studies Administrator at Radcliffe Humanities, and should consist of your proposed title and an explanation of the subject in about 100 words and a letter of approval from your tutor. In practice, it is easier for you to submit this via an online survey, a link to which you will receive before 4th week of Michaelmas. You can also seek approval earlier and it's a good idea to do so before you put in a lot of work. If possible, begin thinking about a thesis topic during the Easter Vacation of the preceding year, and have a talk with a tutor during that Trinity term. If the tutor thinks that the subject is manageable, get some initial suggestions for reading and follow them up. Remember that tutors can only advise: the decision to offer a thesis is your own, and so is the choice of topic. So of course is the work; what makes a thesis worthwhile is that it is your own independent production. Don't worry if the outline of your topic in an early application is not very closely adhered to in the end: the point is to make clear the general subject of the thesis and to show that you have some idea how to go about tackling it. If later you wish to alter the title of your thesis, that should not be a difficulty, but you must apply in the same way for permission to do so (this is so that the Chair of Examiners knows what to expect).

The Regulations state that you may discuss with your tutor the field of study, the sources available, and the method of presentation. Before you start work, go over the plan of the whole thesis very carefully with your tutor. The plan must be yours, but the tutor can help you make sure that the plan is clear, coherent and feasible. Get more advice on reading. But bear in mind that much of your reading will be discovered by yourself, so arrange to be in Oxford, or near a large library, for some weeks of the vacation. Don't let your topic expand or your reading range too widely; 20,000 words is the length of two articles, not a book. Your tutor may also read and comment on drafts, subject to the constraint that the amount of assistance the tutor may give is equivalent to the teaching of a normal paper, so tutorial sessions can be used for trying out drafts of parts of the thesis. However, you have to write the finished version on your own: make sure you allow plenty of time; almost certainly more time will be needed than you first expected. You must not exceed the limit of 20,000 words excluding bibliography. That will probably, to your surprise, become a problem; but the exercise of pruning is a valuable one, encouraging clarity and precision which you should be aiming for in any case.

Some general advice: (i) explain in your introduction just what you are going to do, and in what follows present the argument, step by step, in as sharp a focus as you can achieve; (ii) it is much better to be candid about difficulties than to sweep them aside or fudge issues, and you should show that you appreciate the force of counter-arguments; (iii) bad grammar and bad spelling diminish clarity and detract from an overall impression of competence.

Your bibliography should list all works to which you refer, plus any others you have used that are relevant to the final version. The style for references can be modelled

on any recent philosophy book or periodical. The rules for format and submission are in the Examination Regulations.

If for any reason you expect to submit your thesis late, consult your Senior Tutor in good time. The Proctors may grant permission (in which case payment of a fine for late-presentation may be required, depending on circumstances). If permission is refused the thesis may be rejected or subject to a marking penalty.

The deadline for submitting the thesis is noon on Friday of the week before the Trinity Full Term of the examination, which is **Friday 21st April 2023**

2 Examinations for Part C

Exam Entry

Although you will be taking examinations at the end of each term, you will be entering for these exams via Student Self Service by Friday of Week 2, Hilary term. You must make sure you enter for the examinations that you took in Michaelmas term.

For assessments with submissions i.e. mini-projects, entering for and changing options comes with more restrictions than written examinations. Option changes cannot occur for mini-projects after the exam entry deadline (for Michaelmas Term courses) or the submission deadline (for Hilary Term courses).

For example

A student decides to take Quantum Processes and Computation and Computational Biology in Michaelmas Term and Geometric Deep Learning and Database Systems Implementation in Hilary Term. The student submits mini-projects for their Michaelmas Term courses by the deadline. In Hilary Term, the student completes exam entry (a formal process required by the University which is explained in more detail here) for Computational Biology, Geometric Deep Learning, and Database Systems Implementation, and decides to also enter for Quantum Software (rather than Quantum Processes and Computation). They submit the mini-projects for these courses by the deadline.

After provisional marks for the courses are released, the student decides that they would like the mark for Quantum Processes and Computation to be counted towards their final classification rather than the mark for Quantum Software.

This is not possible under the University's Regulations. Please ensure that you complete exam entry for all the courses you have taken in Michaelmas Term. If you have submitted work for a course, it **must** be included in your exam entry.

Assessment in Part C

The majority of courses at Part C are assessed through a mini-project. This is a written take-home assignment which will be released on Friday of week 8 of the term in which the course is taught. The mini-project will be due at the start of the following term. More details, and the submission deadlines, can be found in Section 3 of this Handbook. The mini-project will be designed to be completed in about three days. It will include some questions that are more open-ended than those on a standard sit-down exam. The work you submit must be your own work, and include suitable references.

Some courses, which are confirmed below, are assessed through a three-hour written examination in Trinity Term. For these courses, there are three questions, each worth 25 marks. You should answer all questions.

2.1 Computer Science

In the fourth year of Computer Science (Part C) you are required to take five courses and a Computer Science project. The courses are chosen from a schedule called C1.

Most courses will be assessed by mini-project, with the exception of Combinatorial Optimisation, Computational Game Theory, Probabilistic Model Checking, and Probability and Computing, which will each be examined by 3-hour written paper in Trinity Term.

2.2 Mathematics & Computer Science

In the fourth year of Mathematics and Computer Science (Part C) you are required to take either five courses and a Computer Science project *or* six courses and a Mathematics dissertation. The courses are chosen from Schedule C1 and Schedule, C2. There is no restriction on the number of courses chosen from each schedule. Note that if you choose to submit a Mathematics dissertation, you must also choose at least two other Mathematics courses.

For Computer Science, most courses will be assessed by mini-project, with the exception of Combinatorial Optimisation, Computational Game Theory, Probabilistic Model Checking, and Probability and Computing which will each be examined by 3-hour written paper in Trinity Term.

For Mathematics, courses which are examined by a written paper will be confirmed by the Mathematics Institute. Each paper will examine one unit.

All mini-projects for Mathematics have a weighting of one unit.

2.3 Computer Science and Philosophy

In the fourth year (Part C) Computer Science courses are chosen from Schedule C1. Philosophy courses are chosen from courses 101-120, 122, 124, 125, 127-129, 137-139 and 198, as described on the Philosophy Faculty Website. Each Philosophy course will be assessed by a 3-hour written examination together with an essay of at most 5,000 words. Further information about the format of these exams will follow.

For Computer Science, most courses will be assessed by mini-project, with the exception of Combinatorial Optimisation, Computational Game Theory, Bayesian Statistical Probabilistic Programming and Probabilistic Model Checking, which will each be examined by 3-hour written paper in Trinity Term.

Rules for Philosophy theses are described in the Examination Regulations except that the word limit is 20,000 words. More advice on Philosophy essays and theses will be issued later in the year.

The deadline for submitting the thesis is noon on Friday of the week before the Trinity Full Term of the examination, which is **Friday 21st April 2023**. The thesis should be uploaded as a PDF file to Inspera.

Philosophy Essays in Part C

Each Philosophy unit, other than a thesis, is examined in a 3-hour paper together with a submitted essay of not more than 5,000 words. No essay shall exceed this word limit, which includes all notes and appendices, but not the bibliography. The word count should be indicated on the front of the essay. There shall be a select bibliography or a list of sources. All essays shall be typed on A4 paper with footnotes rather than endnotes. You should avoid any substantial repetition of material between examination scripts and examination essays.

Prescribed topics for Part C essays for each permitted Philosophy subject consist of the questions set for the most recent examination of that subject in Honour Schools with Philosophy, with the following exceptions:
The multiple passages for comments on any of the papers in ancient philosophy (115, 116, 136-139)
The formal exercises on Philosophical Logic (subject 127). Note that an essay question from 127 would be suitable.
Past examination papers can be downloaded from http://www.oxam.ox.ac.uk. Normally the most recent paper will be that set in the previous academic year, but note that in any given year examinations may not be set on every subject. This explains why topics are taken from the most recent paper rather than from the previous year's paper.

The relative weight of the essay to the three-hour exam shall be 1 to 3, i.e. the essay shall count for 25% of the mark in that subject.

Please see the Examination Regulations for further details.

3 Computer Science Mini-Projects

Computer Science mini-projects will be released on the last Friday of the term in which the subject is being taught. This information will be included in the Notice to Candidates sent out each term.

Mini-projects will be released via Inspera and must be uploaded to Inspera by noon on the date specified below. The mini-project will be designed to be completed in about three days. It will include some questions that are more open-ended than those in a standard sit-down exam. The work you submit must be entirely your own work. If you make use of material from web-sites, books, articles or other sources you must acknowledge these and give suitable references. **Please see the Appendix on plagiarism in the Computer Science Course Handbook.**

Michaelmas Term 2022

Course
Bayesian Statistical Probabilistic Programming
Concurrent Algorithms and Data Structures
Quantum Processes and Computation
Computational Learning Theory
Computational Biology
Advanced Complexity Theory
Graph Representation Learning

The submission deadline for the all mini-projects listed above is **12pm on Tuesday, 3rd January 2023.**

Hilary Term 2023

Course
Advanced Security
Database Systems Implementation
Ethical Computing in Practice
Law and Computer Science
Quantum Software
Geometric Deep Learning
Foundations of Self-Programming Agents

The submission deadline for the all mini-projects listed above is **12pm on Monday, 10th April 2023.**

Trinity Term 2023

Course
Requirements
Deep Learning in Healthcare

Please see the Notice to Candidates nearer the time.

Combinatorial Optimisation, Computational Game Theory, **Probabilistic Model Checking** and **Probability and Computing** will be examined by 3-hour written paper in Trinity Term.

Details of the assessments for Mathematics and Philosophy papers will be communicated via the Mathematical Institute or Faculty of Philosophy respectively.

4 Important Dates

4.1 Dates of term 2022-2023

Michaelmas term:	Sunday 9th October 2022 – Saturday 3rd December 2022
Hilary term:	Sunday 15th January 2023 – Saturday 11th March 2023
Trinity term:	Sunday 23rd April 2023– Saturday 17th June 2023

Dates of Full Term for future years are available on the University's website.

4.2 Hand-In Dates – Mini-projects, Practicals and Project Reports

Michaelmas Term mini-projects
By noon on Tuesday of week -1, Hilary term (to Inspera)

Hilary Term mini-projects
By noon on Monday of week -1, Trinity term (to Inspera)

Practicals reports
By noon on Friday of week 5, Trinity term (to Inspera)

4th Year Computer Science Project Report
By noon on Monday of week 4, Trinity term (to Inspera).

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5 What next?

5.1 Higher degrees

Many of our graduates go on to do a higher degree – a PhD or DPhil – at Oxford or elsewhere; perhaps that interests you.

If you expect to get a First in Finals you may be interested in doing a DPhil. It is important that you realise that a DPhil is not awarded simply for three years of programming. Whilst being adept at programming, you should also have a strong command of the theory and the relationship between the two. As an undergraduate you should have attempted not just the routine tutorial problems, but have demonstrated some creativity and ability to solve harder problems. You should have a critical outlook with strong motivation and independence of thought, and above all a desire to reflect on what you have produced, incorporating the result of your reflection into your work. Typically, you should hope to produce a thesis which makes some novel theoretical contribution and shows how it can be usefully applied.

Talk to DPhil students in the department; discuss the prospect with your tutor if you think you might be interested.

It is worth talking to potential supervisors early (ideally before the end of your penultimate year). This might give them time to find money to fund you!

To apply: the University of Oxford has published a very useful application guide. Applications are made online.

You will need two or three references; it is usual to choose tutors, project supervisors and college lecturers.

The admission deadline for entry in 2023-24 is **Friday 9 December 2022**.

If you have questions about graduate study in the Department of Computer Science please pop in and see a member of the graduate team or email graduate.admissions@cs.ox.ac.uk

5.2 Careers

Information about careers is provided by Oxford University Careers Service, 56 Banbury Road. The Careers Service organise many events to help you choose a career that suits you, and to put you in touch with recruiters. Their web site is at: www.careers.ox.ac.uk.

You are urged to contact the Careers Service for detailed information on careers, and also for advice on compiling a CV, on how to apply, and on interview technique.

When we receive information about careers suitable for Computer Science graduates, it is put on the Careers notice board in the basement of the Department of Computer Science or circulated by email. Information on job vacancies (together with summer internships and competitions) can also be found on our web site at https://www.cs.ox.ac.uk/recruiters/internal/vacancies.html (NB this site can only be accessed from within the Oxford domain).

6 Recommended Patterns of Teaching

Please compare the list of courses on the Departmental Website. If in doubt, please refer to the website.

6.1 Computer Science

4th Year Course structure: 5 optional courses in 4th year plus a Computer Science project						
		Faculty		**College**		**Comments**
Paper	**Term**	**Lectures**	**Classes**	**Tutorials**	**Classes**	
Advanced Complexity Theory	MT	20				
Bayesian Statistical Probabilistic Programming	MT	16	4			
Combinatorial Optimisation	MT	16				
Computational Biology	MT	20				
Computational Learning Theory	MT	24	4			
Concurrent Algorithms and Data Structures	MT	20	4			This course also has practicals.
Probabilistic Model Checking	MT	20	4			This course also has practicals.
Law and Computer Science	MT/HT	16	2.5			This course also has practicals
Graph Representation Learning	MT	18				This course also has practicals
Probability and Computing	MT	20	4			
Quantum Processes and Computation	MT	24	4			
Advanced Security	HT	18	4			This course also has practicals.
Axiomatic Set Theory (C1.4)	HT	16				Taught by the Mathematical Institute
Computational Game Theory	HT	20	4			
Database Systems Implementation	HT	22	4			
Deep Learning in Healthcare	HT/TT	16				This course also has practicals
Ethical Computing in	HT	16	4			This course also has practicals

Practice						
Foundations of Self-Programming Agents	HT	20				
Geometric Deep Learning	HT	18				
Godel's Incompleteness Theorem (C1.2)	HT	16				Taught by the Mathematical Institute
Quantum Software	HT	16				
Requirements	TT	16	4			

Notes:

- Students are also required to undertake a Computer Science Project in the 4th year which is expected to take about a third of the year.

6.2 Mathematics and Computer Science

Maths and Computer Science Part C students are required to take either six optional units from schedules C1 and C2 and a Mathematics Dissertation or five optional courses and a Computer Science Project. Schedule C1 will contain Computer Science options and Schedule C2 will contain Mathematics options.
Schedule C2: Any Maths Schedule C option may be taken.

Paper	Term	Faculty		College		Comments
		Lectures	Classes	Tutorials	Classes	
Advanced Complexity Theory	MT	20				
Bayesian Statistical Probabilistic Programming	MT	16	4			
Combinatorial Optimisation	MT	16				
Computational Biology	MT	20				
Computational Learning Theory	MT	24	4			
Concurrent Algorithms and Data Structures	MT	20	4			This course also has practicals.
Graph Representation Learning	MT	18				This course also has practicals
Law and Computer Science	MT/HT	16	2.5			This course also has practicals
Probabilistic Model Checking	MT	20	4			This course also has practicals.
Probability and Computing	MT	20	4			
Quantum Processes and Computation	MT	24	4			
Advanced Security	HT	18	4			This course also has practicals.
Computational Game Theory	HT	20	4			
Database Systems Implementation	HT	22	4			
Deep Learning in Healthcare	HT/TT	16				This course also has practicals
Ethical Computing in Practice	HT	16	4			This course also has practicals
Foundations of Self-Programming Agents	HT	20				

Geometric Deep Learning	HT	18				
Quantum Software	HT	16				
Requirements	TT	16	4			

Notes:

- Students are also required to undertake a Computer Science Project or a Mathematics dissertation in the 4th year which is expected to take about a third of the year.

6.3 Computer Science and Philosophy

In the fourth year of Computer Science and Philosophy, you must complete between 24 and 26 units; the unit values of the different options are as follows:

- each Philosophy paper or thesis is worth 8 units;
- each Computer Science taught course is worth 3 units;
- a Computer Science project is worth 9 units.

Choices are subject to the following constraints:

- you may take at most six Computer Science taught courses;
- you may not take both a Philosophy thesis and a Computer Science project.

Computer Science courses are chosen from Schedule C1. Philosophy options can be chosen from courses 101-120, 122, 124, 125, 127 and 180, as described on the Philosophy Faculty Website. Each Philosophy course will be assessed by a 3-hour written examination together with an essay of at most 5,000 words.

Rules for Philosophy theses are described in the Examination Regulations except that the word limit is 20,000 words. More advice on Philosophy essays and theses will be issued later in the year.

The effect of these rules is that you should take one of the following combinations:

- three Philosophy papers (maybe including a thesis) (24 units);
- two Philosophy papers (maybe including a thesis) and either three CS courses or a CS project (25 units);
- one Philosophy paper (or thesis), and six CS courses (26 units);
- one Philosophy paper, three CS courses and a CS project (26 units);
- five CS courses and a CS project (24 units).

Paper	Term	Faculty		College		Comments
		Lectures	Classes	Tutorials	Classes	
Advanced Complexity Theory	MT	20				
Bayesian Statistical Probabilistic Programming	MT	16	4			
Combinatorial Optimisation	MT	16				
Computational Biology	MT	20				
Computational Learning Theory	MT	24	4			
Concurrent Algorithms and Data Structures	MT	20	4			This course also has practicals.
Graph Representation Learning	MT	18				This course also has practicals

Law and Computer Science	MT/HT	16	2.5			This course also has practicals
Probabilistic Model Checking	MT	20	4			This course also has practicals.
Probability and Computing	MT	20	4			
Quantum Processes and Computation	MT	24	4			
Advanced Security	HT	18	4			This course also has practicals.
Axiomatic Set Theory (C1.4)	HT	16				Taught by the Mathematical Institute
Computational Game Theory	HT	20	4			
Database Systems Implementation	HT	22	4			
Deep Learning in Healthcare	HT/TT	16				This course also has practicals
Ethical Computing in Practice	HT	16	4			This course also has practicals
Foundations of Self-Programming Agents	HT	20				
Geometric Deep Learning	HT	18				
Godel's Incompleteness Theorem (C1.2)	HT	16				Taught by the Mathematical Institute
Quantum Software	HT	16				
Requirements	TT	16	4			

Notes:

- Students have the option to undertake a Computer Science Project or a Philosophy Thesis in the 4th year which is expected to take about a third of the year.