# DEPARTMENT OF
# COMPUTER SCIENCE

UNDERGRADUATE COURSE HANDBOOK

PARTS A & B

For students entering the second year of their course in 2019

Computer Science
Computer Science & Philosophy
Mathematics & Computer Science

**2019**

**Version 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 second and third years, 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](mailto:academic.administrator@cs.ox.ac.uk) if you have any questions.

# Contents

**Disclaimer**

This handbook supplement applies to students entering the second year of their degree in Computer Science, Mathematics & Computer Science or Computer Science & Philosophy in Michaelmas term 2019. The information in this handbook may be different for students starting their second year in other years.

The Examination Regulations relating to this course are available at

http://www.admin.ox.ac.uk/examregs/2019-20/hsofcompscie/studentview/

http://www.admin.ox.ac.uk/examregs/2019-20/hsomandcompscie/studentview/

http://www.admin.ox.ac.uk/examregs/2019-20/hsocscieandphil/studentview/

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 September 2019. 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 MT19 | 07/10/2019 |
|  |  |  |
|  |  |  |
|  |  |  |

## 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 note that each third year course in Computer Science will require about 10 hours of study a week.

### *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

### *1.1.1    Second and third years*

Synopses for all courses can be found at www.cs.ox.ac.uk/teaching/courses/

Second-year Computer Science candidates will take four core courses:

- Compilers
- Concurrent Programming
- Algorithms
- Models of Computation

Concurrent Programming, Algorithms and Models of Computation will each be examined by a 2 hour written examination.

Compilers will be examined by an assessed practical (35% of the marks) and a 2 hour written examination (65%).

Instructions for the assessed practical will be handed out on Friday in week 8 of Michaelmas term, and the practical report must be uploaded to the departmental WebLearn site by noon on Friday of week 2 of Hilary term. The assessed practical will incorporate and extend elements of the lab exercises that were set during term. As always, the work you submit must be your own, except where explicitly acknowledged.

Appendix A of the Course Handbook sets out the standards that are expected in this regard. Please see also the University's guidelines for academic good practice.

In the second and third years you are required to take a total of 10 optional courses from Schedules S1 and S2 (with no more than two from Schedule S2). It is recommended that you take four or five of these in your second year. These lists can be found at

www.cs.ox.ac.uk/teaching/bacompsci/PartA/

The four core courses will be examined at the end of the second year and the 10 optional courses will be examined at the end of the third year. It is strongly recommended that if you intend to study any Computer Science optional course that is scheduled in Trinity term, you do so in your second year, as they may clash with examinations if studied in your third year.

The examination papers will have three questions, and you may attempt two of them. In finals papers, questions are marked out of 25. The marks for each part of each question will be indicated on the examination paper.

In the third year you are also required to submit a project report. Please find more information on Computer Science Projects here.

### 1.2    Mathematics & Computer Science

The department offers a joint degree with the Department of Mathematics leading either to a BA degree after three years, or to a Masters degree after four years:

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

### 1.2.1    Second and Third years

Second year Mathematics and Computer Science students take the following Maths papers:

- [A0 Linear Algebra](#)

- [A2 Metric Spaces and Complex Analysis](#)

In addition, you must offer either two papers from papers A3-A5, A7-A11 or one paper from A3-A5, A7-A11 and paper ASO

- [A3 Rings and Modules](#)
- [A4 Integration](#)
- [A5 Topology](#)
- [A7 Numerical Analysis](#)
- [A8 Probability](#)
- [A9 Statistics](#)
- [A10 Fluids and Waves](#)
- [A11 Quantum Theory](#)
- [ASO Short Options](#)

You must also take two core Computer Science courses: [Models of Computation](#), and [Algorithms](#). These courses will be examined at the end of the second year.

It is particularly important to choose courses in your second year that will lead on to the options that you wish to take in the third year, especially if you want to spend more than half of your time on Maths courses in the third year. You should consult your college tutor for advice about this.

It is strongly recommended that if you intend to study any Computer Science optional course that is scheduled in Trinity term that you do so in your second year as they may clash with examinations if studied in your third year.

In your third year, you must choose at least two **Part B** options from [Schedule S2](#) for **Maths**.

For **Computer Science**, for **Part B** of your examination at the end of your third year, you will take at least four courses from Schedule S1 across your second and third years. You should aim at taking at least two of the four courses in your second year.

You must offer ten optional courses in total for your Part B examination. Apart from the minimum requirements listed above, you may fill your remaining four option courses from schedules S1 and S2 in any way you like. This is equivalent to 32 lectures

Information about Part A courses can be found at http://www.cs.ox.ac.uk/teaching/mcs/PartA/ and Part B courses at http://www.cs.ox.ac.uk/teaching/mcs/PartB2018-19/

Synopses for Computer Science Courses can be found at www.cs.ox.ac.uk/teaching/courses/

Synopses for Mathematics Courses can be found at www.maths.ox.ac.uk/courses

### *1.3    Computer Science and Philosophy*

The department offers a joint degree with the Faculty of Philosophy leading either to a BA degree after three years, or to a Masters degree after four years:

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

### *1.3.1    Second and Third Years*

**Summary:**

Apart from two Computer Science Part A core courses, you have to take an equivalent of 14 option "course-equivalents", with at least four from Computer Science, and at least six from Philosophy. The remaining four may be chosen from either discipline without restriction. Each Philosophy option is worth two "course-equivalents" and each Computer Science option is worth one. The possible combinations are:

- Four Computer Science options and five Philosophy options
- Six Computer Science options and four Philosophy options
- Eight Computer Science options and three Philosophy options

*Computer Science*

In the second year of the degree you are required to take the core Computer Science subjects:

- [Algorithms](#)
- [Models of Computation](#)

These subjects will be examined at the end of the second year, in your **Part A** examination.

You should also take four, six or eight Computer Science courses, during the second and third years, from [Schedules S1(CS&P) and S2(CS&P)](#) It is recommended that you take at least two of these courses during your second year. These options will be examined in your **Part B** examination at the end of your third year.

It is strongly recommended that if you intend to study any Computer Science optional course that is scheduled in Trinity term that you do so in your second year as they may clash with examinations if studied in your third year.


**Philosophy**

You will take three, four or five Philosophy courses during the second and third years, from the following list of courses. It is recommended that you take two courses in your second year. Two of these courses must be chosen from Papers 101, 102, 103, 104, 108, 122, 124, 125 and 127.

[You can find the subject list for Philosophy on the departmental website](#), and details of these courses on the [Philosophy Faculty Website](#).


Note that each Philosophy option is twice the weight of a Computer Science option.

## 2    Group Design Practical

The second year course also includes a group design practical as part of the practical requirements for the year. This will allow you to practise the skills you learnt in the core programming courses, and to begin to develop a range of further skills including team-working, project and time management, and presentation skills.

The group design practical is intended to take you 20-30 hours, mainly during Hilary term. There will be a briefing meeting early in Hilary term, setting out the aims and format of the exercise and listing several possible problems to tackle. You will then be allocated to a team of around 5 people to work on one particular problem together. Each team will be allocated a member of staff to act as a supervisor, and will have three meetings with their supervisor during the project.

The first meeting with the supervisor will take place at the beginning of Hilary term, where the group will present a specification and project plan.

The second meeting with the supervisor will take place in Hilary term: the group will present their initial module implementations and test results.

The third meeting will take place in Trinity term: the group will demonstrate their product and deliver a brief final report. Each student will also deliver to the supervisor a one-page summary of their individual contribution.

Finally, the groups will present their work to students, members of the Department, and guests. This will take the form of a demonstration session, followed by a seminar where groups will take turns to describe their projects; and prizes will be presented.

The final group report and summary of individual contribution will be assessed as S+, S, Pass or Fail. The group design practical counts as one-third of the total practical mark for the second year and candidates are required to achieve at least a Pass. Your supervisor will submit your group report and your summary of your individual contribution to the Examiners to be considered along with your other practical reports.

## 3    Examinations for Parts A and B

### 3.1    Computer Science

**The examinations for Part A will be sat at the end of your second year:**

A12069W1 Concurrent Programming, A16156W1 Algorithms and A10406W1 Models of Computation will each be examined by a 2 hour written examination at the end of your second year.

A10401W1 Compilers will be examined by an assessed practical (35% of the marks) and a 2 hour written examination (65%).

Instructions for the assessed practical will be handed out on Friday in week 8 of Michaelmas term, and the practical report must be handed in to the Computer Science WebLearn site by noon on Friday of week 2 of Hilary term. The assessed practical will incorporate and extend elements of the lab exercises that were set during term. As always, the work you submit must be your own, except where explicitly acknowledged.

Appendix A in the Computer Science Student Handbook sets out the standards that are expected in this regard. Please see also the University's guidelines for academic good practice.

**The examinations for Part B will be sat at the end of your third year.**

The examination papers will have three questions, and you may attempt two of them. In finals papers, questions are marked out of 25. The marks for each part of each question will be indicated on the examination paper.

In the third year you are also required to submit a project report.

### 3.2    Mathematics & Computer Science

Second year Mathematics and Computer Science students take the following Maths papers:

-    A0 Linear Algebra, which will be 1.5 hours.

This paper includes three questions and you should answer two; each question is marked out of 25.

-    A2 Metric Spaces and Complex Analysis, which will be three hours.

This paper includes six questions and you should answer four. The best four questions count towards a candidate's total mark for the paper.

In addition, candidates must offer either two papers from papers A3-A5, A7-A11 or one paper from A3-A5, A7-A11 and paper ASO

You must also take two core Computer Science courses: A10406W1 Models of Computation, and A16156W1 Algorithms. These courses will be examined at the end of the second year.

In your third year, you must choose at least two **Part B** options from Schedule S2 for **Maths**.

For **Computer Science**, for **Part B** of your examination at the end of your third year, the Computer Science courses will be examined by 2-hour papers each paper which will have three questions, and you should attempt two of them. Questions are marked out of 25. The marks for each part of each question will be indicated on the examination paper. The Compilers course will be examined by assessed practical and written paper as for Computer Science (see above).

### 3.3   Computer Science and Philosophy

Apart from two Computer Science Part A core courses, you have to take an equivalent of 14 option "course-equivalents", with at least four from Computer Science, and at least six from Philosophy. The remaining four may be chosen from either discipline without restriction, as outlined above.
These subjects will be examined at the end of the second year, in your **Part A** examination.

Your Computer Science options from Schedule S1(CS&P)will be examined in your **Part B** examination at the end of your third year.

All Computer Science options will be examined at the end of the third year. The Computer Science courses will be examined by 2-hour papers each paper will have three questions, and you may attempt two of them.

In finals papers, questions are marked out of 25. The marks for each part of each question will be indicated on the examination paper. The Compilers course will be examined by assessed practical and written paper as for Computer Science (see above).

### 4    Important Dates

#### 4.1    Dates of term 2019-20:

Michaelmas term:    Sunday 13<sup>th</sup> October 2019 – Saturday 7<sup>th</sup> December 2019
Hilary term:        Sunday 19<sup>th</sup> January 2020 – Saturday 14<sup>th</sup> March 2020
Trinity term:       Sunday 26<sup>th</sup> April 2020 – Saturday 20<sup>th</sup> June 2020

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

#### 4.2    Hand-In Dates – Practicals and Project Reports

**Practicals reports**

By noon on Friday of week 5, Trinity term
-
**2<sup>nd</sup> Year Compilers Practical Assignment**

- By noon on Friday of week 2, Hilary term (to the Computer Science WebLearn site)

**2<sup>nd</sup> Year Group Design Practical**

**Final Report –** By Friday of week 2 of the Trinity term – you can find more information on the Department's website.
**Presentation** – Week 3 of the Trinity term – day to be confirmed.

**3<sup>rd</sup> Year Computer Science Project Report**

- By noon on Monday week 4 of Trinity term, (to the Computer Science WebLearn site)

## 5    Recommended Patterns of Teaching

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

### 5.1    Computer Science

| Paper | Term | Faculty Lectures | Faculty Classes | College Tutorials | College Classes | Comments |
|---|---|---|---|---|---|---|
| Core courses | | | | | | |
| 1. Models of Computation | MT | 16 | | 6 | | |
| 2. Compilers | MT | 16 | | 4 | | This course also has practicals. |
| 3. Concurrent Programming | HT | 16 | | 4 | | This course also has practicals. |
| 4. Algorithms and Data Structures | HT | 16 | | 6 | | |
| 5.Group Design Practical | HT/TT | 7 | 6-7 one-hour seminars on software engineering/ testing/working in teams and version control | | | |
| Students are required to take 10 optional subjects over the course of the second and third years, to be examined at the end of the third year. The recommendation is that they take four of these in the second year. | | | | | | |
| Computer Security | MT | 16 | 4 | | | This course also has practicals. |
| Computer Aided-Formal Verification | MT | 16 | 6 | | | |
| Computer Graphics | MT | 16 | 4 | | | This course also has practicals. |
| Databases | MT | 16 | 4 | | | This course also has practicals. |
| Artificial Intelligence | MT | 16 | 4 | | | This course also has practicals. |
| Machine Learning | MT | 20 | 4 | | | This course also has practicals. |
| Principles of Programming Languages | MT | 16 | 4 | | | |
| Computational Complexity | HT | 16 | 6 | | | |
| Computer Architecture | HT | 16 | 4 | | | This course also has practicals. |
| Computers in Society | HT | 16 | 5 | | | |
| Geometric Modelling | HT | 16 | 4 | | | This course also has practicals. |
| Knowledge Representation & Reasoning | HT | 16 | 6 | | | |
| Lambda Calculus and Types | HT | 16 | 7 | | | |

| | Term | Lectures | Classes | Tutorials | Classes | |
|---|---|---|---|---|---|---|
| Quantum Information | HT | 16 | 6 | | | |
| Logic and Proof | TT | 16 | 6 | | | |
| Concurrency | TT | 16 | 4 | | | This course also has practicals. |
| Computer Networks | TT | 16 | 4 | | | This course also has practicals. |

**Notes:**
- Second year core courses are accompanied by tutorials organised by colleges; the norm is 4 one-hour tutorials for course with practicals and 5 or 6 one-hour tutorials for courses without practicals.
- Problem classes will be organised centrally for the computer science optional courses, although colleges may alternatively organise tutorials. The group design practical, which is part of the practical requirements for the year, is intended to take 20-30 hours, mainly during Hilary term (with some work in Trinity term).
- Students are also required to undertake a Computer Science Project in the 3rd year which is expected to take about a third of the year.

### 5.2  Mathematics and Computer Science

| | | Faculty | | College | | Comments |
|---|---|---|---|---|---|---|
| Paper | Term | Lectures | Classes | Tutorials | Classes | |
| **Core Computer Science courses** | | | | | | |
| Models of Computation | MT | 16 | | 6 | | |
| Algorithms and Data Structures | HT | 16 | | 6 | | |
| Group Design Practical | HT/TT | 7 | | | | 6-7 one-hour seminars on software engineering/ testing/working in teams and version control |
| **Core Mathematics courses** | | | | | | |
| A0 Linear Algebra | MT | 16 | | 4 | | |
| A2 Metric Spaces and Complex Analysis | MT | 32 | | 8 | | |
| **Mathematics options** | | | | | | |
| A3 Rings and Modules | HT | 16 | | 4 | | |
| A4 Integration | HT | 16 | | 4 | | |
| A5 Topology | HT | 16 | | 4 | | |
| A7 Numerical Analysis | HT | 16 | | 4 | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| A8 Probability | MT | 16 | | 4 | | Lectured by Department of Statistics |
| A9 Statistics | HT | 16 | | 4 | | Lectured by Department of Statistics |
| A10 Fluids and Waves | HT | 16 | | 4 | | |
| A11 Quantum Theory | MT | 16 | | 4 | | |
| ASO Number Theory | TT | 8 | | 2 | | Weeks 1-3 |
| ASO Group Theory | TT | 8 | | 2 | | Weeks 1-3 |
| ASO Projective Geometry | TT | 8 | | 2 | | Weeks 1-3 |
| ASO Introduction to Manifolds | TT | 8 | | 2 | | Weeks 1-3 |
| ASO Integral Transforms | HT | 8 | | 2 | | |
| ASO Calculus of Variations | TT | 8 | | 2 | | Weeks 1-3 |
| ASO Graph Theory | TT | 8 | | 2 | | Weeks 1-3 |
| ASO Special Relativity | TT | 8 | | 2 | | Weeks 1-3 |
| ASO Mathematical Modelling in Biology | TT | 8 | | 2 | | Weeks 1-3 |
| **Computer Science options** | | | | | | |
| Computer Security | MT | 16 | 4 | | | This course has practicals. |
| Compilers | MT | 16 | | 4 | | This course has practicals. |
| Computer Aided-Formal Verification | MT | 16 | 6 | | | |
| Databases | MT | 16 | 4 | | | This course has practicals. |
| Geometric Modelling | HT | 16 | 4 | | | This course has practicals. |
| Artificial Intelligence | MT | 16 | 4 | | | This course has practicals. |
| Machine Learning | MT | 20 | 4 | | | This course has practicals. |
| Principles of Programming Languages | MT | 16 | 4 | | | This course has practicals. |
| Computational Complexity | HT | 16 | 6 | | | |
| Computer Architecture | HT | 16 | 4 | | | This course has practicals. |
| Concurrent Programming | HT | 16 | | 4 | | This course has practicals. |
| Knowledge Representation & Reasoning | HT | 16 | 6 | | | |
| Lambda Calculus and Types | HT | 16 | 7 | | | |
| Quantum Information | HT | 16 | 6 | | | |

| | | Lectures | Classes | | | Comments |
|---|---|---|---|---|---|---|
| Logic and Proof | TT | 16 | 6 | | | |
| Concurrency | TT | 16 | 4 | | | This course has practicals. |
| Computer Graphics | MT | 16 | 4 | | | This course has practicals. |
| Computer Networks | TT | 16 | 4 | | | This course has practicals. |
| **Mathematics Options** | | | | | | |
| B1.1 – B8.5 | MT/HT | 16 | 6 | | | |

> **Notes:**
> • Second year core courses are accompanied by tutorials organised by colleges; the norm is 4 one-hour tutorials for course with practicals and 5 or 6 one-hour tutorials for courses without practicals.
> • Problem classes will be organised centrally for the computer science optional courses, although colleges may alternatively organise tutorials.
> • The group design practical, which is part of the practical requirements for the year, is intended to take 20-30 hours, mainly during Hilary term (with some work in Trinity term).

## 5.3   Computer Science and Philosophy

| Paper | Term | Faculty Lectures | Faculty Classes | College Tutorials | College Classes | Comments |
|---|---|---|---|---|---|---|
| Core courses | | | | | | |
| 1. Models of Computation | MT | 16 | | 6 | | |
| 2. Algorithms and Data Structures | HT | 16 | | 6 | | |
| 3. Group Design Practical | HT/TT | 7 | 6-7 one-hour seminars on software engineering/ testing/working in teams and version control | | | |
| Students are required to take 10 optional subjects over the course of the second and third years, to be examined at the end of the third year. The recommendation is that they take four of these in the second year. | | | | | | |
| Mathematics for Computer Science and Philosophy | MT | 17 | | | 5 | |
| Computer Security | MT | 16 | 4 | | | This course also has practicals. |
| Computer Aided-Formal Verification | MT | 16 | 6 | | | This course also has practicals. |
| Computer Graphics | MT | 16 | 4 | | | This course also has practicals. |
| Databases | MT | 16 | 4 | | | This course also has practicals. |
| Artificial Intelligence | MT | 16 | 4 | | | This course also has practicals. |
| Machine Learning | MT | 20 | 4 | | | This course also has practicals. |

| | | | | | |
|---|---|---|---|---|---|
| Principles of Programming Languages | MT | 16 | 4 | | |
| Computational Complexity | HT | 16 | 6 | | |
| Computer Architecture | HT | 16 | 4 | | This course also has practicals. |
| Computers in Society | HT | 16 | 5 | | |
| Concurrent Programming | HT | 16 | | | |
| Database Systems Implementation | HT | 22 | | | |
| Geometric Modelling | HT | 16 | 4 | | This course also has practicals. |
| Knowledge Representation & Reasoning | HT | 16 | 6 | | |
| Lambda Calculus and Types | HT | 16 | 7 | | |
| Quantum Information | HT | 16 | 6 | | |
| Logic and Proof | TT | 16 | 6 | | |
| Concurrency | TT | 16 | 4 | | This course also has practicals. |
| Computer Networks | TT | 16 | 4 | | This course also has practicals. |
| B8.4 Information Theory | | | | | Taught by the Mathematics Institute |
| B1.2 Set Theory | | | | | Taught by the Mathematics Institute |

**Notes:**
- Second year core courses are accompanied by tutorials organised by colleges; the norm is 4 one-hour tutorials for course with practicals and 5 or 6 one-hour tutorials for courses without practicals.
- Problem classes will be organised centrally for the computer science optional courses, although colleges may alternatively organise tutorials. The group design practical, which is part of the practical requirements for the year, is intended to take 20-30 hours, mainly during Hilary term (with some work in Trinity term).
- Students are also required to undertake a Computer Science Project in the 3rd year which is expected to take about a third of the year.