



University of Edinburgh

Division of Informatics

School of Computer Science

COMPUTER SCIENCE

SECOND YEAR

Course Guide 2001–2002

James Clerk Maxwell Building,
The King's Buildings,
Mayfield Road
Edinburgh,
EH9 3JZ

October 2001

COMPUTER SCIENCE TWO 2001–2002

URL: <http://www.dcs.ed.ac.uk/teaching/cs2/www>.

NEWSGROUP: eduni.dcs.cs2.

COURSE ORGANISER: Kyriakos Kalorkoti, kk@dcs.ed.ac.uk, JCMB room 2612.

INFORMATICS TEACHING OFFICE: ito@dcs.ed.ac.uk, JCMB room 1502.

Contents

1	Introduction	2
2	Course activities	3
3	Course assessment	4
3.1	Assessed practical work	5
3.2	Examinations	6
3.3	Determination of overall results	6
3.4	Proceeding to Honours	6
3.5	Examination resits	7
3.6	Appeals	7
4	Coursework and plagiarism	7
5	Responsible behaviour and harassment	8
6	Help, suggestions, requests and complaints	8
7	CS2 facilities	10
8	Communication mechanisms	12
9	Student records	12
10	Syllabus	13
10.1	Computer Science 2Ah	13
10.2	Computer Science 2Bh	15
10.3	Textbooks	16
11	Timetable	19
11.1	Lecture timetable	19
11.2	Practical timetable	20
12	CS2 Staff	21

Important

Information in the CS2 Course Guide may be updated from time to time during the year. The definitive version will be maintained on-line on the CS2 Web page. Any major alterations will be publicised to the class at the time of amendment.

Note also that important announcements during the course will be made via the CS2 newsgroup. You must read the newsgroup regularly, this is a condition of attending the course. There are various ways to read news, a simple one being to use the `xrn` program; make sure that you are subscribed to the CS2 newsgroup, `eduni.dcs.cs2`.

1 Introduction

The first year of Computer Science at the University of Edinburgh provides a broad introduction both to the general academic subject of computer science and to the discipline of software engineering. The second year course builds on this foundation, further developing these subjects in depth and breadth. In addition, there is a significant focus on current and emerging computing technologies, centring around the Internet and the World-wide Web.

Students entering CS2 require a knowledge of (at least) the following topics from Computer Science 1.

- Use of Unix/Linux and the X-windows interface, including the emacs editors, mail and news programs, and the Netscape WWW browser.
- Basic program design, and the Java programming language.
- Simple data structures (lists and trees), and examples of their uses.
- Finite state machines and regular expressions
- Proof by induction and propositional logic.
- Basic concepts of software engineering.

Students taking CS2 this year, who did not take CS1 in 1999–2000 or 2000–2001 must ensure that they do any background reading necessary for following CS2. Suggestions for textbooks to look at are given at the end of this Course Guide. In addition, it is strongly recommended that you obtain a copy of the CS1 lecture notes from 2000–2001. These notes are available from the Informatics Teaching Office (JCMB, room 1502).

The CS2 course consists of two “half” courses, CS2Ah and CS2Bh. Students normally attend both halves.

Computer Science 2Ah runs in the first half session, throughout term 1, and for the first two weeks of term 2. This half course covers three topics: *computer systems*, which studies the internal structure and implementation of digital computers; *language processing*, which studies the representation and implementation of formal languages in

computers, as used, for example, in compilers for programming languages; and *software engineering*, which continues the study of software engineering begun in CS1 with an elaboration of the whole software engineering lifecycle.

Computer Science 2Bh runs in the second half session, from week 4 of term 2 until week 5 of term 3. This half course again covers three topics: *algorithms and data structures*, which studies the fundamental algorithms and data structures of computer science at a more rigorous level than in CS1; *current technologies*, a hands-on introduction to Internet and Web-centred technologies; and *advanced programming in Java*, which further develops your knowledge of Java, introducing, at the same time, a number of important high-level programming concepts.

A syllabus for the whole course is given in Section 10 of this document.

2 Course activities

Scheduled CS2 classes run during weeks 1 to 10 of term 1, weeks 1 to 10 of term 2, and weeks 1 to 5 of term 3. This period comprises of 24 weeks of lectures (12 weeks per half course), with a lecture-free week in week 3 of term 2, between CS2Ah and CS2Bh. (Other courses in the Faculty may set class exams during this week. There are no class exams in CS2.) The CS2 degree exams are held towards the end of term 3. The period between the end of lectures and the exams is set aside for exam preparation.

Lectures Three lectures are held per week, at 11am each Monday, Wednesday and Friday; all lectures are held in JCMB Lecture Theatre A. Outline lecture notes are handed out at each lecture, but students may need to augment these with their own, more detailed notes. Sufficient copies of lecture notes and other CS2 documents are printed so that all students can take one, and any remaining copies are placed in the pigeonholes outside the Informatics Teaching Office. On-line copies of CS2 documents will be made available off the CS2 Web pages. Students wanting additional paper copies of notes, after the copies in the pigeonholes are exhausted, should ask for them from the ITO (if necessary print off the on-line copy; see Section 7 for details of printer use and the possibility of charges).

Tutorials Tutorials are held at 2pm each weekday, normally in JCMB. Each student attends one tutorial group, which will meet most teaching weeks during the course (the actual meeting times are specified in the CS2 homepage under “Tutorial groups and timetable”). The allocation of students to tutorial day, tutor, and tutorial room will be announced during the first two weeks of the course. Discussion at tutorials will normally centre on the content or organisation of the course, and in particular on the practical exercises, but discussion of wider Computer Science or other issues is welcome. You should *not* regard tutorial attendance as optional. Attending tutorials (as well as lectures) is the best way of keeping up with the CS2 course. Also, important information about coursework will be discussed only at tutorials. Your tutors may be available for additional consultation at times other than the scheduled tutorial class—it is best to request help via e-mail in the first instance, if only to find out whether your tutor is in their office!

Coursework The assessed coursework component of CS2 consists of eight practical exercises, most of which run for two weeks. Practical exercises will generally combine computer-based tasks, such as programming, with “pencil and paper” work. Students carry out the practical work using the CS2 computing facilities, and other facilities such as the JCMB library when appropriate.

Each practical will be described in a practical handout, distributed at a lecture. The practical handout will include a deadline for the completion of the practical, together with instructions on how to submit your solution. For each practical, it is **essential** that you deliver your solution in advance of the advertised deadline, following the instructions given for submission.

You are yourself responsible for scheduling the hours you spend on coursework. It is important to bear in mind that the computing facilities are likely to become heavily loaded close to practical deadlines. Do not leave coursework until the last minute!

Further help on practicals will be available from lectures, tutorials and the CS2 newsgroup `eduni.dcs.cs2`. Coursework will either be marked by your tutor or by a designated graduate student or member of staff. It will be returned with constructive feedback at tutorials.

Other activities CS2 is meant to occupy one third of an academic year of 24 teaching weeks. In practice this means that students are expected to devote an average of about 13 hours work per week to CS2 during term-time. Lectures and tutorials take 4 hours per week, leaving 9 hours, of which you should expect to spend up to 5 hours each week on practical work (although this will vary from practical to practical and from person to person). This leaves a non-trivial amount of time per week for consolidation of the lecture material and background reading. It is essential that you make effective use of this time. It is up to you to schedule your working week to cover the demands of CS2 and your other courses—time management is a useful skill to develop in itself.

3 Course assessment

The performance of CS2 students is measured by the continuous assessment of practical work during the academic year, and by an examination at the end of the academic year. All work in CS2 is assessed according to the University’s standard marking scale, see Figure 1.

The two half courses are marked separately. Under normal circumstances, the final mark for each half course is given by the formula:

$$\text{Final mark} = \frac{1}{4} \text{ Practical mark} + \frac{3}{4} \text{ Exam mark.}$$

However, in order to pass you must have an exam mark of at least 35%. Otherwise your mark will be limited to a maximum of 39%.

The pass mark for each half course is 40%. However, students who wish to continue with an Honours degree in the School of Computer Science are expected to achieve an overall standard of at least grade C for their work (there are similar requirements for the

A	$70 \leq \text{mark} \leq 100$	(CS Honours degree standard)
B	$60 \leq \text{mark} < 70$	(CS Honours degree standard)
C	$50 \leq \text{mark} < 60$	(CS Honours degree standard)
D	$40 \leq \text{mark} < 50$	(CS Ordinary degree standard)
E	$35 \leq \text{mark} < 40$	(Fail)
F	$25 \leq \text{mark} < 35$	(Fail)
G	$0 \leq \text{mark} < 25$	(Fail)

Figure 1: The University-wide marking scale, and its CS2 interpretation

joint degrees). It is therefore wise to set 50% as a minimum target for all work throughout the 2nd year.

More detailed descriptions of how the practical work and examinations are marked are given in the subsections below.

3.1 Assessed practical work

Each assessed practical is marked out of 100 and given both a numerical mark and a grade according to the University-wide standard marking scale in Figure 1.

You should aim to obtain a mark of at least 50 on practicals. A mark between 40 and 50 is a warning that an improvement in work is desirable. Note that it is *always* worth making a submission for a practical exercise, even if your submission is very incomplete — any mark contributes something to the final result.

The assessed practical work component of CS2 contributes one quarter of the final mark for each half course. There are four practical exercises in the first half course, and four in the second half course. At the end of each half course, the marks awarded for each of the practicals in the half course are averaged (each practical is given equal weighting) to arrive at a percentage overall practical mark for the half course.

Practical work is marked either by tutors or by graduate student markers who return it together with a mark and more detailed feedback. *It must be noted that marks returned during the course are provisional and may be revised by the Board of Examiners.*

Practical submissions will be monitored by the Informatics Teaching Office. Failure to submit practical work will be notified to Directors of Studies. *Late work will not be accepted other than in exceptional circumstances and with the prior approval of the course organiser.* There must be a genuine reason for a late submission to be allowed. If you need an extension of more than a week, you must produce an appropriate certificate (or a letter from your DOS) to justify your request. Late submissions may be penalised by a reduction to the mark.

Students who get behind with coursework due to illness or other circumstances, or who run into any other difficulties with the work of the course, should take the appropriate actions suggested in Section 6 of this guide.

A timetable for all practical exercises is in Section 11; for each exercise, the exact deadlines are made clear at the time of promulgation.

Students should note that marked coursework returned to them by tutors must be retained throughout the year, and resubmitted at the end of the year, in case the Board of Examiners wishes to examine it. Details of how and when to resubmit coursework will be given at the end of the CS2 lecture series.

3.2 Examinations

The examination contributes three-quarters to the final mark for both half courses. The examination consists of two **two-and-a-half hour** papers, one for each half course, in the June degree-examination diet. (Two further papers are set for the September resit diet.) Each paper consists of four compulsory questions worth ten marks each, and a choice of two out of three questions worth thirty marks each. The questions are set and marked by lecturers. Before the examination, the papers are scrutinised within the Division, and by the External Examiner, who is a senior member of teaching staff from the computer science department at another UK university.

There are no class examinations. Thus there are no exemptions from the June examination. Past CS2 exam papers, although for a different syllabus (other than for last year when the new syllabus was introduced), are available from the course secretary, in the library and on-line. Some of the questions in the older exam papers are still relevant, and will give an indication of the level of difficulty you might expect in this year's CS2 exams.

3.3 Determination of overall results

The Board of Examiners consists of senior staff from the Division, CS2 lecturing staff (who set and mark the examinations), the Course Organiser and the External Examiner. The Board considers practical marks, examination marks and any other relevant information, including information which is provided by students' Directors of Studies, to decide whether each student has passed or failed CS2Ah and CS2Bh. It is possible to pass half courses on an individual basis. The pass mark is 40%.

The University Registry notifies students in July of their final CS2Ah and CS2Bh marks, and students can, on request, obtain a more detailed breakdown of marks from their Director of Studies.

3.4 Proceeding to Honours

In order to proceed to Computer Science 3 (Honours) or Software Engineering 3 (Honours), or to any of the third year joint Honours courses with Computer Science, you are normally expected to obtain an average CS2 mark (across the two half courses) of at least 50%, in addition to passing each of the half courses separately. This assumes, of course, that the prerequisite results in other subjects are also attained. The final decision about who is admitted to Honours is the responsibility of the Head of Division.

3.5 Examination resits

Students who fail one or both half courses in June may resit the failed half course(s) in September.

Students who pass one or both half courses in June, but with a mark below 50%, will, at the discretion of the Head of Division, be given the opportunity to resit one or both CS2 half course examinations in September, in order to demonstrate sufficiently improved performance to attain entry to Honours. In these cases, the resit is “unofficial”, in the sense that the marks are *not* recorded by the University (you can only pass the half courses once), but are used only within the Division, by the Head of Division, to assist decisions on whom to admit to Honours courses. A final list of students permitted to enter Honours courses is published in September.

3.6 Appeals

Decisions of Boards of Examiners, once certified in writing, are final except that candidates have the right of appeal: (a) on the grounds of substantial information which for good reason was not available to the examiners when their decision was taken, or (b) on the grounds of alleged improper conduct of an examination (this includes conduct of a meeting of a Board of Examiners). Please take the time to read the full regulations; there is a link to them via the CS2 web homepage. (Note that ignorance of the regulations does *not* exempt you from them.) Students are advised to consult their Director of Studies before initiating an appeal. If an appeal is made, it must be submitted in writing to the Secretary to the University as soon as possible; only in exceptional circumstances are appeals considered more than three months after the results of an examination have been made known to the appellant.

4 Coursework and plagiarism

Coursework is an important component of CS2. As well as contributing 25% to the final mark for each half-course, coursework plays an essential part in the process of learning computer science skills. Exam questions will often be set in a way that makes use of information consolidated by coursework. You are highly unlikely to pass the exams unless you have done the coursework.

Because coursework contributes to your own individual assessment, **it is essential that any work you submit is your own work**. Of course it is perfectly acceptable to discuss general aspects of your work with other students, lab demonstrators, your tutor and lecturers. However, you must not copy (or disguise) someone else’s work presenting it as your own. If you do so, it will be treated as **plagiarism** and disciplinary action will be taken.

The Division of Informatics has its own guidelines on plagiarism. You must read these. There is a link from the CS2 Web page, and also from:

<http://www.inf.ed.ac.uk/admin/IT0/RegulationsandGuidelines.html> (*)

The above URL also contains a link to the University's official policy on plagiarism, which is set out in Section 5 of the Degree Exam Regulations.

5 Responsible behaviour and harassment

Although the syllabus is predominantly concerned with what computer systems *can* and *cannot* do, an equally important consideration is what computer systems *should* and *should not* be used for. Within an easy-going, but socially conscious environment such as the Division of Informatics, computer systems are designed for a responsible user community and, for example, do not incorporate elaborate electronic policing. This makes life easier for everyone. It is not the function of CS2 to moralise about life in general but, it is essential that students make responsible use of the computer facilities provided.

An example of computer related activity which is illegal under the criminal law or which is civilly actionable is the holding or distribution of any material which is defamatory, discriminatory, obscene or otherwise illegal or is offensive or calculated to make others fearful, anxious or apprehensive. The latter behaviour will be treated as **harassment** and disciplinary action will be taken.

There is a University Code of Practice on Personal Harassment, available from the URL (*) above.

Any student who considers themselves to be a victim of harassment should raise the matter quickly with the Course Organiser and/or their Director of Studies.

6 Help, suggestions, requests and complaints

Help with work Help with practicals or other aspects of the CS2 course may be obtained from a number of different sources. Lecturers will recommend books which may be consulted for an alternative explanation of material in the course—these books will often be available in the reserve section of the JCMB library (Room 4327). Discussion with fellow students may help (although read Section 4 of this guide!). Tutorials provide an opportunity for students to discuss difficulties both with the lecture material and with practicals. Tutors and lecturers may also be consulted at other times, either in their room or by e-mail. You should also keep up to date with discussions on the newsgroup `eduni.dcs.cs2`, which provides a forum for the clarification of course material. Demonstrators will be present in the CS2 labs some afternoons every week (a timetable will appear on the CS2 Web page). Demonstrators are there to help you make progress when you are stuck. They should not be expected to solve your coursework problems (or write your programs) for you.

Help with other problems If you run into difficulties keeping up with your CS2 work, whether because of illness or for any other reason, you should discuss the situation with your Director of Studies as soon as practicable. Your Director will be able to offer advice, and will treat anything you say in confidence, and will also ensure that the Board of

Examiners is aware if your circumstances are likely to have affected your coursework or exam marks.

It is also helpful if students who are ill or otherwise unable to attend classes inform the Course Organiser of their absence.

Suggestions, requests and complaints No course is perfect and constructive feedback from staff and students is always welcome. We do our best to ensure that CS2 operates as smoothly as possible, with a good balance of material pitched at a suitable level. Nevertheless there is bound to be room for improvement. Thus feedback from students will be especially welcome and helpful.

Comments and suggestions can be made by anyone, in person or by e-mail, to the CS2 Course Organiser, or to lecturers or tutors, at any time. The `eduni.dcs.cs2` newsgroup is also available for discussion of any issues of interest to the class, and is read by the Course Organiser. At the beginning of the year, students can volunteer to be Class Representatives, who act as a channel to the Course Organiser on matters related to CS2. If more than five students volunteer, the class elects five of them to act as their representatives. Comments may be made to class reps in person, or by sending e-mail to `cs2reps`. Students wishing to make an anonymous suggestion about the course can do so via a class rep.

CS2 staff-student liaison meetings, attended by CS2 teaching staff and CS2 class reps, are usually held once a term, and whenever staff or students have issues which they feel merit discussion; agenda items may be submitted by anyone, either to the Course Organiser or to the class reps. Minutes of the meetings are made available on the CS2 Web page. At the end of the first and second half courses, a questionnaire about the course is given to students, who can complete it and return it anonymously. All students are encouraged to take advantage of this, even if they only wish to answer a few of the questions. This information is reviewed by staff at the end of the year.

As a result of these activities, changes may be made to the course. Simple adjustments are implemented by the Course Organiser as soon as practicable; these will be publicised to the class immediately. Changes to the syllabus are discussed by the Divisional Syllabus Committee; major changes have to be referred to the Faculty Board of Studies in Engineering and Informatics. Changes to teaching and assessment procedures, and to resource requirements, are discussed by the Divisional Teaching Committee. Decisions of the Syllabus and Teaching committees are ratified by a Divisional Meeting.

Grievances Specific grievances relating to, for example, the marking of a particular submission, for which the above class-wide procedures may not be appropriate, should ideally be taken up with the tutor or lecturer concerned in the first instance. If this is not possible, or if a satisfactory conclusion cannot be reached in this way, the grievance should be brought to the attention of the Course Organiser.

In cases where students do not consider that their concerns have been satisfactorily addressed by the mechanisms outlined above, they may appeal to the Head of Division (see Section 12 of this document).

Section 3.6 gives details of the procedure to follow to appeal a decision of the Board of Examiners.

7 CS2 facilities

Location of facilities All CS2 activities take place in the James Clerk Maxwell Building (JCMB) on the King's Buildings (KB) site. Apart from academic buildings, the KB site has the KB Centre, which houses a general shop and a book shop; and KB House, which houses a bar, a refectory and other leisure facilities.

The JCMB is open from 8.15 a.m. to 10 p.m., Monday to Friday, and from 9 a.m. to 7 p.m. on Saturday and Sunday. CS2 students can expect to be evicted from the building by night security personnel if they are present outwith these times. Further, all areas containing equipment are fitted with card-operated security locks, which are only deactivated between 9 a.m. and 6 p.m., Monday to Friday. Your student matriculation card will be accredited to operate the security locks when you register for CS2.

All rooms in the JCMB have four-digit numbers; the first digit indicates which floor the room is on, and the second digit indicates which corridor the room is on. All CS2 lectures take place in Lecture Theatre A (3902). The CS2 machines are in the Machine Halls (rooms 1206 and 1305); they are most easily reached by going down the flight of stairs in front of the servitors' box at the JCMB main entrance, and then following the corridor past the boiler room. The JCMB Library (4327) contains Computer Science books and journals, together with desks for private study.

The CS2 Unix system Computing facilities for CS2 coursework consist of networked PC workstations. These run the Redhat Linux operating system and the X11 window management software. CS2 students also have access to the multi-user Linux server `scar`. All students should telnet to `telnet.dcs.ed.ac.uk` and then if required, connect to `scar.dcs.ed.ac.uk`.

Any faults encountered on computing facilities, especially broken machines, terminals and monitors should be reported by sending electronic mail to `faults`.

Disk quotas Appropriate disk quotas are set for each user group. Information about quotas can be found at:

<http://www.dcs.ed.ac.uk/support/supFAQ.phtml#JA0>

This is kept up to date by support.

Printing CS2 students should use the South Machine Hall laser printer, `ljmh`, for hard copies. The `lpr` command will print to this printer by default. Printing for coursework is free of charge; abuse of the facility may incur a charge.

The news system The Unix read news commands `rn` or `xrn` can be used to read news articles in the `eduni.dcs.cs2` newsgroup (plus many other newsgroups of varying degrees of interest). Articles can be posted to the `eduni.dcs.cs2` newsgroup by sending the article in the form of a mail message to the mail address `eduni.dcs.cs2` or by using the `Pnews` command. Anyone may post an article to `eduni.dcs.cs2`—articles must have meaningful names, must be of genuine interest to CS2, and must be at most two screen pages long. It is possible to post articles to other newsgroups using the facilities within the `rn` or `xrn` programs, or by using the `Pnews` command. Before posting to any newsgroup other than `eduni.dcs` groups, however, the standard rules for posting to the worldwide network should be studied—these rules must be followed, and may be found in the news article entitled *Rules for posting to Usenet*, which is posted regularly to the newsgroup `news.announce.newusers` (along with other articles containing useful information about the Usenet network).

Non-coursework use of the system Access to computing facilities is provided only for activities related to the work of the class. In the main, this means practical exercises, but it also includes electronic communication amongst students and staff. Elaborate word processing of practical work submissions is not desirable; the content is far more important than the appearance (although, of course, legibility is essential). Other educational activities using the standard CS2 facilities are allowable, but must be justified to the CS2 Course Organiser on request, must not cost the Division money, and must have the lowest priority of any Divisional activities. It is impractical for the Division to restrict access to all non-CS2 facilities, so it should not be assumed that because a non-CS2 facility is accessible, it may be used with impunity. Permission must be obtained before any non-CS2 facility is used.

CS2 students are permitted responsible use of email, the Usenet news system and the World Wide Web (subject to the provisions of the previous paragraph). Remote login to any site outwith the University for the purpose of playing interactive games is *not* allowed under any circumstances.

All students must remember that they agree to respect the University Computing Regulations when signing the Sponsio Academica at matriculation.

Safety The computing equipment used for CS2 coursework does not present any unusual hazards. Students should however be aware of the general safety rules appropriate for any working environment and described in the Safety Handbook. In particular, spilt liquids could create a potential electrical hazard in the Machine Halls, which is why food and drink are banned. All students must read the Safety Handbook at the start of the year, and complete and return the associated form to acknowledge that they have understood the contents. This is now usually done via the Web.

8 Communication mechanisms

Both non-electronic and electronic communication is used in support of the course. Students are expected to log on to the CS2 Unix system *regularly* (two or three times every week) in order to receive, and respond to, time-critical electronic communications.

Class-wide communication might take the following forms:

- Announcements at lectures or tutorials;
- Alert messages displayed when logging on to the CS2 system;
- Messages in the `eduni.dcs.cs2` newsgroup;
- Documents and handouts held by the Informatics Teaching Office.

In addition, the CS2 Web page always contains up to date information about most aspects of the course. The URL for accessing that page is given at the very beginning of this document. All of this may seem complicated, but care is always taken to ensure that students who log on regularly do not miss crucial information.

Members of staff have mail baskets in the corridor near their rooms. Room and telephone numbers, and electronic mail addresses, for all relevant members of staff are available from the CS2 Web page.

The “electronic revolution” is far from complete, and many people still prefer the non-electronic form of a particular type of communication. Also, people differ in their preferences for various degrees of directness in interaction. Learning how to use various communication facilities wisely is seen as a valuable (albeit unassessed) component of the CS2 course.

9 Student records

To assist in the administration of the course, some information about students may be held on computer. Most of this information is obtained from a form completed by each student at the start of the course; the remainder consists of practical work and examination details. The items of information are as follows:

- Full formal name, and usual name;
- Home and term-time addresses;
- Matriculation number;
- Computer username;
- Degree type and subject, and year of study;
- Director of Studies;

- Tutorial group;
- Practical marks obtained over the year;
- Examination marks obtained in June and September;
- Final marks for the course;
- Whether permitted to proceed to CS3 Honours or Ordinary courses.

Students may examine and, if necessary, correct the above information.

Students are responsible for keeping their personal records up to date. Any changes must be reported promptly to the Informatics Teaching Office.

The registration forms completed at the start of the course contain most of the information listed above, as well as details of other courses taken by each student; these forms are stored in a locked filing cabinet.

10 Syllabus

The aim of the second year in computer science is to present students with a range of material across the spectrum of Computer Science, combining close study of well-established areas with an introduction to significant current and emerging computing technologies. While primarily a course for computer scientists, it also supports students preparing for other, related, honours programmes. Teaching builds on that in Computer Science 1, adding detail and depth while retaining a broad appreciation of the full scope of the subject.

10.1 Computer Science 2Ah

The first half course consists of three lecture threads: computer systems, language processing, and software engineering.

Computer systems

The primary aim of this section of the syllabus is to convey an understanding of the internal structure and implementation of digital computers. To impart this knowledge, we first explain how a typical hardware/software interface is constructed. This interface consists of several key components:

- Techniques for **representing and operating upon atomic data** (i.e., binary representations for integers, characters and floating-point values).
- The **structure of typical instruction sets**.
- The **environment in which a program executes** (e.g., the concepts of *processes* and *virtual memory*).

In addition to explaining the hardware/software interface, we also need to convey an understanding of how this interface can be realised in logic. This consists of several further components:

- **Combinational logic**—i.e., how simple state-less building blocks such as adders, multiplexers and decoders, can be synthesised from gates.
- **Sequential logic structures**—i.e., how components with state, such as latches, registers, register files and memories can be constructed from gates.
- **Processor structure**—i.e., how a simple RISC instruction set can be implemented using the combinational and sequential logic components derived earlier.

The computer systems thread consists of 13 lectures, given by Marcelo Cintra. Practical 1 will be concerned with this section of the course.

Language processing

In CS1, finite state machines and regular expressions were introduced as tools for describing and recognising simple formal languages. This thread of CS2 builds on this material. It studies transition systems and finite state machines in more depth, particularly with reference to their associated “regular languages”. It then proceeds to develop the tools and concepts required to deal with more complex formal languages. Such tools include formal grammars and parsing, as used in the description and implementation of programming languages.

- Transition systems, finite state machines and regular languages.
- Formal grammars.
- Parsing.

12 lectures will be given by Martin Grohe and Ian Stark. Practical 2 will be associated with this thread of CS2Ah.

Software engineering

The aim of this section is to build on the knowledge of software engineering taught in CS1. After following both CS1 and CS2, students will be left with a broad understanding of the discipline of software engineering, and its relationship to computer science. In particular, where CS1 treated the innermost part of the software engineering lifecycle, the construction phase, in CS2 we focus on the other phases of the lifecycle: the inception, elaboration and transition phases. The course will cover in particular:

- Rôle of software engineer.
- Scale of the discipline.

- Process of software engineering.
- Requirements engineering.
- Verification and validation.
- Delivery and beyond.

8 lectures will be given by Stuart Anderson and Michael Fourman. Practical 3 will be associated with this section of the course.

Practical 4

Practical 4 will be a Java programming practical (probably with a pencil and paper part) related to at least one of the threads of the course.

10.2 Computer Science 2Bh

The second half course also consists of three lecture threads: algorithms and data structures; current technologies; and advanced programming in Java.

Algorithms and data structures

This module presents the basics of algorithms and data structures at a more rigorous level than in CS1. On the one hand it will introduce the tools required for the analysis of algorithms, and motivate the need for such analysis. On the other, it will demonstrate several basic and useful computer science algorithms and data structures, especially ones based on trees and graphs.

- Analysing algorithms—theory versus practice.
- Trees and searching.
- Graphs and graph algorithms.
- Algorithm examples.

11 lectures will be given by Martin Grohe. Practical 5 will be associated with this part of the course.

Current technologies

This thread presents an introduction to current and emerging technologies in computer science. The thread will be based around the Web as a binding theme.

- Database Systems and Database Design.
- SQL programming.

- The Internet and World-Wide-Web.
- HTML, XML, and XSLT.
- Internet Security Issues.

11 lectures will be given by Chris Walton and Henry Thompson. Practical 6 will be associated with this part of the course.

Advanced programming in Java

This thread introduces a selection of high-level programming concepts, by exhibiting these concepts within Java. The thread will thus maintain and extend the students' basic competence as programmers, building on their experience from CS1.

- Using the class hierarchy.
- Modular Programming.
- Concurrency.
- Class libraries: input/output; collections; graphics.
- Reasoning about programs.

10 lectures will be given by Ian Stark. Practical 8 will be associated with this part of the course.

Practical 7

Practical 7 involves researching and writing an essay. The essay topic will be relevant to computer science in general, and not necessarily directly connected to topics covered in CS2 lectures. The essay question is distributed towards the end of term 2, and the deadline is in term 3. Week 10 of term 2 is reserved for research into the essay topic, and there will be no CS2 lectures during that week.

10.3 Textbooks

There is no single textbook that covers all the material to be taught in the course. Lecturers will from time to time refer to various textbooks, and will give an indication of how important it is that you read the material referred to. In addition, you may want to refer to relevant textbooks for a second explanation of material in the course. The principal books, which might be referred to for each section of the course, are listed below; copies of most of these books can be found in the reserve section of the JCMB library (Room 4327).

In the lists of books below, books are given star ratings of between one and three stars. Books with three stars will be used as course texts, and are considered as being essential purchases. Books with two stars are highly recommended as being very relevant to the

course, but are not essential purchases. Books with one star are relevant to some section of the course, or are useful background reading.

The following is a general introduction to computer science.

A.V. Aho and J.D. Ullman, (*)
Foundations of Computer Science. C Edition,
Computer Science Press, 1995

Although it is not essential to buy this book, it is an excellent introduction to the foundation of Computer Science, containing a wealth of material spanning courses from first to third year. The one drawback of this book, as regards CS1 and CS2 at Edinburgh, is its use of the C programming language. However, this should not prevent a student acquainted with Java from following the book.

The other recommended CS2 textbooks are divided according to the sections of the course they are associated with.

Computer systems

D.A. Patterson and J.L. Hennessy, (*)
Computer Organization and Design, 2nd edition,
Morgan Kaufmann, 1998.

A. Silberschatz and P.B. Galvin, (*)
Operating Systems Concepts, 5th edition,
Wiley, 1998.

The first is one of the best introductory books on computer systems hardware, and covers most of the material in the Computer Systems part of the course, plus much more. It is a well-written interesting book.

The second covers the material in the two or three CS2 lectures on operating systems, and of course much more on the same subject.

Language processing

The main textbook associate with the language processing part of the course is Aho and Ulman's *Foundations of Computer Science*, already referred to above.

Other worthwhile books are:

A.V. Aho, R. Sethi and J.D. Ullman, (*)
Compilers: Principles, Techniques and Tools, (the Dragon book)
Addison–Wesley, 1988

A.W. Appel, (*)
Modern Compiler Implementation in Java,
Cambridge Universtiy Press, 1998.

Software engineering

A. Cockburn, (**)
Surviving Object-oriented Projects,
Addison Wesley, 1998

A survey of strategies for dealing with both small and large scale object-oriented software projects, identifying many problems that may be encountered, with illustrative case histories.

Algorithms and data structures

The Aho and Ullman book, *Foundations of Computer Science*, referred to above covers much of the material on algorithms and data structures. However, the best textbook for this thread of CS2Bh is:

T.H. Cormen, C.E. Leiserson and R.L. Rivest, (**)
Introduction to Algorithms,
MIT Press, 1990

It is not necessary to purchase this book as it is rather advanced for second year. However, it is the recommended text for the CS3 Algorithms and Data Structures module, so it might be worth buying it if you plan to do a Computer Science degree.

Current technologies

R. Elmasri and S. Navathe,
Fundamentals of Database Systems (3rd Edition),
Addison-Wesley, 2000.

D. Box, A. Skonnard and J. Lam, (**)
Essential XML,
Addison Wesley, 2000.

The first specifically covers material in the database part of the course, and is probably not worth purchasing for CS2 alone.

Advanced programming in Java

The following books are very useful:

B. Eckel, (**)
Thinking in Java, Second Edition,
Prentice Hall, 2000.

K. Arnold, J. Gosling and D. Holmes, (**)

The Java Programming Language, Third Edition,
Addison Wesley, 2000.

B. Cornelius,
Understanding Java,
Addison Wesley, 2001.

(**)

You are strongly recommended to buy at least one of these books.

11 Timetable

11.1 Lecture timetable

The introductory lecture for CS2 will take place on Monday week 1 of term 1 at 11am in Lecture Theatre A. A detailed lecture plan for the first half course, CS2Ah, will be handed out at this lecture.

The lectures for CS2Ah start on Wednesday week 1 of term 1 (also 11am, Lecture Theatre A). CS2Ah lectures continue until the end of week 10 in term 1 (if you have class exams clashing with CS2 lectures in week 10 of term 1 then the class exams should take priority over attending CS2 lectures), and then throughout weeks 1 and 2 of term 2. Week 3 in term 2 is left as a free week between CS2Ah and CS2Bh. (You may have class exams in other subjects during this week.)

The second half course, CS2Bh, starts on Monday, week 4 of term 2. Lectures continue until the end of week 9 of term 2, and then throughout weeks 1 to 5 of term 3. Week 10 of term 2 is left free of lectures as a study week during which you can begin your research on the CS2 essay topic (Practical 7). Detailed lecture plans for CS2Bh will be handed out at the start of the half course.

The concluding lecture for CS2 will take place on Friday, week 5 of term 2. Important information about the June examination will be provided at this lecture.

Term 1		Term 2		Term 3	
Week	Begins	Week	Begins	Week	Begins
1	8 Oct	1	7 Jan	1	15 Apr
2	15 Oct	2	14 Jan	2	22 Apr
3	22 Oct	3	21 Jan	3	29 Apr
4	29 Oct	4	28 Jan	4	6 May
5	5 Nov	5	4 Feb	5	13 May
6	12 Nov	6	11 Feb	6	20 May
7	19 Nov	7	18 Feb	7	27 May
8	26 Nov	8	25 Feb	8	3 Jun
9	3 Dec	9	4 Mar	9	10 Jun
10	10 Dec	10	11 Mar	10	17 Jun

11.2 Practical timetable

Practical number	Handout distributed by	Submission due by	Marked work returned by
------------------	------------------------	-------------------	-------------------------

CS2Ah

P1	start of week 1, term 1	start of week 4, term 1	tutorial in week 6, term 1
P2	start of week 5, term 1	start of week 7, term 1	tutorial in week 9, term 1
P3	start of week 8, term 1	start of week 10, term 1	tutorial in week 1, term 2
P4	start of week 1, term 2	<i>end</i> of week 3, term 2 (†)	tutorial in week 5, term 2

(†) To allow time for students with exams in this week.

CS2Bh

P5	start of week 5, term 2	start of week 7, term 2	tutorial in week 9, term 2
P6	start of week 7, term 2	start of week 9, term 2	tutorial in week 1, term 3
P7	start of week 10, term 2	start of week 3, term 3	tutorial in week 4, term 3
P8	start of week 3, term 3	start of week 5, term 3	from tutors in week 6, term 3

12 CS2 Staff

Lecturing and administrative staff are detailed below—an on-line list of these and tutoring staff may be found on the Web page.

Lecturers

Name	Username	Room number	Phone number
Stuart Anderson	soa	1610	50 5191
Marcelo Cintra	mc	3419	50 5118
Michael Fourman	Michael.Fourman@ed.ac.uk	2BP-4R03	50 4416
Martin Grohe	grohe	1606	50 5135
Ian Stark	stark	2506	50 5143
Henry Thompson	ht@cogsci	6BP-G14	50 4440
Chris Walton	cdw	80SB-E14	50 2718

Rooms are at JCMB unless otherwise indicated (BP stands for Buccleuch Place and SB for South Bridge).

Administrative staff

Name	Username	Room number	Phone number
Kendal Reid <i>CS2 Course Secretary</i>	kr	1502 (ITO)	50 5194
Kyriakos Kalorkoti <i>CS2 Course Organiser</i>	kk	2612	50 5149

Extension number 50 *nnnn* is called by dialling 50 *nnnn* on an internal University phone, or (0131) 650 *nnnn* on the public phone network.