UCL DEPARTMENT OF STATISTICAL SCIENCE

Undergraduate Student Handbook

SEPTEMBER 2010

DEPARTMENT OF STATISTICAL SCIENCE
UNDERGRADUATE STUDENT HANDBOOK

The *Department of Statistical Science Undergraduate Student Handbook* has been written for undergraduate students admitted by the Department of Statistical Science to study for one of the following degrees:

BSc Statistics (UCAS code G300)
BSc Statistics and Management for Business (known as SAMB, UCAS code GN32)
BSc Statistics, Economics and Finance (known as SEF, UCAS code GLN0).
BSc Statistics, Economics and a Language (known as SEL, (UCAS code GLR0).
MSci Statistical Science (International Programme) (UCAS code G305)
BSc (Econ) Economics and Statistics (known as Econ/Stats, UCAS code LG13)

The contents also provide information for undergraduate students studying Statistical Science as part of the following degrees:

BSc Mathematics and Statistical Science (known as MASS, UCAS code GG13)
MSci Mathematics and Statistical Science (known as MASS, UCAS code GGC3)

Students on the Econ/Stats, SAMB and MASS degree programmes will also need to refer to the corresponding booklets produced respectively by the Departments of Economics, Management Science and Innovation and Mathematics.

The *Department of Statistical Science Undergraduate Student Handbook* is intended to provide particular information for students registered for the degrees listed above. General information about studying at UCL is given in the *UCL Student Handbook* and the *UCL Guide for Students*, which you should have received from the Registrar's Division. General information is also available on the UCL web site at http://www.ucl.ac.uk/current-students/.

It is important that you are aware of the contents of the UCL Student Handbook and the UCL Guide for Students, which include information on:

College tutors and advisers	Jurisdiction over students	Registrar's Division
Computing facilities	Terms	Library services
Enrolment	Medical services	Attendance
Welfare services	Courses of study	Examinations
College facilities and amenities	Students' Union	Safety and security
Grants, loans, access funds	Fees	College premises and maps

The information given in this departmental handbook is as far as possible accurate at the date of publication but the College reserves the right to make amendments before the commencement of, or during, the courses to which it refers. Information concerning College regulations and procedures is given for guidance only, and is not intended as a substitute for that contained in the UCL Student Handbook and in the UCL Academic Regulations for Students (both available from the web address above).

Department of Statistical Science, University College London, September 2010.

CONTENTS

The *Department of Statistical Science Undergraduate Student Handbook* includes information on the following:

Note: in this handbook, a *course* normally refers to a particular module of a degree *programme*

CALENDAR OF EVENTS

The dates of terms for the current and next sessions are advertised in the College Prospectus, the *UCL Student Handbook* and in the UCL Web pages (http://www.ucl.ac.uk). Terms for the 2010/11 session are based on the pattern of 12 weeks, 11 weeks and 7 weeks.

You should regularly check the departmental noticeboards for current information about teaching matters, particularly during the first few weeks of each term when the timetable may have to be amended for unforeseen reasons.

Lectures in other departments may not follow the schedule below: please check the relevant departmental noticeboard for information. If the arrangements are different you should still follow the Department of Statistical Science instructions regarding Statistics teaching arrangements.

TERM 1

- **Week 1:** *Enrolment* takes place in week 1 of term 1: new students have to carry out *College enrolment* and *course unit enrolment*; returning students should only need do the latter.

  College enrolment for new students is organised by the Registrar's Division, who send you information about the procedure in their Enrolment Booklet before the start of the term. (Returning students should be enrolled automatically).

  Course enrolment is done using the online PORTICO system at http://www.ucl.ac.uk/portico. The procedure will be explained to you upon arrival (see also the section on “Selection of course units” later in this handbook).

  Induction week for freshers: details are given to you on arrival at the Department. Freshers should also register for using the College computer services; details on how to do this are given to you at College enrolment.

  Friday afternoon: tutorial groups should be posted on a departmental noticeboard by now. Check the noticeboards and follow the instructions given.

- **Week 2:**

  Monday: start of lectures for all courses in the Department of Statistical Science.

- **End of October:** first years – *deadline for changing main field of study* is the end of October.
- **Week 7:** This is *reading week.* Classes in the Department of Statistical Science are replaced by self-study activities, including some set by the course lecturers. *Not all departments have a reading week: most students will be attending courses given in another department and you MUST attend these classes if they continue during reading week.*
- **Week 12:** *All teaching* in the Department of Statistical Science ends on the *last* day of term, irrespective of arrangements made by other departments whose courses you may be attending.

TERM 2

- **Week 1:** lectures in the Department of Statistical Science start on the *first* day of term. Check the noticeboards for the term 2 tutorial arrangements. Check the noticeboards for any timetable changes.
- **Weeks 1 and 2:** *Examination registration* – you are required to check your examination entry. See the departmental noticeboards for instructions on how to do this.
- **Week 2:** *Changing options*: the end of week 2 is the deadline for changing options.
- **Week 6:** This is *reading week*. Refer to the corresponding item in term 1 for details.
- **Week 11:** *All teaching* in the Department of Statistical Science ends on the *last* day of term.

TERM 3

- **Week 1:** Some *revision classes* will be offered.
- **Week 2:** *Examinations* start.

DEPARTMENT OF STATISTICAL SCIENCE

The *Department of Statistical Science* is a constituent department of the *Faculty of Mathematical and Physical Sciences* (abbreviated to MAPS). Some general information about the history of the Department is provided in the departmental information booklet for prospective undergraduates given to you during the application procedure and also through the Department's web site (address http://www.ucl.ac.uk/Stats).

The Department of Statistical Science is located on the first floor of 1-19 Torrington Place. The offices of the academic staff are all in this location.

TEACHING STAFF

Academic staff in Department

Prof V S Isham (Head of Department)	Dr G Ambler	Dr G Baio
Dr J Barber	Dr A Beskos	Dr R E Chandler
Prof T Fearn	Mr D H Girmes	Prof M Girolami
Dr S Guillas	Dr C Hennig	Dr H Herbots
Dr I Kosmidis	Dr G Marra	Dr J Nelson
Dr P J Northrop	Prof S Olhede	Dr R Omar
Dr Y Pokern	Dr A Siddiqui	Dr R Silva
Prof T J Sweeting	Dr J Xue	

Others teaching courses in the Department for the 2010/11 session (staff indicated with an asterisk are based outside UCL)

Dr J Herbert* Dr V Raats*

STAFF RESPONSIBLE FOR UNDERGRADUATE STUDENTS

- **Statistical Science Departmental Tutor**: Dr Paul Northrop (Room 145)
- **Undergraduate Student Administrator** Ms Karen Leport (Room 120)
- **Departmental Tutor to MASS students:** is the Departmental Tutor in the Department of Mathematics (Dr Mark Roberts).
- **Statistics Tutor to MASS students**: Dr Paul Northrop (Room 145)
- **Study Abroad Tutor, Tutor to Affiliate students**: Dr Serge Guillas (Room 133)
- **Personal Tutor:** You should be told who this is at registration and it is expected that it will be the same person for the whole of the degree programme.
- **Departmental Careers Tutor**: Dr Paul Northrop (Room 145)
- **Chair of Staff-Student Committee:** Dr Richard Chandler (Room 135)
- **Chair of Departmental Teaching Committee:** Dr Christian Hennig (Room 129)

WHOM TO APPROACH WITH PROBLEMS

Personal Tutor

This person is your mentor and is there for you to consult about your academic progress and in times of trouble.

If you become unhappy with your degree programme, or a particular course, or with your progress, or if you cannot cope, or if you have other problems, you should immediately discuss the matter with your personal tutor. Such problems are often much simpler to deal with if they are addressed immediately. Your personal tutor will then direct you to an appropriate person for more specialist advice if that is necessary.

Your personal tutor may invite you to discuss your academic progress at appropriate times during the session.

Undergraduate Student Administrator

The Undergraduate Student Administrator is the first point of contact for many aspects of your studies. For example, you should contact the Undergraduate Student Administrator to notify absence from college, to submit medical documentation or to change a module registration.

Departmental Tutors

The Statistical Science Departmental Tutor is responsible for the day-to-day running of the five Statistical Science degree programmes (i.e. Statistics, SAMB, SEF, SEL and Econ/Stats), as well as the International Programme.

The Departmental Tutor to in the Mathematics Department is responsible for the running of the MASS degree.

UCL Student Support Group

This is an online service that allows students to offer peer support to each other; students can log on and anonymously discuss any issues that may be troubling them. There is a discussion board and information pages containing helpful advice about common student problems including anxiety, loneliness, issues around sexuality, coping with exams, procrastination and many others. There is also a ‘sources of support’ page with details of

where to find further help if necessary. The web address for this support group is http://www.ucl.ac.uk/support-pages.

Queries about changing a course or your degree programme

Statistics, SAMB, SEF, SEL and Econ/Stats students: please consult the Statistical Science Departmental Tutor (this applies for courses in any subject). For Econ/Stats students, there is also a tutor available in the Department of Economics whom you may consult about the Economics courses in the degree programme.

MASS students: please consult appropriate tutors as follows:

Mathematics courses: Departmental Tutor in Department of Mathematics.

Statistics courses: Tutor to MASS students in Department of Statistical Science.

International Programme students: please consult your Departmental Tutor (this applies for courses in any subject). For organisation of the year abroad, please consult the Study Abroad Tutor.

Questions arising from lectures, problems sheets and assessments

From courses in Department of Statistical Science

First year students: discuss in tutorials (you will also be allocated an academic tutor for the Statistical Science courses).

Second and third year students: discuss in tutorials or approach the course lecturer in a nominated office hour, as appropriate for the course.

All years: each member of the Department's teaching staff should nominate at least one office hour for general availability. If you need to consult a course lecturer, please do so in an office hour. **In particular, in the period leading up to any assessment (see page 20) the course lecturer will set aside a fixed time or times at which (s)he will be available to answer questions about the assessment. (S)he will *not* answer queries about the course outside these times until the assessment is over.**

From courses offered by other UCL departments

As arranged by the relevant department.

Letters or certificates of attendance at UCL

Please obtain these from the Registrar's Division. If you need a document to prove that you are currently studying at UCL, you must go to the Student Records Office (Room G9, South Wing) with your student ID card. The document will be produced for you while you wait.

Visa requirements for international students

General advice for international students, including Home Office requirements for visa renewal, is available from http://www.ucl.ac.uk/prospective-students/international-students/after-you-apply/immigration/. If you need a document for visa purposes, you should download a form from http://www.ucl.ac.uk/current-students/services/recordgeneral/attendance and follow the instructions given there. **Do NOT ask Statistical Science departmental staff for documents for visa purposes: ONLY the Student Records Office is able to issue documents that comply with UK Home Office requirements**.

The Student Union's Rights and Advice Centre (http://www.uclunion.org/get-advice/) is able to provide advice for students with visa problems.

DEPARTMENTAL OFFICE

The Departmental Office is Room 120 on the first floor of 1-19 Torrington Place. There will be occasions when you will be asked to return forms to this office.

Office Staff: Ms Marion Ware (*Departmental Administrator* and *Postgraduate Student Administrator*), Ms Karen Leport (*Undergraduate Student Administrator*).

PORTICO – THE UCL STUDENT INFORMATION SERVICE

UCL operates a web-based student information service which is known as PORTICO. This is used to store personal information such as addresses and contact details, as well as to deal with course unit registration (see page19), examination entry and to provide students with a record of their academic results. Access to PORTICO is available to everyone across UCL – staff and students alike – via the web portal www.ucl.ac.uk/portico. You will need to logon using your UCL userid and password, which are issued to you once you have enrolled.

PROCESSING OF PERSONAL INFORMATION

Whilst you are a student here the department will need to store and communicate information about you. The Data Protection Act, a law designed to protect the privacy of individuals, applies in any such situation. The guidelines here summarise our procedures with respect to such information.

References

We need your explicit permission to give any reference for you. This applies to **all** references, (e.g. for a landlord, a prospective employer or a Masters degree programme). Thus when you give either the department's or a tutor's name as a referee it is important that you inform the departmental office that you have done so. You will be asked to sign a form to confirm that we have your permission to give the reference. This form also contains space for you to provide other relevant information (see page 11).

Please note that the Department will **not** issue certificates of student status or attendance. You should obtain these from the Registrar's Division, as described on page 9.

Return of coursework

Marked coursework, bearing a grade, may be returned to you via your pigeonhole, in classes, or through the departmental office. These routes are not completely secure and may result in other students seeing your grade. If you are unhappy about this, you should discuss your worries with your course tutor.

Upon your arrival at UCL, you will be asked to sign a declaration indicating that you agree to the Department's policy for returning coursework and that you agree to inform the Department and/or Tutor of any forthcoming reference requests. Again, if you have any concerns about this you should discuss them with your course tutor in the first instance.

NOTICES

Notices about courses, examinations, tutorials and the timetable are posted on the noticeboards in the corridor near to Room 119. Please check these noticeboards regularly,

including the blackboard on the pillar outside the Students' Common Room, where urgent requests for individuals to see staff are often written.

MAIL AND E-MAIL

Please check regularly:

- the student pigeon holes in the Students' Common Room for internal mail;
- your e-mail.

There may be urgent messages left there for you, e.g. from the Registrar's Division, your Departmental Tutor, your Personal Tutor, and from staff teaching courses that you attend.

You will be allocated an e-mail address when you register for use of the College computing facilities. E-mail is used for communication throughout the College. Your tutors, teaching staff and College administrative staff will use *your College e-mail address* and expect you to read and act promptly upon all messages sent to you at this address. If you wish to use only your own e-mail address from a provider external to the College, then it is your responsibility to arrange e-mails to be forwarded from your College e-mail address. This can be done from https://www.ucl.ac.uk/directory/self-service/. However, UCL cannot be held responsible for mail that is delayed or lost as a result of being forwarded to an external provider. *Any consequences arising from not acting upon e-mails to your College address rest with you.*

CHANGE OF ADDRESS

Most communication within the College is carried out using the internal mail or via email (see above). However, formal communications may be sent to your registered address. For example, upon successful completion of your degree, a transcript of your studies will be sent to this address. ***It is therefore vital that you keep the College informed of any changes of address or contact details***. You can do this via the online Portico system, at http://www.ucl.ac.uk/portico/.

It is your responsibility to ensure that your contact details are up-to-date at all times; you are responsible for the consequences of any failure to do so.

STUDENTS' COMMON ROOM AND DEPARTMENTAL STUDENT SOCIETY

Room 117 is the common room for students registered for any of the degree programmes listed on page 1. Students registered for these programmes are eligible for membership of the student-run Statistics Society, which organises social and other activities.

THE UCL TRANSITION PROGRAMME

UCL runs a “Transition Programme” that aims to support all new UCL students in adapting to university life, assisting first years in dealing with the social, academic and personal issues that are specific to UCL (see http://www.ucl.ac.uk/transition/). Under this programme, all first year students are allocated a student mentor from the second or third year. Mentors are able to provide advice on academic and non-academic matters from a student’s perspective. Subject to availability, transition programme mentors may also provide “Peer Assisted Learning” sessions, which are informal group sessions that are intended to help first year students with course material.

STUDY FACILITIES

Within the Department some study space is provided in Room 116 (the Reading Room) when it is not being used for meetings. *This is not a common room! The student common room is Room 117. Please do not eat or drink in the Reading Room.*

Students may use the lecture room 102 for study when it is not being used for lectures or other classes and meetings. The College's safety regulations only permit students to be in the Department between 8am and 7pm Monday to Friday.

There is substantial space for reading and studying in the College Library (see later information on library facilities).

CAREERS INFORMATION

Within the Department, there is a careers noticeboard in the Students' Common Room. Job advertisements and information about careers talks, fairs and courses are posted there. There are special careers talks arranged by the Department's Careers Tutor for students from each year, including first years. You may approach members of the Department's staff for a job reference. However, please note that staff cannot supply a reference without your permission (see page 9). If you require a reference, therefore, you should fill in a form (available from the Departmental Office and online at http://www.ucl.ac.uk/Stats/current/) to confirm that we have your permission to give it. This form also contains space for you to provide other relevant information (for example, a description of the position / course you are applying for, and a brief CV). This kind of information will enable staff to write constructive references for you.

The UCL Careers Service is located on the fourth floor of the ULU Building in Malet Street. Information about its facilities can be found at http://www.ucl.ac.uk/careers/. You are advised *not* to wait until your final year to find and register with the UCL Careers Service. They also have information about appropriate summer vacation jobs.

TEACHING AND STUDYING ARRANGEMENTS

COURSE UNITS

Teaching is organised on a *course unit* system. A student normally takes courses equivalent to four units in each year of full-time study; most individual courses are worth either 0.5 or 1.0 units. Most courses consist of *lectures* supplemented by at least one of the following: *tutorials, workshops, problem classes*. The proportions of these activities vary over courses; details for courses offered by the Department of Statistical Science are provided in this handbook. A few courses are *Projects*. Outline details of courses offered by other departments to students on the Statistics, SEF and SEL programmes are also provided in this handbook. Econ/Stats, SAMB and MASS students should also refer to the course booklets produced by the Economics, Management Science and Innovation and Mathematics Departments, respectively, for details of Economics, Management and Mathematics courses.

A list of staff responsible for each course unit is posted on a departmental noticeboard at the start of session.

TIMETABLE

The timetable for lectures, workshops and problem classes is posted on the departmental noticeboard opposite room 119 and on the Department's web site (http://www.ucl.ac.uk/stats) at the start of the session. Your timetable for tutorials is arranged by your Departmental Tutor: follow the instructions given on the noticeboard

announcing the tutorial groups at the start of terms 1 and 2. After making their module selections on PORTICO (see page 9), students will be able to access personal timetables from http://www.ucl.ac.uk/timetable. *Note, however, that it may take one or two days after registration has been approved before all of the classes appear on a student's personal timetable, particularly for tutorials.* Do check your timetable again at the start of term 2, in case alterations have been made.

Although the timetable states that lectures (and other classes) begin on the hour, there is a College-wide agreement that this refers to a starting time of *5 minutes past the stated hour*. Lectures should finish at *5 minutes to the hour*. Please try to get to your next lecture *before it is due to start.*

LECTURES

These are formal and can involve large groups. Some lecture courses include students from other departments and those of you on joint degrees will be taking courses in other departments alongside their own and other students. Where possible, Statistics lectures take place in lecture rooms 102 and 115 in 1-19 Torrington Place. These rooms are too small for the larger courses, however: therefore many Statistical Science lectures take place in other rooms around the College, as do lectures for other departments' courses (e.g. Economics, Mathematics).

WORKSHOPS

Workshops, also referred to as "practical classes" within the Department, involve doing set work under guidance from the course staff. Some workshops will take place in the Computer Cluster Rooms. You should take a pocket calculator to all workshops (see below for guidelines regarding calculators).

PROBLEM CLASSES

These involve discussing coursework with the whole class.

TUTORIALS

Weekly academic tutorials are provided for first and second year students. These are less formal than lectures and enable you to raise your own questions about course material, as and when they arise from lectures or coursework. You normally have different academic tutors in terms 1 and 2.

For third year students, tutorials for courses STAT3001 and STAT3002 are provided. For all other third year Statistical Science courses, the staff involved should nominate office hours during which they will be available to discuss any queries about the course material.

PROJECTS

These normally involve a small amount of class training. Most of the work is done under individual supervision from a staff member whom you meet once a week to discuss your progress.

LIBRARY FACILITIES

The Science Library (in the DMS Watson building, Foster Court) contains an exceptionally good collection of statistical science text and reference books. Copies of most books that are highly recommended for courses taught by the Department are included in the Short Loan Collection on the ground floor in the Science Library. The Collection consists of all subjects of the Science Library and is arranged on open access shelves in one alphabetical sequence under authors. The period of loan for statistical science books is 2 days. Books

cannot be taken out of the room without being issued. Other recommended books, for which there is less demand, are kept on the third floor of the Science Library. The loan period assigned to these is one week. There are longer loan periods for other books.

The UCL Library has developed a set of online training materials, called WISE, to help users find and use information effectively. WISE is designed to help you to discover the most valuable information for your topic, and to make the best use of it. Topics covered include finding materials in reading lists; search tips and techniques; accessing electronic resources; referencing; and copyright and plagiarism issues. The 'WISE for Beginners' course, accessible from http://www.ucl.ac.uk/Library/infoskill.shtml, is recommended to all new students. Students taking project courses may also benefit from the more advanced 'WISE for Mathematical and Physical Sciences' course at the same address.

Further information on the College libraries is provided in the *UCL Student Handbook* and in the UCL Web pages (http://www.ucl.ac.uk).

COMPUTING FACILITIES

Undergraduate students use the College computing facilities provided by Information Systems (IS), which is a part of the Education and Information Support Division (EISD). Computer clusters, for teaching and for individual study, are located throughout the College. Further information on these facilities, including how to register to use them, is provided in the *UCL Guide for Students* and in the UCL Web pages (http://www.ucl.ac.uk). Although there are no computer facilities for undergraduates within the Department of Statistical Science, there is an IS Computer Cluster Room near to the Department (Room 113). Moreover, students are able to access the College's main facilities remotely via the internet. This means that, from home, students are able to use all of the software that is available in the computer clusters[1], check and send email and access their filespace on the UCL system. For more information on this service, see http://www.ucl.ac.uk/is/wts/cluster/remote/.

UCL has a "virtual learning environment" called *Moodle* (http://moodle.ucl.ac.uk/). All courses in the Department of Statistical Science have a presence on Moodle, and students registered for these courses can use the service to access online resources such as course information, lecture notes and assessment material. Students are given additional printing credits, to allow them to print copies of the lecture notes for each of their statistics courses. In addition, there is a Moodle space called the "Department of Statistical Science Student Home" (DOSSSH) to which all Statistical Science students have access: this contains useful information about the department, as well as downloadable forms and links to resources that are described elsewhere in this handbook.

CALCULATORS

There are eight calculator models that the College has approved for use in examinations. These are the Casio FX83ES, FX83GT, FX83MS and FX83WA which are all battery powered, and Casio FX85ES, FX85GT, FX85MS and FX85WA which are all solar powered. **Students on the degree programmes covered by this handbook may not use any other type of calculator in their examinations.** Students are therefore strongly advised to purchase one of these calculators at the start of their degree programme. The use of a non-approved calculator constitutes an examination irregularity (i.e. cheating) and carries potentially severe penalties.

[1] There are some restrictions on the use of Microsoft Office products (Word, Excel, Powerpoint etc.) via this remote system – see the web address above for details. However, students may use any of the other software on the system without restriction. They may, of course, continue to use their own personal copies of Microsoft Office products!

STATISTICAL TABLES

Statistical tables are provided by the College for use in all examinations set by the Department. The currently provided tables are *New Cambridge Elementary Statistical Tables* by D.V.Lindley & W.F.Scott. New students are strongly advised to purchase a copy of these statistical tables at the start of their degree programme. These will be the statistical tables referenced in the Department's courses.

WHAT IS EXPECTED OF STUDENTS

AWARENESS

- You are required to abide by the College's rules, regulations and procedures. These are provided in the two UCL handbooks mentioned on page 1. *You are expected to be familiar with the contents of these UCL Handbooks.*
- You are expected to be familiar with the contents of this departmental handbook and to keep it throughout your time here. You will be informed of any changes as necessary.
- *You should ensure that you know what is required of you for each course that you take.* For courses given by the Department of Statistical Science, this information will be provided in the *first* lecture of each course.

ATTENDANCE

Detailed information on the procedures to follow if you are absent from College are contained in the *UCL Student Handbook*. Some general points to note are:

- You are expected to be in attendance during the UCL terms throughout your programme of study. This includes reading week (see page 5).
- If you wish to be absent from College for some special reason, then you should obtain permission *beforehand* from the appropriate Departmental Tutor (see earlier section "Whom to approach with problems").
- UCL's **minimum** requirement is that you attend at least 70% of compulsory classes unless you have good reason (e.g. medical) to be absent. If you fail to satisfy this requirement you may be marked non-complete for the course in question. This will result in you being barred from taking the examination for the course and may mean that you cannot progress to your next year of study.
- If you have a good reason (e.g. medical) for needing to miss a compulsory class, you must inform the lecturer concerned so that you can be excused.
- If you have been absent for more than two consecutive days, you should immediately inform the Undergraduate Student Administrator of the reason for your absence. If this extends to more than five working days, then on your return you must give your Departmental Tutor a medical certificate if appropriate.
- You should also provide a medical certificate if you are absent from an examination or can not submit your in-course assessment because of illness (see page 23 for further details on this).
- At the end of each term, your Departmental Tutor is required to report on your attendance to the Faculty. You will be required to explain an unsatisfactory attendance record to the Faculty Tutor. An unsatisfactory explanation may lead to the withdrawal of your degree registration or, if you wish to follow the International Programme, you might not be allowed to go abroad.

- We do monitor your attendance. We record your attendance at tutorials and at the workshops. We also have a record of your coursework.

The importance of attendance at lectures and other classes has been stressed above. Requests for special attention (e.g. for missed notes/handouts/problem sheets) due to non-attendance without good reason (e.g. medical), do not create a good impression. The same applies to non-submission of coursework. Remember that when writing a job reference for you, we are usually asked to provide information about your attendance and punctuality, as well as your ability, etc. If you are absent from any lecture or other class, you should endeavour to copy up notes promptly.

ATTENDANCE AT COURSES IN OTHER DEPARTMENTS

You will be taking some courses provided by other departments, where arrangements are likely to be different from those in the Department of Statistical Science. *It is important that you know what is expected of you in each of these courses. You may be banned from taking examinations if you have not attended enough tutorials or submitted enough coursework, even if it does not count towards the final examination mark.*

STUDYING

Tutorials

Tutorials provide the opportunity to get personal attention. It is important to prepare yourself by reading through the latest lecture material and trying the relevant exercises sheets *before the tutorial*. Think of questions relating to the course material to ask; make a note of points that you don't understand so that you can get them cleared up in tutorials. Take your recent lecture notes and exercise sheets to each tutorial, in particular those relating to material that you know will be discussed.

Tutorials are compulsory and provide us with a record of your attendance at College.

Lectures, workshops and problems classes

Most new material is presented in lectures; some might be introduced by your trying ideas in workshops. The workshops give the opportunity to solve problems with guidance, a helpful alternative method of learning. In most courses learning is sequential: you need to have met and understood past material in order to follow the current material. You are therefore strongly advised to attend all classes. Teaching staff and demonstrators are able to give some personal attention in workshops; absences are likely to be noted.

Staff sometimes receive complaints from students about disruption and noise (caused by other students) in large classes. All students are respectfully asked to consider others when in the classroom: excessive noise and disruption can have a negative impact on the learning experience for everybody. Any student who is persistently disruptive will be asked to leave the classroom, and will receive an official warning from the Departmental Tutor with an appropriate note on the student's record.

Coursework

In the Department of Statistical Science regular, often weekly, coursework is set. Some of this is for in-course assessment, but much of it is to help you to learn the material being taught. You will normally receive feedback from coursework during problem classes, tutorials or workshops, as appropriate for the course. You will generally be expected to hand in your work so that we can monitor your progress. The detailed arrangements for coursework will vary over courses and you will be told about them at the start of each course. *You should ensure that you know what is required for each course that you take*. Our teaching assumes that you have attempted the coursework, and we may refer to it in

subsequent classes and coursework. *In-course assessment is compulsory: it contributes to your final examination mark for that course and non-submission may mean that you cannot pass the course* (see the later section on examinations). Furthermore, for courses with tutorial classes your tutor will record whether you have submitted each piece of non-assessed coursework by the deadline and whether it is a reasonable attempt (i.e. an attempt of pass standard). The Statistical Science department expects a reasonable attempt for at least 70% of non-assessed coursework in each course. If you fail to satisfy this requirement you may be marked non-complete for the course in question. This will result in you being barred from taking the examination for the course and may mean that you cannot progress to your next year of study.

Do leave enough time to complete each exercise sheet. Weekly sets of exercises may well need about 5 hours work on them, including reading time. In some courses, more substantial sets of exercises are given out on a fortnightly basis: it is recommended that you start them in the *first* of the two weeks allowed. A prompt start to exercises set for in-course assessment is well advised.

It is good practice to aim for legibility, accuracy and clarity in your coursework, whether or not it is for in-course assessment (the same applies to examinations, of course!).

Self study

After a lecture, study your notes carefully. Work through the details slowly and annotate your notes in a different colour to that used in taking them; this can help with revision. It is important to keep on top of each course by reviewing the appropriate notes *before the next class* (lecture, tutorial, problem class or workshop). Read supporting material from textbooks as necessary. Start coursework well in advance of the submission date (see the earlier comments on coursework).

The following will help you understand and communicate your understanding of course material:

- continual practice at solving problems,
- thorough preparation for all classes,
- regular revision of course material as the course progresses,
- seeking help when you have difficulties.

The Department has prepared a questionnaire to help you to evaluate what you are getting out of your studies and to take responsibility for your own progress. This questionnaire is available from the Department's Web site (http://www.ucl.ac.uk/Stats). Try completing it for each course during reading week.

Total workload

For a typical half-unit course, you should expect a workload of about *9 or 10 hours per week* – this includes lectures, workshop, problems class, tutorial, reading and coursework, as appropriate for each course. For example, if you are studying the equivalent of four half-unit courses per term, your total weekly workload is expected to be around *40 hours.*

As part of monitoring your own progress, you may find it helpful, in some weeks, to keep a diary of the time you spend actively working.

COURSE EXERCISES AND MODEL ANSWERS

Many Statistical Science courses have regular sets of exercises. These are designed to help students learn and, in most courses, it is essential that students do the exercises in order to understand the subject. Course lecturers are often asked to provide model answers to the exercise sheets. There is a similar demand for model answers to past exam papers.

Lecturers do provide model or outline answers to some exercises and to some exam questions, but it is the Department's policy *not* to do so in general, for a number of reasons:

- We do not want to encourage students to "learn answers" but rather to create a culture in which they know that they must work out the answer for themselves. Often it is not the answer, but the process of working it out that is the main learning experience.
- We are trying to encourage independent thought and understanding, so that students can answer (more or less well) different questions, similar questions in different forms, and to solve related problems. Understanding in statistical science, and in mathematics, comes much more from doing than from reading.
- It is important for students to learn how to persevere with a problem when they are "stuck". In the past, we have found that model answers handed out in one year are often passed on to students in a subsequent year, to the detriment of the learning process.

A common argument put forward by students is "Yes, we want to do the exercises, but we would like model answers in order to check that we have the right method and right answer". Of course it can sometimes be helpful to look at answers, but it is also important to learn how to verify answers when they are not otherwise available, and to gain the confidence to know when you are right. One function of tutorials is to discuss problems or work through them with the teacher, and this is one way in which answers may be obtained. Part of the skill of the teacher is to help the student to progress without "spoon feeding" the answer.

Having said all of this, the Department recognises that while preparing for examinations in particular, it can be useful for students to have the final answers (rather than complete solutions) to past exam questions: this provides some confidence that the answers obtained while attempting past papers are correct. All teaching staff should provide such "final" answers routinely, for selected exam papers from 2010 onwards, via their course Moodle pages (see page 13).

FEEDBACK ON STUDENT WORK

Students receive feedback on all items of assessed coursework (see "Components of compulsory assessment" below) and on selected items of non-assessed work. Feedback may be given in tutorials, problems classes or electronically. It may take the form of verbal or written comments, either personalised or in the form of general points that emerged from the class as a whole. These comments are intended to help you see what was done well and where there is room for improvement. For assessed work, the comments are also provided to help justify the grade awarded.

For assessed work, feedback will include a *provisional* letter grade. The correspondence between letter grades and percentage marks, along with guidance regarding the interpretation of each grade, is as follows:

	Grade	Mark	Interpretation
Pass	A+	≥80	The criteria for an A grade are all met. Additionally, exceptional quality has been demonstrated with respect to at least two of the following: understanding, insight, depth of analysis or clarity of discussion, with evidence (where appropriate) of relevant knowledge or reading.

	A	70 to 79	The criteria for a B grade are all met, along with one or more of the following: high quality answers in a wide range of questions, evidence of a very sound understanding, thoroughness of discussion and clarity of expression, evidence of insight, wide knowledge or reading. There may be a small number of relatively minor errors or inconsistencies, but there should not be serious errors in knowledge or understanding.
	B	60 to 69	Good understanding of the questions asked, good knowledge of the main aspects of the subject and good levels of appropriate skills (such as the ability to carry out calculations and manipulations, and to develop a logical argument). At the higher end of the range, one would expect to see clear expression and presentation. A few mistakes are allowable, providing they are not serious.
	C	50 to 59	Reasonable understanding of the subject, and a reasonable level of ability in the appropriate skills. Work in this category may fail to reach Grade B either because it does not demonstrate a wide enough range of knowledge (e.g. some good answers, but too many questions or part questions either omitted or answered inappropriately), or because skill deficiencies lead to too many mistakes or badly presented answers.
	D	40 to 49	Basic but limited understanding of the subject, together with some basic ability in the appropriate skills. There may be many mistakes, but there will be clear evidence of some relevant knowledge.
	F	$\leq$ 39	Not of pass standard. At the higher end of the scale a very limited understanding may be present, but answers will present little evidence of relevant knowledge and contain many mistakes, irrelevancies or misunderstandings. At the lower end, answers will show little or no understanding of either the questions or the subject.

STUDENT FEEDBACK

COMMITTEES

Staff-Student Consultative Committee

This usually meets once each term. Student membership normally consists of representatives from each year of each degree programme. These students meet with appropriate staff from the Department. This is an opportunity for students to discuss the results of the course questionnaires, and to air concerns about particular courses in the degree programmes as well as more general issues. The minutes of the meetings and summaries of the questionnaire results are available in the Department and online at http://www.ucl.ac.uk/Stats/current/ for students to consult.

Departmental Teaching Committee

This committee oversees the organisation and structure of the degree programmes and courses offered by the Department. It also considers teaching matters arising from meetings of the Staff-Student Consultative Committee.

QUESTIONNAIRES

You will be asked to complete a questionnaire for each course that you take. This is usually done during the last two weeks of a course. You are expected to take this exercise seriously. Anonymity is preserved and space is provided on the questionnaires for additional comments if you feel that is required (positive comments are also helpful; frivolous comments will be discounted). Similarly, you will also be asked to complete a questionnaire about tutorial classes. At the end of your degree programme you will be asked to participate in the National Student Survey (http://www.thestudentsurvey.com/), which is your opportunity to give public feedback on all aspects of university life – from the learning resources available, to course teaching and academic support.

SELECTION OF OPTIONS

Each degree programme has some compulsory courses to reflect the core of each of the subjects in the degree title. You make up a total of four course units in a particular year by the choice of appropriate options. There is normally a specified list of options, but you may choose a limited number (normally no more than one half unit course per year) of options from other courses offered in the College *provided that there is no timetable clash and subject to approval by your own Departmental Tutor and the Department offering the option.* These are sometimes referred to as *electives*. The timetable will not be amended so that you may choose an elective option. However, third and fourth year students may usually take electives that are scheduled for Friday afternoons even though these clash with occasional workshops for statistics courses: in this case, it is the student's responsibility to catch up on any work missed as a result of the clash. In choosing options you are advised to try and balance the amount of work you have to do between the two terms.

To take an optional course, you must register for it on the PORTICO system at http://www.ucl.ac.uk/portico (see page 9). Instructions on how to do this can be found on the PORTICO web site (log on to PORTICO using your UCL user ID and password, then look at the document "Module registration for students" which can be found under the heading "Documentation links"). **Please remember that your registration for any option is subject to approval both by your Departmental Tutor and by the Department offering the option. Moreover, any final year student who has failed more than half a unit of courses MUST discuss their options with their Departmental Tutor, since failed courses may affect your eligibility for the award of a particular degree. Attempts to register for unsuitable options will be rejected. If you are in any doubt as to whether you will be allowed to take a particular option, you should discuss it with both your Departmental Tutor and with the Department offering the option, *before* attempting to register for it on the PORTICO system.**

OPTIONS FOR THE FOLLOWING YEAR

During term 3 the Department holds meetings for current first and second year students to discuss the options available for the next year. You will be reminded of the options available to you and the rules of your degree programme. Although you will not select your modules (using Portico) until later in the summer, it is helpful for you to think about your options seriously at this point.

Second year students taking a project in their third year will also be asked to nominate a topic from a list of topics suggested by the staff. You must discuss a proposed topic with the supervisor named on the list *before* stating your intention to do it on the form referred to above. These topics are allocated on a first taker basis so you must not delay making your

choice and getting a supervisor's agreement. You may suggest a topic of your own but you must see your Departmental Tutor to discuss whether it will make a suitable project and to find out who might supervise it.

LEVELS OF COURSES

All UCL courses have a *level* associated with them. These levels are as follows:

- Level 0 (Basic/ introductory – a level below that of a normal first-year course)
- Level 1 (First – the level of most first-year courses)
- Level 2 (Intermediate – the level of most second-year courses)
- Level 3 (Advanced – the level of most third-year courses)
- Level M (Masters)

Students must take courses at an appropriate level for the degree programme for which they are registered (see *Schemes for the Award of Honours* later in this Handbook). The levels of all courses offered by the Statistical Science Department are given in the course descriptions later in this handbook.

EXAMINATIONS

COMPONENTS OF COMPULSORY ASSESSMENT

For most courses, you are examined by in-course assessment and written examinations (there are exceptions, notably if the course is a project).

In-course assessment

Details of the methods of in-course assessment, how much work is involved and the proportion it normally counts towards the final mark are provided for each course later in the handbook.

The result for a student who does not submit enough in-course assessment will be recorded as "non-complete", unless there are strong mitigating circumstances (e.g. medical) with supporting documentation (e.g. medical certificate). Non-completion is regarded as a failed first attempt at an examination. The Statistical Science department reserves the right to declare a student non-complete for a course if ***any*** *in-course assessment is missed without good reason; more stringent requirements are in place for some courses (see course descriptions at the end of this handbook). At the beginning of each course, the lecturer will provide details of the method and dates of in-course assessment. The assessment dates will also be posted on the departmental noticeboard. Students should ensure that they have no other commitments on these dates, to avoid being declared "non-complete".* ***In-course assessment is a form of examination, and should be treated as such.***

Each piece of in-course assessment set by the Department of Statistical Science has its own rubric and the instructions given must be followed. *In particular, do pay attention to the consequences of missing the deadline set, non-submission and plagiarism (see below); any of these can result in your not passing the course.* Teaching staff will set aside extra office hours to discuss assessment-related matters (see page 7) students should respect the lecturers' time by confining queries to these hours.

Some assessments take the form of a "take-home" assignment, to be handed in to the Departmental Office or the course lecturer by a set deadline. For such assessments, you will need to sign a cover sheet (provided by the course lecturer) containing a declaration that the submitted work is entirely your own (see section on "Plagiarism and Collusion"

below). You will also need to submit your work in a *single securely stapled bundle* including the cover sheet.

Deadlines: the Department aims to allow a reasonable period of time to complete any item of assessment if you manage your time effectively. Late submissions will incur a penalty unless there are extenuating circumstances (e.g. medical) supported by appropriate documentation. Penalties are as follows:

- For work submitted after the deadline but before the end of the next working day, the full allocated mark will be reduced by 5 percentage points.
- For work submitted at any time during the following six days, the mark will be reduced by a further 10 percentage points.
- For assessments submitted more than 7 days late but before the end of the first week in Term 3, a mark of zero will be recorded. However, the assessment will be considered complete (see above).

Word counts: some assessments (usually involving the production of reports) carry a specified maximum word count. Assessed work (including dissertations) with a stated word count more than 10% above this maximum will not be accepted and will not be considered as submitted. If submitted work is subsequently found to have an inaccurately stated word count, and to exceed the upper word limit by at least 10% and by less than 20%, the mark will be reduced by ten percentage marks, subject to a minimum mark of 40% (50% for fourth-year courses) providing the work is of pass standard. For work that exceeds the upper word limit by 20% or more, a mark of zero will be recorded.

You will be given feedback after each piece of in-course assessment (see earlier section "Feedback on student work"). The Department aims to provide feedback in all cases within four weeks of the submission deadline.

Written examinations

These normally take place during term 3. The Registrar's Division provides you with your own copy of the examination timetable, normally just before the end of term 2. This also refers to examination regulations: read them!

In most examinations set by the Department of Statistical Science, there are two sections and candidates are required to answer all questions. The questions in Section A are intended to be straightforward and to focus on core material, whereas those in Section B are more challenging. The rubric will indicate the proportion of the total mark allocated to each section. Statistical tables will be provided by the College in all examinations set by the Department (the currently provided tables are *New Cambridge Elementary Statistical Tables* by D.V.Lindley & W.F.Scott). You should take a pocket calculator to all of these examinations (see page 13 for details of permitted calculators).

The Department's recent past examination papers are available for consultation and photocopying in the Science Library. Some of them are also available from the Department's Web pages (http://www.ucl.ac.uk/Stats).

Final course mark

For courses in Statistical Science, which are assessed by both in-course assessment and written examination, the final mark is obtained by combining the in-course assessment mark and the written examination mark. To pass a course at any level below Masters, a final mark of at least 40% is required. To pass a Masters-level course, a final mark of at least 50% is required. For each course described later in this handbook, a guideline is given to indicate the scheme used for combining marks. This guideline will normally be adhered to, but is subject to change at the discretion of the Department's Board of Examiners.

EXAMINATION MARKS

Each examination script is marked by two examiners, one of whom is normally the course lecturer. The scripts are also scrutinised by an External Examiner and the marks are finalised at meetings of examiners in the departments offering the courses. When finalising the marks, examiners in the Statistical Science Department refer to the grade descriptors summarized in the "Feedback on student work" section above (page 17). Recommended degree classifications for final year students registered on the Statistics, SEF, SEL and International programmes are made at the Department's Examiners' Meeting at the end of term 3. Recommended degree classifications for the Econ/Stats, SAMB and MASS degrees are made by the Examination Boards for these programmes.

Provisional degree classifications for final year students and *provisional* marks for courses offered by the Department of Statistical Science are released after the appropriate Examiners' Meetings, normally shortly after the end of term 3. These results are provisional until confirmed by the College Examination Board later in the summer. Degree classifications will be displayed on noticeboards in the Department (you will need your candidate ID number) and online via the DOSSSH Moodle page (see page 13). To access the provisional results online you will need your candidate ID number, along with your UCL username and password. Students will be advised via UCL email when results are available, and therefore should check their email regularly and **not** waste staff time by asking about this! Under the Data Protection Act (see page 9), we are unable to provide results by telephone or by e-mail.

Upon successful completion of your degree programme and when all degree results are confirmed by the College Examination Board, the Registrar's Division will normally send you a complete transcript of marks from your entire time at UCL. **This transcript will be sent to your registered home address – please ensure that this is correct (see page 10)!** Transcripts will not be sent automatically to continuing (i.e. non-final year) students: these students can access their confirmed marks, once they are available, via the online Portico system at http://www.ucl.ac.uk/portico/. Alternatively, a results sheet can be provided on request by the Examinations Section of the Registrar's Division.

If you have any queries about your examination results, please consult your Departmental Tutor in the first instance.

APPEALS CONCERNING EXAMINATION RESULTS

Candidates may appeal against their examination results under one or more of the following conditions (see http://www.ucl.ac.uk/academic-manual/part-k/k10, paragraph 7.3):

i) Arithmetical or transcription error in the compilation of marks
ii) The Examiners could not reasonably be made aware, formally, of special circumstances notified by the candidate which significantly affected his / her performance. For a candidate to appeal on these grounds, it is necessary to demonstrate that they could not reasonably have submitted the appropriate claim for extenuating circumstances by the required deadline (see the "Extenuating Circumstances" section below).
iii) The examination and / or classification process was not conducted in accordance with the relevant Instructions and/or Regulations.
iv) There is substantive evidence that one or more of the Examiners was biased or prejudiced against the candidate in one or more specific examinations.

Any such appeal should be addressed in the first instance to the Registrar of the College.

Note that appeals will NOT be considered except under one or more of the conditions above. The Department of Statistical Science would therefore like to reassure all students that all staff in the Department take the assessment process extremely seriously. The marking process described above is designed to ensure that papers are marked fairly and accurately, with all marks agreed by at least three examiners (two internal and one external) and any difficulties discussed by the entire Board of Examiners.

SPECIAL EXAMINATION ARRANGEMENTS

If you have a disability or specific learning difficulty (including dyslexia), UCL recognises that the usual format of exams may not be suitable for you. In this case, you are advised to contact the Disability Centre (http://www.ucl.ac.uk/disability/services/disability-centre/) as early as possible in the academic year to discuss the possibility of making special examination arrangements to ensure a consistent and fair approach. All applications must be accompanied by evidence of disability or medical condition provided by a competent authority. Such authority would usually be your consultant or GP. Students with dyslexia and other specific learning difficulties will need a recent assessment by a qualified psychologist. Such an assessment can be provided by the UCL Dyslexia Assessment and Support Centre (http://www.ucl.ac.uk/disability/services/dyslexia-centre/). Even if you have a recent assessment carried out by outside body you must contact the Dyslexia Co-ordinator who will assess your needs and pass the necessary information to the Examinations Section.

Application forms (for students with disabilities other than dyslexia / specific learning difficulties) can be obtained from the Disability Centre or the Examinations Section. UCL will endeavour to ensure that appropriate arrangements are put in place. However, you should be aware that arrangements need to be put in place well in advance. Applications should be submitted as early as possible and **not later than six weeks before the start of your examinations**.

EXTENUATING CIRCUMSTANCES

If you are prevented from taking an examination or a piece of assessment as a result of medical or personal problems, or with other good reason, or if there are factors affecting your studies over an extended period of time, it is usually possible for examiners to take this into account. UCL has a procedure for dealing with such extenuating circumstances. In the Statistical Science department, this procedure is implemented as follows:

- A student claiming extenuating circumstances should complete the appropriate College form (available from the DOSSSH Moodle page – see page 13) and submit this, along with appropriate documentation, to the Undergraduate Administrator in the Statistical Science departmental office (see page 9). This should be done as soon as possible in general, but the deadline for receipt of any such application within any session is one week after the end of the exam period in June. No claims for extenuating circumstances will be considered after this date.
- After discussion with the relevant member(s) of academic staff, an acknowledgement will be sent to the student concerned. This acknowledgement will EITHER confirm that the circumstances will be taken into account in due course, OR request additional documentation in support of the application. In the latter case, the application will not be considered further unless the requested documentation is received by the due date.

Where a student claims extenuating circumstances for a missed examination, the Department will require evidence that the student was unable or unfit to take an examination *on the specific date in question*. If necessary, students may obtain a certificate to this effect from the College Health Centre at 3 Gower Place.

You should be aware that unless you follow the above procedure, it will not be possible for the examiners to take any extenuating circumstances into account. Details of the precise circumstances affecting individual students are not made available to all examiners.

REFERRED MARKS

If your final mark for any course is below 40% but above 35%[2], then the option of *referred assessment* in that course is available if the following conditions are satisfied:

- You are not in the final year of your degree programme.
- If you are in the first year of your degree programme, you have passed in at least 2.5 units; if in the second year, you have passed in at least 6 units altogether.
- If you complete the referral successfully, there is nothing to prevent you from progressing to the next year of your degree programme.

Referred assessment provides you with the opportunity to pass the course before the next normal resit opportunity. In the Department of Statistical Science, the procedure used for referred assessment for a course is normally the following:

- You are given a choice of dates, normally at the end of August or beginning of September, on which to come into the department and resit the examination paper you took in May, under examination conditions. You should use the intervening period to study the course material in your own time so that you are able to solve the questions.
- If you obtain a mark of at least 60% on your resit attempt, you will be awarded a bare pass (40%) for the course. Otherwise, your original mark will remain unchanged.

If you are offered the opportunity of referred assessment, you do not have to accept it. Other options are (i) to resit the examination at the next available opportunity, in the hope of obtaining a mark higher than 40% (ii) keep the failed mark. Note, however, that students on 3-year programmes must pass at least 11 course units to be eligible for the award of an Honours degree, so can retain at most 1 unit of failed marks in this way. Students on the 4-year MSci International Programme must pass at least 14.5 units to be eligible for the award of an Honours degree, so can retain at most 1.5 units of failed marks.

Arrangements for referred assessment in other departments may differ from those in Statistical Science. Your Departmental Tutor will give you further advice about the procedure and its consequences if any of your marks are referred.

RESITS

A student who fails a course, and either (i) is ineligible for referred assessment (ii) has declined the offer of referred assessment, or (iii) fails the referred assessment in that course, can resit the failed component(s) of assessment for that course at the next available opportunity. This is normally the following year. Only one resit attempt is normally allowed for each course.

DEFERRED ASSESSMENT

A non-final year student who is absent from a written examination because of mitigating circumstances (e.g. medical) may apply, through his/her Departmental Tutor, for *deferred assessment.* This requires the student to provide appropriate documentation to support the application (e.g. medical certificate). Approval for deferred assessment will not be granted to a student who could have made arrangements to attend the examination. A student may

[2] For some courses in other departments (for example Mathematics), referred assessment may be offered if the final mark is below 40% with an examination mark above 30%.

have deferred assessment in at most 3 units in any one year. Students on 3-year programmes may have deferred assessment in at most 4 units altogether; students on 4-year programmes may have deferred assessment in at most 6 units altogether.

Deferred assessment is normally by written examination, and usually completed before the end of July.

PROGRESSION TO NEXT YEAR OF STUDY

As a guideline you are normally allowed to proceed to the second year if you have passed in at least 3.5 units *including STAT1005*, and to the third year if you have passed in at least 7 units.

To progress from year 2 to 3 of the MSci International programme, a student must normally pass a total of at least 7 units from years 1 and 2 and achieve at least 60% average from all year 2 courses. To progress from year 3 to 4 of the MSci programme, a student must normal pass at least 11 units from years 1 to 3 and achieve at least 50% average from all year 2 and 3 courses, with year 3 given half the weight of year 2. A student who fails to meet the rules for progression to the final year of the MSci programme may opt to transfer to the BSc programme followed in the first two years, or to resit their failed third year courses (at the overseas institution). A student who fails to progress from year 2 to 3 of the MSci programme cannot take year 3 abroad but must switch to a BSc programme.

Non-progression: options available

The following options are normally available to first- and second-year students who are not allowed to proceed to the next year of their degree programme, and to final-year students who are not eligible for the award of a degree:

1. Take a year out and resit any failed examinations at the next available opportunity.
2. Register as a part-time student and re-attend up to two units of failed courses. A student choosing this option is responsible for paying the appropriate fees. A part-time student failing to attend sufficient teaching or complete adequate coursework may be barred and have no further opportunity to progress.

PLAGIARISM AND COLLUSION

Plagiarism means attempting to pass off someone else's work as your own, while collusion means passing off joint work as your own unaided effort. Both are unacceptable, particularly in material submitted for examination purposes including exercises done in your own time for in-course assessment. Plagiarism and collusion are regarded by the College as examination irregularities (i.e. cheating) and are taken extremely seriously. UCL uses a sophisticated detection system (Turn-It-In®) to scan work for evidence of plagiarism and collusion, and the Department reserves the right to use this for assessed coursework. This system gives access to billions of sources worldwide, including websites and journals, as well as other work submitted to the Department, UCL and other universities. It is therefore able to detect similarities between scripts that indicate unacceptable levels of collusion, as well as material taken from other sources without attribution.

If plagiarism or collusion are suspected, on the basis either of the Turn-It-In® software or other evidence, it can be dealt with informally only in the case of first offences committed by first year students. All other cases must be dealt with formally, which involves adjudication by a departmental panel and/or College Examinations Irregularities panel. If the panel finds that an offence of plagiarism or collusion has been committed, a penalty will be imposed. Penalties depend on the severity of the offence, and range from being awarded zero marks for the work in question up to exclusion from all further examinations. They can also include a formal reprimand, which will be entered on the student's departmental and College records.

What isn't acceptable?

Students sometimes find it difficult to know what counts as plagiarism or collusion. The following list is not exhaustive, but gives some indication of what to avoid. It is based on guidelines developed by Nick Hayes of the UCL Pharmacology Department. You may **NOT**:

- Create a piece of work by cutting and pasting material from other sources (including web sites, books, lecture notes and other students' work).
- Use someone else's work as your own. This includes, but is not limited to:
  - Making notes while discussing an assessment with a friend, and subsequently using these as the basis for all or part of your submission.
  - Phoning another student to discuss how best to carry out a particular piece of analysis.
  - Employing a professional ghostwriting firm or anyone else to produce work for you.
- Use somebody else's ideas in your work without citing them.
- Ask a lecturer in the department for help with assessed work, unless you make it clear to them that the work is assessed.
- Help another student with their assessed work. If you do this, you will be deemed to be guilty of an examination irregularity.

What is acceptable?

The following practices do not constitute plagiarism / collusion:

- Quoting from other people's work, with the source (e.g. book, lecture notes, web site) clearly identified and the quotation enclosed in quotation marks.
- Summarising or paraphrasing other people's work, providing they are acknowledged as the source of the ideas (again, usually this will be via a reference to the book, journal or web site from which the information was obtained).
- Asking the course lecturer for help with difficult material, providing it is clear that the question is in connection with the assessment. The lecturer will be able to judge for him or herself what is an appropriate level of assistance.

Some examples

Unfortunately, each year there are some students in the Statistical Science Department who submit work that contravenes the regulations. The consequences can be severe. For example:

- Final-year student A had a lot of coursework deadlines in the same week as an important job interview. One of the coursework deadlines was for an extended piece of data analysis, set two weeks previously. Because of his other commitments, student A did not start this piece of coursework until shortly before the deadline, at which point he discovered that he did not have enough time to do it. He asked student B for help. The result was that both students submitted essentially identical work using exactly the same computer output. A departmental panel was convened to investigate the matter. The panel suggested that student B had passed electronic material (computer output and graphics files) to student A, who had pasted this material straight into his own submission. Although student A admitted asking student B for help, both students denied exchanging electronic material. They were, however, unable to explain how the same electronic files came to appear in both submissions. As a result, the allegation was upheld and both students were penalised. Student A was recorded as "not complete" for the course in question (this meant that he had no possibility of passing it that year), and student B was given a mark of zero for the coursework component.

- Students C and D both had to submit some computer code for an assessment, which was worth one third of the total mark for a course. There was considerable flexibility in how to go about the assessment. Although the students submitted code that looked very different, closer inspection revealed that they were carrying out the same procedures in more or less the same order, and that the methods they used to carry out these procedures were essentially the same. Further, these procedures and methods were not used by other students in the class. On investigation, it transpired that the students had discussed the assessment over the phone while sitting in front of their computers. This is unacceptable, and as a result the marks of both students for this piece of assessment were halved.

How to avoid plagiarism and collusion

If you are found to have committed an offence of plagiarism / collusion, it makes no difference whether or not you intended to do so. Ignorance is no excuse. To avoid committing an offence, a useful rule of thumb is: if in doubt, don't do it. Make sure that any work you submit is your own unaided effort. More specific guidance is as follows:

- Plan your work schedule carefully, to allow enough time to complete each piece of assessment.
- If you have genuine problems in meeting a deadline, don't take the easy way out and borrow a friend's work. Discuss your difficulty with the course lecturer in the first instance.
- If you are stuck with an assessment, don't ask another student for help. Discuss it with the course lecturer.
- If another student asks you for help with an assessment, or asks to see your work, suggest that they approach the course lecturer instead. Remember: if somebody else copies or uses your work, you will be penalised as well, even if you didn't expect them to use your work in this way.

More information can be found at http://www.ucl.ac.uk/current-students/guidelines/policies/plagiarism, and in the UCL Library's WISE courses (see page 12).

FURTHER INFORMATION ON EXAMINATIONS AND ASSESSMENT

For more details on:

- regulations on plagiarism
- examination entry
- examination timetable
- absence from examinations
- deadline for withdrawal from examinations[3]
- special arrangements for students with medical problems
- grievance procedures
- withholding of results
- re-entry to examinations

and other matters relating to examinations are given in the *UCL Student Handbook.*

[3] **Withdrawal** from an examination after the deadline or absence without good reason (e.g. medical) will count as the *first attempt* at the examination. A similar comment applies to the failure to submit a project report by the due date.

ROYAL STATISTICAL SOCIETY ACCREDITATION

The Royal Statistical Society (RSS) accredits university degree programmes at undergraduate and MSc level for a particular year on the basis of information supplied by the university. For undergraduate degrees, accreditation means that graduates for that year will automatically be granted Graduate Statistician (GradStat) status on application to the RSS, provided that at least second class honours has been achieved. Applicants must already be Fellows of the RSS or become Fellows concurrently.

Four undergraduate programmes offered by the Department of Statistical Science (Statistics, SEF, SEL and the International Programme) have been accredited for the year 2010/11, as have the MASS BSc and MSci programmes. The joint Economics and Statistics programme has not been accredited because it does not contain enough compulsory course units in statistics. Graduates with this degree may apply individually for GradStat status; they will need to provide a transcript of courses taken. The RSS will make a decision on whether to accredit the new joint SAMB degree in 2011; it is likely that its status will be the same as for the Economics and Statistics programme.

Accreditation will be renewed annually subject to RSS approval of any amendments to the programmes of study and the syllabuses of constituent courses.

ACTUARIAL PLACEMENT SCHEME

The Department participates in an undergraduate placement scheme run by Alpha Consulting Ltd., which involves a 12-month paid work placement with an actuarial employer (see http://www.alphaconsulting.co.uk/placements). This is normally taken at the end of the second year of a degree programme. Following the placement, undergraduate students return to complete the final year of their studies. This scheme can give students some excellent experience of the actuarial profession. However, competition for places is intense and there is no guarantee that students will be successful in gaining a placement. The scheme is open to all students in principle, although **those from outside the European Union will need to check that their visa allows them to participate and subsequently to complete their studies**, since for visa purposes a work placement is likely to be regarded by the Home Office as “full-time employment” rather than “full-time education”. Any student who is potentially interested in this scheme should attend a presentation by Alpha Consulting in the Autumn term; details will be emailed to all students in advance.

SCHEMES FOR THE AWARD OF HONOURS

A scheme for the award of honours provides the formula for determining your degree class at the end of your final year. The following pages describe the current schemes for the award of honours.

Award of honours for the BSc degrees in Statistics, SEF, SEL and SAMB, and for the BSc (Econ) degree in Economics and Statistics

Degree classification takes place after the examinations in term 3 of your final year. Provided you have taken no more than one unit of courses at Introductory level, at least three units at Advanced level, and have passed at least 11 units in total, you will be considered for Honours. An initial classification is obtained as follows:

1. Marks are calculated for each year of your degree programme. The precise details of these calculations vary between programmes and are given below.

2. Your final mark is calculated as a weighted average, rounded to the nearest whole number, of the marks for each year of your degree programme. The relative weights attached to the first-, second- and third-year marks are 1, 3 and 5 respectively.
3. The resulting final mark is referred to the following table:

Final mark	Initial Assessment
70 or over	First
60 to 69	Upper Second
50 to 59	Lower Second
40 to 49	Third

In cases where a candidate resits a course, the highest available mark is used in the calculation. The resulting mark is credited to the year in which the course was first taken.

Candidates whose overall degree mark falls within 1% of a class boundary may be considered for raising to the higher class. Examiners will consider the following criteria in such cases, before making the final recommendation of Honours class:

- The overall distribution of marks: does the candidate have a majority of marks in any particular class, for example;
- The final-year performance compared with that in earlier years, and whether this is reflected adequately in the weight attached to the third year mark;;
- The performance in modules of more advanced level or those with a significant research element;
- Marks that have a particular significance for the overall classification (for example, marks for modules with a high course unit value, or marks that were affected by extenuating circumstances for which the appropriate documentation has been received).

Any candidate who does not meet the requirements for an Honours classification, but who satisfies the following criteria:

- At least 11 course units have been completed
- At least 10 course units have been passed
- At least 2 course units have been passed at Advanced level

will be offered an Ordinary degree. If such a candidate has exhausted all resit attempts available to them, they must accept this offer. Otherwise, they may either (i) decline the offer and resit any failed examinations at the next available opportunity, with a view to improving their degree classification, or (ii) accept the offer (in which case they have no further right to resit any failed examinations). Candidates choosing option (i) above should be aware that the syllabus may change before the next examination opportunity, and that this may reduce the chance of passing a resit.

Calculation of yearly marks

BSc Statistics: For the calculation of each yearly mark, a 1-unit course is counted as two half-unit courses. The first-year mark is then a weighted average of all first-year course marks; full weight is attached to courses STAT1004 and STAT1005 and to the best unit from your remaining courses, and half weight to the other two units. The second-year mark is a weighted average of all second-year course marks; full weight is attached to STAT2001, STAT2003 and to the best two units of your remaining courses, and half weight to the other unit. The third-year mark is a weighted average of all third-year course marks; full weight is attached to STAT3001, half a unit of STAT3901 and the best two units of remaining courses, and half weight to the other unit.

BSc SEF: For the calculation of each yearly mark, a 1-unit course is counted as two half-unit courses. The first-year mark is then a weighted average of all first-year course marks;

full weight is attached to courses STAT1004 and STAT1005 and to the best unit from your remaining courses, and half weight to the other two units. The second-year mark is a weighted average of all second-year course marks; full weight is attached to STAT2001, STAT2003 and to the best two units of your remaining courses, and half weight to the other unit. The third-year mark is a weighted average of all third-year course marks; full weight is attached to STAT3001, STAT3006 and the best two units of remaining courses, and half weight to the other unit.

BSc SEL: For the calculation of each yearly mark, a 1-unit course is counted as two half-unit courses. The first-year mark is then a weighted average of all first-year course marks; full weight is attached to courses STAT1004 and STAT1005 and to the best unit from your remaining courses, and half weight to the other two units. The second-year mark is a weighted average of all second-year course marks; full weight is attached to STAT2001, STAT2003 and to the best two units of your remaining courses, and half weight to the other unit. The third-year mark is a weighted average of all third-year course marks; full weight is attached to STAT3001 and the best 2.5 units of remaining courses, and half weight to the other unit.

BSc SAMB: For the calculation of each yearly mark, a 1-unit course is counted as two half-unit courses. The first-year mark is then a weighted average of all first-year course marks; full weight is attached to courses STAT1004, STAT1005 and to the best unit of remaining courses, and half weight to the other two units. The second-year mark is a weighted average of all second-year course marks; full weight is attached to STAT2001, MSIN7002 and to the best two units of your remaining courses, and half weight to the other unit. The third-year mark is a weighted average of all third-year course marks; full weight is attached to the best three units of courses, and half weight to the other unit.

BSc (Econ) Econ/Stats: For the calculation of each yearly mark, a 1-unit course is counted as two half-unit courses. The first-year mark is then a weighted average of all first-year course marks; full weight is attached to courses STAT1004, STAT1005 and ECON1604 (which counts as two half-unit courses), and half weight to the other two units. The second-year mark is a weighted average of all second-year course marks; full weight is attached to STAT2001, half a unit of ECON2601 and to the best two units of your remaining courses, and half weight to the other unit. The third-year mark is a weighted average of all third-year course marks; full weight is attached to the best three units of courses, and half weight to the other unit.

Award of honours for the MSci International Programme[4]

Degree classification takes place after the examinations in term 3 of your final year. Provided you have:

- Taken no more than one unit of courses at Introductory level;
- Taken at least three units at Masters level;
- Passed at least 14.5 units in total;
- Passed in statistical project work amounting to the equivalent of at least one unit undertaken in the third and/or fourth year,

you will be considered for Honours. An initial classification is obtained as follows:

[4] In general, the degree awarded according to the scheme of awards of honours is an *MSci in Statistical Science (International Programme)*. The title might be modified to take the specific course choice into account, i.e. the examiners will determine the degree title with reference to the subjects taken and, where appropriate, the UCL rules for combined degrees.

1. Marks are calculated for each year of your degree programme. For the calculation of each yearly mark, a 1-unit course is counted as two half-unit courses. The first- and second-year marks are calculated in the same way as for the corresponding BSc programme (see above). The third-year mark is a weighted average of all third-year courses, with full weight attached to the best three units and half weight attached to the remainder.[5] The fourth-year mark is an average of all fourth-year courses, in which all units are given equal weight.
2. Your final mark is calculated as a weighted average, rounded to the nearest whole number, of the marks for each year of your degree programme. The relative weights attached to the first-, second-, third- and fourth-year marks are 1, 3, 2.5 and 5 respectively.
3. The resulting final mark is referred to the following table:

Final mark	Initial Assessment
70 or over	First
60 to 69	Upper Second
50 to 59	Lower Second
40 to 49	Third

In cases where a candidate resits a course, the highest available mark is used in the calculation. The resulting mark is credited to the year in which the course was first taken.

Candidates whose overall degree mark falls within 1% of a class boundary may be considered for raising to the higher class. Examiners will consider the following criteria in such cases, before making the final recommendation of Honours class:

- The overall distribution of marks: does the candidate have a majority of marks in any particular class, for example;
- The final-year performance compared with that in earlier years, and whether this is reflected adequately in the weight attached to the third year mark;;
- The performance in modules of more advanced level or those with a significant research element;
- Marks that have a particular significance for the overall classification (for example, marks for modules with a high course unit value, or marks that were affected by extenuating circumstances for which the appropriate documentation has been received).

Any candidate who does not meet the requirements for an Honours classification, but who satisfies the following criteria:

- At least 11 course units have been completed
- At least 10 course units have been passed
- At least 2 course units have been passed at Advanced level

will be offered an Ordinary degree. If such a candidate has exhausted all resit attempts available to them, they must accept this offer. Otherwise, they may either (i) decline the offer and resit any failed examinations at the next available opportunity, with a view to improving their degree classification, or (ii) accept the offer (in which case they have no further right to resit any failed examinations). Candidates choosing option (i) above should

[5] The description given here is standard for MSci programmes within the UCL Faculty of Mathematics and Physical Sciences. In practice however, students on the International Programme spend their third year abroad and, since other universities do not operate the same course unit system as does UCL, it is necessary to translate their marks to a “UCL equivalent” for the purposes of degree classification. The translation is done on a case-by-case basis, taking into account the known correspondence between marking scales at different institutions as well as any relevant individual circumstances. No attempt is made to translate marks for individual courses: rather, a single mark for the year abroad is recorded and this is treated as a 4-unit course for the purpose of applying the formula described above.

be aware that the syllabus may change before the next examination opportunity, and that this may reduce the chance of passing a resit.

Award of honours for the BSc and MSci MASS programmes

Schemes are provided by the Mathematics Department.

Award of honours: illustrative calculation for a SEF student

Here is an example to show how the preliminary assessment of Honours is calculated. A student on the BSc SEF programme obtains marks as follows:

First year: STAT1004 63%; STAT1005 53%; ECON1604 32% with an examination mark of 29%; marks for all other half-unit courses 72%, 64%, 58%, 46%.

The student has only passed three units of courses, and the examination mark for ECON1604 is not high enough for a referral to be offered (see section “Referred Marks” above). The student therefore takes a year out, resits ECON1604 at the next available opportunity and obtains a mark of 45%.

Second year. STAT2001 38% with an examination mark of 44%; STAT2003 64%; marks for all other half-unit courses 68%, 64%, 59%, 53%, 50%, 46%. A referral is offered in STAT2001, since the examination mark is above 35. The student passes this referral, and is therefore credited with a mark of 40% for this course.

Third year. STAT3001 52%, STAT3006 64%, marks for all other half-unit courses 73%, 67%, 63%, 57%, 54%, 48%.

The student meets all the criteria for the award of an Honours degree. The marks for each year of the degree programme are calculated as follows:

First year. Since ECON1604 is a 1-unit course, it is equivalent to two half-units. Full weight is attached to STAT1004, STAT1005 and to the best unit of remaining courses (i.e. to the marks of 72% and 64%); half weight to the remainder. The first year mark is therefore

$$\frac{(1\times 63)+(1\times 53)+(1\times 72)+(1\times 64)+(0.5\times 58)+(0.5\times 46)+(0.5\times 45)+(0.5\times 45)}{1+1+1+1+0.5+0.5+0.5+0.5}=58.17$$

Second year. Full weight is attached to STAT2001, STAT2003 and to the best two units of remaining courses (i.e. to the marks of 68%, 64%, 59% and 53%); half weight to the remainder. The second year mark is therefore

$$\frac{(1\times 64)+(1\times 40)+(1\times 68)+(1\times 64)+(1\times 59)+(1\times 53)+(0.5\times 50)+(0.5\times 46)}{1+1+1+1+1+1+0.5+0.5}=56.57$$

Third year. Full weight is attached to STAT3001, STAT3006 and to the best two units of remaining courses (i.e. to the marks of 73%, 67%, 63% and 57%); half weight to the remainder. The third year mark is therefore

$$\frac{(1\times 52)+(1\times 64)+(1\times 73)+(1\times 67)+(1\times 63)+(1\times 57)+(0.5\times 54)+(0.5\times 48)}{1+1+1+1+1+1+0.5+0.5}=61$$

The final mark for this student is obtained by rounding the weighted average

$$\frac{(1\times 58.17)+(3\times 56.57)+(5\times 61)}{1+3+5}$$

to the nearest whole number. The resulting final mark is 59%. The preliminary classification for this student would therefore be a Lower Second class degree. However, since the final mark is within 1% of a class boundary, the Board of Examiners has the discretion to award an Upper Second degree if appropriate (on the basis, for example, of extenuating circumstances for which appropriate documentation was received by the required deadline).

PRIZES AND MEDALS

Departmental

The following prizes may be awarded to outstanding students studying for one of the six degrees for which the Department of Statistical Science is responsible:

Egon Pearson Prize: first year prize
Karl Pearson Prize: second year prize.
Fisher prize: for outstanding performance in either the first or second year.

Prizes may also be awarded to outstanding first and second year SEF students.

Faculty

The Department may nominate outstanding students for consideration by the MAPS Faculty for the following awards:

Faculty Medal: a final year student
Dean's Commendation: a final year student
Jackson Lewis Scholarship: a second year student.

Other

GlaxoSmithKline Prize: a final year student (including Econ/Stats, MASS)
Royal Statistical Society Prize: a final year student on a programme accredited by the Royal Statistical Society – see page 28.

AIMS AND OBJECTIVES OF THE STATISTICAL SCIENCE DEGREE PROGRAMMES

BSc Statistics

Aims

To provide an intellectually challenging undergraduate degree programme in the theory and practice of Statistical Science. This training should enable students to proceed directly to posts as Statisticians in industry, commerce or the civil service, or by profiting from the general numeracy and reasoning skills acquired during the programme, to take up trainee positions in accountancy, insurance or management. The programme should also provide a preparation for a Master's programme in Statistics, which in turn is a normal requirement for postgraduate research in Statistics.

Objectives

On completion of the programme, a student is expected to be able to do the following:

- Explain the concepts and properties of discrete and continuous random variables, common probability distributions (both univariate and multivariate), and carry out basic calculations associated with these.

- Summarise the main features of a set of data, and explain and use basic methods of statistical estimation and significance testing in a variety of standard situations; explain and use basic concepts in the theory of statistical inference.

- Explain, and apply to simple situations, basic ideas in applied probability such as Markov Chains and Markov processes (discrete states only).

- Undertake a research project involving data analysis under supervision and present the findings by oral presentation and written report.

- Use a modern computer operating system, use at least one major statistical package, use a word processor, spreadsheet, database and graphics software.

In addition, a student should be introduced to most of the following:

- The problems associated with planning a survey, and the use of simple methods of analysing survey data.

- The problems associated with planning a clinical trial, and the use of simple methods for analysis of data from clinical trials and epidemiological studies.

- Forecasting procedures.

- Criteria for decision making, utility theory, decision trees.

BSc Statistics and Management for Business (SAMB)

Aims

To provide an intellectually challenging undergraduate degree programme in the theory and practice of Statistical Science, and equip those students who wish to enter industry or commerce with sufficient management skills for the first few years at work. This training should enable students to proceed directly to posts as Statisticians in industry, commerce or public organisations, or by profiting from the general numeracy and reasoning skills acquired during the programme, to take up trainee positions in accountancy, insurance or management. The programme should also provide a preparation for a Master's programme in Statistics, which in turn is a normal requirement for postgraduate research in this area.

Objectives

On completion of the programme, a student is expected to be able to do the following:

- Explain the concepts and properties of discrete and continuous random variables, common probability distributions (both univariate and multivariate), and carry out basic calculations associated with these.
- Summarise the main features of a set of data, and explain and use basic methods of statistical estimation and significance testing in a variety of standard situations; explain and use basic concepts in the theory of statistical inference.
- Carry out a critical evaluation of an analytical method, recognising both its strengths and its limitations.
- Explain the ideas of Markov Chains, Markov processes (discrete states only) and renewal processes, and use them in simple applications, including queues and reliability.
- Understand the practical aspects of applying theories of management and present arguments and views that demonstrate understanding of the realities of organisation life.
- Identify and discuss the impact of cultural, political, social, economic and technological issues on organisations.
- Define, analyse and present recommendations for the solution of given management problems.

In addition, a student should be introduced to most of the following:

- One or more specialised areas of management science as applied to business, including e-Business, ethics, international business, business law, managing organisational change and marketing.
- The problems associated with planning a survey, and the use of simple methods of analysing survey data.
- Forecasting procedures.
- Concepts and principles of risk, assessment and management of risk; criteria for decision making, utility theory, decision trees.
- Practical experience of techniques in Statistics through project work or case studies.
- Apply the methods of linear and dynamic programming, and solve simple problems in game theory and Markov sequential processes.
- Use of a modern computer operating system including spreadsheet, database and graphics software and the use of a computer package for data analysis.

BSc Statistics, Economics and Finance (SEF)

Aims

To provide an intellectually challenging undergraduate degree programme in quantitative methods together with a basic knowledge of Economics and Finance. This training should enable students to profit from the general numeracy and reasoning skills acquired during the programme in order to take up trainee positions in accountancy, finance, insurance or management, or to proceed to positions as statisticians in industry, commerce or public organisations. The programme should also provide a preparation for a Master's programme in Statistics, Economics or Finance, which in turn is a normal requirement for postgraduate research in any of these areas. Via appropriate choice of options, the programme may also provide a foundation for a career, or for further study, in Operational Research.

Objectives

On completion of the programme, a student is expected to be able to do the following:

- Explain the concepts and properties of discrete and continuous random variables, common probability distributions (both univariate and multivariate), and carry out basic calculations associated with these;
- Summarise the main features of a set of data, and explain and use basic methods of statistical estimation and significance testing in a variety of standard situations; explain and use basic concepts in the theory of statistical inference;
- Carry out a critical evaluation of an analytical method, recognising both its strengths and its limitations;
- Explain the ideas of Markov Chains, Markov processes (discrete states only) and renewal processes, and use them in simple applications, including queues and reliability;
- Use a major statistical computer package, and interpret the output;
- Have a basic knowledge of central principles of microeconomics including supply and demand, consumer choice, firm behaviour, product markets, labour markets and international trade;
- Have a basic knowledge of central principles of macroeconomics including national accounts, relations between private sector and government, consider the problems of inflation, unemployment, balance-of-payments and growth, aggregate demand and supply;
- Formulate economic arguments and understand the role of argument and evidence in the policy-making process;
- Interpret company financial reports and appreciate the use of basic financial products;
- Use the basic mathematical and probabilistic tools of modern finance, and apply the relevant techniques for the pricing of derivatives;

In addition, a student should be introduced to most of the following:

- The problems associated with planning a survey, and the use of simple methods of analysing survey data.
- Forecasting procedures.
- Concepts and principles of risk, assessment and management of risk; criteria for decision making, utility theory, decision trees.
- Practical experience of techniques in Statistics through project work or case studies.
- Methods of linear and dynamic programming, and simple problems in game theory and Markov sequential processes.

BSc Statistics, Economics and a Language (SEL)

Aims

To provide an intellectually challenging undergraduate degree programme in quantitative methods, together with a basic knowledge of Economics and a reasonable ability to communicate in a second language in addition to English. This training should enable students to profit from the general numeracy, reasoning and linguistic skills acquired during the programme in order to take up trainee positions in accountancy, finance, insurance or management, or to proceed to positions as Statisticians in industry, commerce or public organisations. The study of a second language recognises that increasingly these careers have an international dimension. Students should be able to converse reasonably fluently (according to the level) with native speakers and discuss personal, social, current and professional issues using appropriate structures. The programme should also provide a preparation for a Master's programme in Statistics or Economics, which in turn is a normal requirement for postgraduate research in either of these areas. Via appropriate choice of options, the programme may also provide a foundation for a career, or for further study, in Operational Research.

Objectives

On completion of the programme, a student is expected to be able to do the following:

- Explain the concepts and properties of discrete and continuous random variables, common probability distributions (both univariate and multivariate), and carry out basic calculations associated with these.
- Summarise the main features of a set of data, and explain and use basic methods of statistical estimation and significance testing in a variety of standard situations; explain and use basic concepts in the theory of statistical inference.
- Explain the ideas of Markov Chains, Markov processes (discrete states only) and renewal processes, and use them in simple applications, including queues and reliability.
- Have a basic knowledge of central principles of microeconomics including supply and demand, consumer choice, firm behaviour, product markets, labour markets and international trade.
- Have a basic knowledge of central principles of macroeconomics including national accounts, relations between private sector and government, consider the problems of inflation, unemployment, balance-of-payments and growth, aggregate demand and supply.
- Formulate economic arguments and understand the role of argument and evidence in the policy-making process;
- Speak, write and comprehend a language other than English, to a level of fluency which is sufficient for future professional activities.

In addition, a student should be introduced to most of the following:

- The problems associated with planning a survey, and the use of simple methods of analysing survey data.
- Forecasting procedures.
- Concepts and principles of risk, assessment and management of risk; criteria for decision making, utility theory, decision trees.
- Practical experience of techniques in Statistics through project work or case studies.
- Use of a major statistical computer package, and interpretation of the output.
- Methods of linear and dynamic programming, and simple problems in game theory and Markov sequential processes.

BSc (Econ) Economics and Statistics

Aims

To provide an intellectually challenging undergraduate degree programme that provides training in all major aspects of Economics, and in the theory and practice of Statistical Science. This training should prepare students for a career as an economist or statistician or, by profiting from the general numeracy and transferable skills acquired during the programme, to take up trainee positions in accountancy, insurance or management. The programme also aims to provide a foundation for graduate study in Economics, Statistics and related fields.

Objectives

On completion of the programme, a student is expected to be able to do the following:

- Understand the central ideas, concepts and methods of modern economics, including core elements of macroeconomics, microeconomics and quantitative empirical economics.
- Apply these core concepts to one or more specialised areas of economics.
- Explain the concepts and properties of discrete and continuous random variables and common probability distributions (both univariate and multivariate), and carry out basic calculations associated with these.
- Summarise the main features of a set of data, and explain and use basic methods of statistical estimation and significance testing in a variety of standard situations.
- Approach economic and more general quantitative problems in a methodical and structured manner, bringing to bear skills of conceptualisation, problem solving, analysis and communication.

In addition, a student should be introduced to most of the following:

- One or more specialised areas of economics, including financial economics, industrial relations, international trade and economic applications of game theory.
- Use of a modern computer operating system, and use of a computer package for data analysis.
- Methods of linear and dynamic programming and their application to simple problems.
- The problems associated with planning a survey, and the use of simple methods of analysing survey data.
- Forecasting procedures.
- Criteria for decision making, utility theory, decision trees.

MSci Statistical Science (International Programme)

Aims

As for the corresponding BSc degree (see previous pages)

In addition, the International Programme aims at continuing advanced education in Statistics, as well as providing experience of education in a different cultural and/or linguistic setting which will broaden the horizon of students and increase chances to find positions with special emphasis on international expertise.

Objectives

As for corresponding BSc degree plus:

- Deepened / advanced understanding of statistical theory and its applications in a variety of areas.
- Mastering a foreign language (for those not already following a with language degree programme).

STRUCTURES OF THE DEGREE PROGRAMMES

The tables on the following pages show the degree programme structures by subject material for each year and term.

You will see that each degree programme has compulsory courses to fulfil the aims and objectives of the degree. In these tables, some course titles have been abbreviated; full course titles are given in the list of courses in the section following these tables. You will normally have the required prerequisites for each compulsory course. You should check on the prerequisites for an optional course by reference to the course descriptions later in the handbook.

Structure of the Statistics degree programme

Students study four units per year. All courses are half units except where otherwise stated.
Courses marked • are compulsory; first- and second-year courses in capital letters are specified to have full weight in the scheme for the award of honours.
At least one of the courses marked † should be chosen in the second year.
Courses in brackets are third year options if not taken in the second year.
A limited number of options may be chosen from other course units offered in the College, subject to approval by the appropriate Departmental Tutors and the constraints of the timetable.

Year	1		2		3	
Term	1	2	1	2	1	2
Mathematics	Maths I •	Maths II •	Maths III •			
Core Probability & Statistics	INTRO. PROB & STATS •	FURTHER PROB/STATS • Intro to Practical Stats •	PROB.& INFERENCE • Linear Models & Anova •	INTRO.APPLIED PROB. •	Stat. Inference •	
Operational Research			Optimisation Algorithms †		Decision & Risk	Stochastic Systems Forecasting [Optimisation Algorithms]
Other Statistics			Social Statistics †		Project, 1 unit • Medical Statistics 1 Stochastic Methods in Finance	Medical Statistics 2 Factorial Experimentation [Social Statistics]
Computing			Computing for Practical Statistics •			
Required options	*At least one from* Writing in Academic contexts Academic writing in English Hist. of Science Philos. Science Analysis 1 Intro. Sci Policy Studies Intro. Sci Comm *Remaining options from e.g.* Maths, Computing, Language, Management Studies, Economics, …		*At least one from, e.g.* Maths, Computing, Language, Management Studies, Economics, …			

Structure of the Statistics and Management for Business degree programme

Students study four units per year. All courses are half units except where otherwise stated.
Courses marked • are compulsory; first- and second-year courses in capital letters are specified to have full weight in the scheme for the award of honours.
Courses in brackets are options if not taken in the previous year.
A limited number of options may be chosen from other course units offered in the college, subject to approval by the appropriate Departmental Tutors and the constraints of the timetable.

Year	1		2		3	
Term	1	2	1	2	1	2
Mathematics	Maths I •	Maths II •	Maths III •			
Core Probability & Statistics	INTRO PROB & STATS •	FURTHER PROB & STATS •	PROB.& INFERENCE • Linear Models & Anova •			
	Intro to Practical Stats •					
Other Statistics			Computing for Practical Statistics	Social Statistics Intro. Applied Prob.	*At least two from* Project[1] [Computing for Practical Statistics] Statistical Inference Medical Statistics 1 Decision & Risk Stochastic Methods in Finance	Medical Statistics 2 Forecasting Stochastic Systems Factorial Experimentation [Social Statistics] [Intro. Applied Prob.]
Management	Foundations of Management •	Communication & Behaviour in Organisations •		Accounting for Business • Business in a Competitive Environment •	Project Management •	Human Resource Management •
	Information world •		*At least one[2] from* Organisational Change Entrepreneurship Innovation Management	E-Business Business Plan Introduction to Marketing[3] International Business Law for Managers Managerial Accounting World Economy	*At least one[2] from* Dissertation, 1 unit[1] [Organisational Change] [Entrepreneurship [Innovation Management] Game Theory Corporate Financial Strategy The Marketing Process[3]	Business Operations Mergers and Valuations [E-Business] [Business Plan] [Introduction to Marketing][3] [International Business [Law for Managers] [Managerial Accounting]

1. Only one of these two options may be taken during the degree programme.
2. A total of at least 1.5 units must be taken during the second and third years.
3. Students should take ONLY one marketing course, Introduction to Marketing or The Marketing Process.

Structure of the Statistics, Economics and Finance degree programme

Students study four units per year. All courses are half units except where otherwise stated.
Courses marked • are compulsory; first- and second-year courses in capital letters are specified to have full weight in the scheme for the award of honours.
Courses in brackets are options if not taken in the previous year.
A limited number of options may be chosen from other course units offered in the college, subject to approval by the appropriate Departmental Tutors and the constraints of the timetable.

Year	1		2		3	
Term	1	2	1	2	1	2
Mathematics	Maths I •	Maths II •	Maths III •			
Core Probability & Statistics	INTRO. PROB & STATS •	FURTHER PROB/STATS • Intro to Practical Stats •	PROB.& INFERENCE • Linear Models & Anova •	INTRO.APPLIED PROB. •	Stat.Inference •	
Other Statistics			Computing for Practical Statistics •	Social Statistics	*At least two from* Project Medical Statistics 1 Decision & Risk	Stochastic Systems Forecasting Medical Statistics 2 Factorial Experimentation [Social Statistics]
Economics	Economics 1 (Combined Studies), 1 unit •		*At least one from* Applied Economics Economics 2 (Combined Studies), 1 unit		Game Theory Econometrics, 1 unit[2] *Other Economics options may be available*[3]	
Finance	Accounting for Business •		Management Information and Control	Money and Banking[1] Financial Computing[1]	Stochastic Methods in Finance • Economics of Finance[1,2] Corporate Financial Strategy [Management Information and Control]	Econ. Corp. Finance[1,2] Mergers and Valuations [Financial Computing[1]] [Money and Banking[1]]

1. At least one of these courses must be selected during the degree programme.
2. Only available to students taking Economics 2 in the second year.
3. For students taking Economics 2 in the second year, the following options may be available in the third year, subject to the constraints of the timetable: Economics of Labour, Economics of Industrial Relations, Economics of the Public Sector, Economics of Tax Policy and Environmental Economics.

Structure of the Statistics, Economics and a Language degree programme

Students study four units per year. All courses are half units except where otherwise stated.
Courses marked • are compulsory; first- and second-year courses in capital letters are specified to have full weight in the scheme for the award of honours.
Courses in brackets are third year options if not taken in the second year.
A limited number of options may be chosen from other course units offered in the college, subject to approval by the appropriate Departmental Tutors and the constraints of the timetable.

Year	1		2		3	
Term	1	2	1	2	1	2
Mathematics	Maths I •	Maths II •	Maths III •			
Core Probability & Statistics	INTRO. PROB & STATS • Intro to Practical Stats •	FURTHER PROB/STATS •	PROB.& INFERENCE • Linear Models & Anova •	INTRO.APPLIED PROB. •	Stat.Inference •	
Other Statistics			Computing for Practical Statistics	Social Statistics	*At least three from* Project, Medical Statistics 1, Decision & Risk, Stochastic Methods in Finance, Stochastic Systems, Medical Statistics 2, Forecasting, Factorial Experimentation, [Social Statistics]	
Economics	Economics 1 (Combined Studies), 1 unit •		*At least one from* Economics 2 (Combined Studies), 1 unit	Applied Economics	*At least one from* Corporate Finance, Game Theory, Environmental Economics, Economics of Finance[6], Econometrics, 1 unit[1], Money and Banking	
Language	Course in selected language •		Course in selected language • Option in selected language		Course in selected language • Option in selected language	

1. Only available to students who take Economics 2 in the second year.

Structure for the BSc (three year) MASS degree programme

Students study four units per year. All courses are half units except where otherwise stated.
Courses marked • are compulsory.
Courses in brackets are options if not taken in the second year.
A limited number of options may be chosen from other course units offered in the college, subject to approval by the appropriate Departmental Tutors and the constraints of the timetable.

Year	1		2		3	
Term	1	2	1	2	1	2
Core Maths	Analysis 1 • Algebra 1 • Math. Methods 1 •	Analysis 2 • Math. Methods 2 •	Complex Analysis •	Real Analysis • Algebra 2 •		
Maths options					*At least two from* Real Analysis, Further Linear Algebra, Math. Methods 3, Graph Theory & Combinatorics, Groups & Rings, Math. Ideas in Biology, Probability (Measure Theory), Computational Methods, OR & Math Modelling	
Core Statistical Science	INTRO. PROB & STATS • Intro to Practical Stats •	FURTHER PROB/STATS •	Prob. & Inference • Linear Models & Anova • Computing for Practical Statistics •	Intro.Applied Prob. •	Statistical Inference •	
Statistical Science options			*One from* Social Statistics, Optimisation Algorithms		*At least one from* Decision & Risk, Medical Statistics 1, Stochastic Methods in Finance, Forecasting, Medical Statistics 2, Stochastic Systems, Factorial Experimentation, [Social Statistics], [Optimisation Algorithms], Project	

Structure of the MSci (Four year) MASS degree programme

Students study four units per year. All courses are half units except where otherwise stated.
Courses marked • are compulsory. Students *must* choose one (but not both) of the project courses marked † in year 4.
Project course marked ‡ may be taken if Mathematics project is chosen in year 4.
Courses in brackets are options if not taken in the previous year.
A limited number of options may be chosen from other course units offered in the college, subject to approval by the appropriate Departmental Tutors and the constraints of the timetable.
Years 1 and 2 are the same as for the three year degree; years 3 and 4 are given below.

Year	3		4	
Term	1	2	1	2
Mathematics	Real Analysis • Further Linear Algebra • *At least one course from* Mathematical Methods 3 Groups and Rings Mathematical Ideas in Biology Functional Analysis Computational Methods Probability (Measure Theory)		*At least one unit from* Project (1 unit †) *and courses listed in the Department of Mathematics booklet on Degree Programmes*	
Statistical Science	Statistical Inference • *At least two courses from* Decision & Risk Stochastic Systems Forecasting [Social Statistics] [Optimisation Algorithms]		*At least one unit from* Project (1 unit) † Project (½ unit) ‡ [Decision & Risk] Medical Statistics 1 Stochastic Methods in Finance	[Stochastic Systems] [Forecasting] Medical Statistics 2 Factorial Experimentation

Structure for the Economics and Statistics degree programme

Students study four units per year. All courses are half units except where otherwise stated.
Courses marked • are compulsory; first- and second-year courses in capital letters are specified to have full weight in the scheme for the award of honours.
* In the third year, a limited number of options may be chosen from other course units offered by the Departments of Economics and Statistical Science, or up to 1.5 units may be chosen from other course units offered in the College, subject to approval by the appropriate Departmental Tutors, the constraints shown below for choosing options from the two Departments, and the constraints of the timetable.

Year	1		2		3	
Term	1	2	1	2	1	2
Mathematics	Maths I •	Maths II •	Maths III •			
Core Economics	ECONOMICS 1 (COMBINED STUDIES), 1 unit •		ECONOMICS 2 (COMBINED STUDIES), 1 unit • Econometrics, 1 unit •			
Economics Options	*One from* World Economy Applied Economics				** At least three from* Econ. of Labour, Econ. of Finance, Game Theory, International Trade, Microeconometrics, Money & Banking, Econ. of Industrial Relations, Experimental Economics, Econometrics for Macroecon. & Finance	
Core Probability Statistics	INTRO. PROB & STATS •	FURTHER PROB/STATS • Intro to Practical Stats •	PROB & INFERENCE • Linear Models & Anova •			
Stats/OR Options			*One from* Social Statistics, Intro. Applied Prob.		** At least two from* Statistical Inference, Decision & Risk, Stochastic Methods in Finance, Forecasting, Stochastic Systems, Optimisation Algorithms, Factorial Experimentation, [Intro.Applied.Prob.], [Social Statistics]	

Structure of MSci International Programme

Students may be accepted onto the International Programme from year 1 with the intention of following the first two years of one of our existing three-year BSc programmes (excluding Economics and Statistics). Alternatively, students starting on one of these existing programmes may be allowed to transfer to the International Programme after their first year. The Department will only support a limited number of students on the International Programme. Where more students seek to follow the programme than there are opportunities available, the candidates will be selected by the Study Abroad Tutor in conjunction with the Departmental Tutor, based on overall profile of academic performance, enthusiasm and contribution to the Department. Students who wish to study in a language other than English must be able to demonstrate linguistic competence through qualifications and/or following UCL Language Centre courses. The Department may ask the Language Centre to assess students seeking to study abroad.

Years 1 and 2 are the same as for the corresponding BSc programme selected by the student at the start of year 1 except that, if required, a student should take up to one unit of additional language courses in the first two years. These language courses should be taken instead of options named in the programme structure of the selected programme; students will be required to take all of the compulsory first and second year courses of the selected programme.

Year 3 will be the year abroad and will be substantially composed of courses in Statistics or closely related allied disciplines such as Mathematics, Econometrics, Operations Research, Computer Science. Students studying abroad must follow a programme that is to the fullest extent possible agreed in advance with the Study Abroad Tutor. The programme must

- be overall of equivalent depth and quality to the third year of one of our current BSc programmes;
- be substantially composed of courses in Statistics or closely related allied disciplines such as Mathematics, Econometrics, Operations Research, Computer Science;
- be of equal workload to that of the UCL third year of one of our BSc courses, that is, using accepted equivalence measures, be of 4 units;
- be formally assessed by the host institution and the results of the assessment independently reported to the Study Abroad Tutor;
- include taught courses / units, i.e. not consist solely of project work;
- be formally documented by the student in an up to date written study plan, signed by the Study Abroad Tutor and kept by the Departmental Tutor.

In year 4, the choice of courses should complement the one in the year abroad according to the selected BSc programme. At most 1 unit of Advanced level courses can be taken in year 4; the remaining 3 units will be at Masters level (in Statistical Science these will be Masters level versions of the Advanced level courses). A student should do in year 3 and/or 4, statistical project work amounting to the equivalent of at least one-unit. If taken in year 4, the project will be at Masters level. For some of the Department's programmes, a compulsory one-unit statistical project is already included in the final year. For the other programmes, a student may opt to undertake the project work by registering for at least a half-unit project course in each of years 3 and 4 instead of undertaking the work in one year only. Year 4 students must have their options courses agreed by the Study Abroad Tutor and Departmental Tutor in order to avoid overlap and to fill in gaps caused by attending an overseas institution.

COURSES AVAILABLE IN THE DEGREES

COURSE CODES

Each course has a code: this consists of a four character prefix which indicates the examination board that is responsible for that course, followed by another four characters indicating a course code within that board. Courses in Statistics and Operational Research have the prefix STAT. However, you will often find that staff refer to course codes as simply 1005 for STAT1005, and 1604 for ECON1604 (for example).

CODES OF COURSES ON OFFER

In the list below, the courses are listed by subject area. All courses listed are 0.5 unit unless stated otherwise.

Please refer to the programme structures shown in the previous pages for the appropriate courses for your degree.

Statistics, SEF and SEL degree programmes

- *Mathematics*

Year	Course Code	Course Title	Level	Term
1	MATH6401	Mathematics I †	First	1
	MATH6402	Mathematics II †	First	2
2	MATH6403	Mathematics III †	Intermediate	1

- *Statistics and Operational Research*

Year	Course Code	Course Title	Level	Term
1	STAT1004	Introduction to Probability and Statistics	First	1
	STAT1005	Further Probability and Statistics	First	2
	STAT1006	Introduction to Practical Statistics	First	1 & 2
2	STAT2001	Probability & Inference	Intermediate	1
	STAT2002	Linear Models & the Analysis of Variance	Intermediate	1
	STAT2003	Introduction to Applied Probability	Intermediate	2
	STAT7001	Computing for Practical Statistics	Intermediate	2
	STAT7002	Social Statistics *	Intermediate	2
	STAT7003	Optimisation Algorithms in OR *	Advanced	1
3	STAT3001	Statistical Inference	Advanced	1
	STAT3002	Stochastic Systems	Advanced	2
	STAT3003	Forecasting	Advanced	2
	STAT3004	Decision & Risk	Advanced	1
	STAT3005	Factorial Experimentation	Advanced	2
	STAT3006	Stochastic Methods in Finance	Advanced	1
	STAT3008	Medical Statistics I	Advanced	1
	STAT3009	Medical Statistics II	Advanced	2
	STAT3901	Project (1 unit)	Advanced	1 & 2
	STAT3902	Project	Advanced	1 & 2
	ECON3014	Game Theory	Advanced	1

- *Economics and Finance*

† The full title for these Mathematics course units is "Mathematics for Students of Economics, Statistics & Related Disciplines".

* This course unit may be offered in either years 2 or 3, depending on the degree programme.

Year	Course Code	Course Title	Level	Term
1	ECON1604	Economics I (Combined Studies) – 1 unit	First	1 & 2
	MSIN1004	Accounting for Business	First	2
2	COMP6006	Financial Computing	Advanced	2
	ECON1002	Applied Economics	First	2
	ECON2601‡	Economics II (Combined Studies) – 1 unit	Intermediate	1 & 2
	MSIN7001	Management Information & Control	Intermediate	1
3	ECON2007	Econometrics – 1 unit	Intermediate	1 & 2
	ECON3017	Economics of Corporate Finance	Advanced	2
	ECON7002	Economics of Finance♣	Advanced	1
	ECON7003	Money & Banking	Advanced	2
	ECON7007	Environmental Economics	Advanced	1
	MSIN3004	Mergers and Valuations	Advanced	2
	MSIN3017	Corporate Financial Strategy	Advanced	1

- *Languages* - see page 52 onwards.

- *Other options*. First year students on the Statistics degree programme are required to choose at least one option from any course available in the following list:

Course Code	Course Title	Level	Term
EDUC6002	Writing in Academic Contexts	Advanced	1 or 2
HPSC1001	History of Science	First	1
HPSC1003	Philosophy of Science	First	1
HPSC1004	Introduction to Science Policy Studies	First	2
HPSC1008	Introduction to Science Communication	First	2
LCEN6801	Academic Writing in English for non-native speakers	Advanced	1 & 2
MATH1101	Analysis I	First	1

Unfortunately, although the department makes every effort to ensure that all of these options will be available to first year students on the Statistics degree, timetabling constraints mean that this cannot be guaranteed. If a preferred option is not available, students must select another option from the list above.

Students registered for Statistical Science degrees may also choose alternative options from elsewhere in the College *but do recall the restrictions on choosing them described earlier on page 19 in the section on selection of courses.* The following is a selection of courses that could be chosen:

Language half unit course (see next section on these).
MSIN6001: Management Principles (but not if you have taken MSIN1001).
PSYC6001: Introduction to Social & Business Psychology (but not if you have taken MSIN1002).
MATH3701: Theory of Numbers, MATH3801: Logic, MATH3802: History of Mathematics.

Year 3 students may *not* take a first year Mathematics courses, MSIN1004 or similar modules offered by other departments. Students may not take both of MATH7502 Linear Programming and Optimization) and STAT7003, or both of MATH3508 (Financial Mathematics) and STAT3006.

‡ ECON2601 requires at least grade B in ECON1604 as a prerequisite.
♣ Students are strongly recommended to take STAT3004 as a prerequisite for ECON7002.

SAMB degree programme

- *Mathematics* - the courses are those listed on page 48.

- *Statistics* - the courses are included in the list on page 48.

- *Management and Business Studies*

Year	Course Code	Course Title	Level	Term
1	MSIN1001	Foundations of Management	First	1
	MSIN1002	Communication & Behaviour in Organisations	First	2
	MSIN1003	Information World	First	1
2	MSIN1004	Accounting for Business	First	2
	MSIN7002	Business in a Competitive Environment	Intermediate	2
	MSIN7009	Introduction to Marketing	Intermediate	2
	ECON1005B	The World Economy	First	2
2 or 3	MSIN7003	Organisational Change	Intermediate	1
	MSIN7004	E-Business Environment and Management	Intermediate	2
	MSIN7005	Law for Managers	Intermediate	2
	MSIN7007	Mastering Entrepreneurship	Intermediate	1 or 2
	MSIN7008	Business Plan	Advanced	2
	MSIN7011	International Business	Advanced	2
	MSIN7013	Innovation Management	Intermediate	1
	MSIN7016	Managerial Accounting for Decision Making	Intermediate	2
3	MSIN3001	Project Management	Advanced	1 or 2
	MSIN3002	The Marketing Process	Advanced	1
	MSIN3004	Mergers and Valuations	Advanced	2
	MSIN3017	Corporate Financial Strategy	Advanced	1
	MSIN7014	Strategic Human Resource Management	Intermediate	2
	MSIN7015	Managing Business Operations	Intermediate	2
	MSIN9001	Dissertation	Advanced	1 & 2
	ECON3014	Game Theory	Advanced	1

In year 3, students may choose other second and third year courses from the Department of Management Science and Innovation instead of those listed for year 3 and other third year courses from the Department of Statistical Science instead of those listed for year 3, and they may also choose up to 0.5 units of options from other departments. *These choices are subject to the approval of the appropriate Departmental Tutors, the constraints shown for choosing options from the two departments (see degree programme structure), and the constraints of the timetable. The timetable will NOT be changed to allow students to choose other options.* Year 3 students who wish to opt for either the half or one unit statistical project are still required to choose at least two taught courses from the list of Stats/OR options.

Year 3 students may *not* take a first year Mathematics course, MSIN1004 or similar modules offered by other departments. Students may not take both of MATH7502 (Linear Programming and Optimization) and STAT7003, or both of MATH3508 (Financial Mathematics) and STAT3006.

Economics and Statistics degree programme

- *Mathematics* - the courses are those listed on page 48.

- *Statistics* - the courses are included in the list on page 48.

- *Economics*

Year	Course Code	Course Title	Level	Term
1	ECON1002	Applied Economics	First	2
	ECON1005B	The World Economy	First	2
	ECON1604	Economics I (Combined Studies) – 1 unit	First	1 & 2
2	ECON2601	Economics II (Combined Studies) – 1 unit	Intermediate	1 & 2
	ECON2007	Quantitative Economics & Econometrics	Intermediate	1 & 2
3	ECON3002	Microeconometrics	Advanced	1
	ECON3003	Econometrics for Macroeconomics and Finance	Advanced	2
	ECON3004	International Trade	Advanced	1
	ECON3014	Game Theory	Advanced	1
	ECON3020	Experimental Economics	Advanced	2
	ECON7001	Economics of Labour	Advanced	1
	ECON7002	Economics of Finance	Advanced	1
	ECON7003	Money and Banking	Advanced	2
	ECON7004	Economics of Industrial Relations	Advanced	2

In year 3, students may choose other second and third year courses from the Department of Economics instead of those listed for year 3 and other third year courses from the Department of Statistical Science instead of those listed for year 3, and they may choose up to 1.5 units of courses from other departments. *These choices are subject to the approval of the appropriate Departmental Tutors, the constraints shown for choosing options from the two departments (see degree programme structure), and the constraints of the timetable. The timetable will NOT be changed to allow students to choose other options.* The *Undergraduate Course Booklet* issued by the Department of Economics contains a list of all available Economics courses. Year 3 students who wish to opt for either the half or one unit statistical project are still required to choose at least two courses from the list of Stats/OR options. Year 3 students must take at least 0.5 units of courses with ECON3xxx codes.

Year 3 students who wish to take an outside option should note that they may *not* take a first year Mathematics course, MSIN1004, MSIN7002 or similar modules offered by other departments. Students may not take both of MATH7502 (Linear Programming and Optimization) and STAT7003, both of MATH3508 (Financial Mathematics) and STAT3006, both of MSIN1002 and PSYC6001, both of MSIN1001 and MSIN6001, both of MSIN7004 and COMP6005, and more than 0.5 units of MSIN courses below Advanced level (see page 49 for the titles of the courses listed here).

MASS degree programmes

- *Mathematics*

Year	Course Code	Course Title	Level	Term
1	MATH1101	Analysis 1	First	1
	MATH1102	Analysis 2	First	2
	MATH1201	Algebra 1	First	1
	MATH1401	Mathematical Methods 1	First	1
	MATH1402	Mathematical Methods 2	First	2
2	MATH1202	Algebra 2	First	2
	MATH2101	Analysis 3: Complex Analysis	Intermediate	1
	MATH7102	Analysis 4: Real Analysis	Advanced	2
3	MATH2201	Algebra 3: Further Linear Algebra	Intermediate	1
	MATH2401	Mathematical Methods 3	Intermediate	1

Year	Course Code	Course Title	Level	Term
	MATH3101	Real Analysis	Advanced	1
	MATH3103	Functional Analysis	Advanced	2
	MATH3105	Probability (Measure Theory)	Advanced	2
	MATH3503	Graph Theory and Combinatorics	Advanced	1
	MATH3505	Mathematical Ideas in Biology 2	Advanced	2
	MATH3506	Mathematical Ideas in Biology 1	Advanced	2
	MATH7202	Algebra 4: Groups and Rings	Advanced	2
	MATH7601	Computational Methods	Intermediate	2

- *Statistical Science* - the courses are included in the list on page 48.

In year 3, students on the BSc programme may choose other second and third year courses from the Department of Mathematics instead of those listed for year 3 and other third year courses from the Department of Statistical Science instead of those listed for year 3, or a half unit course from another department, subject to the approval of the Departmental Tutors, the constraints shown for choosing options from the two departments (see degree programme structure), and the constraints of the timetable. The timetable will NOT be changed to allow students to choose other options. The Degree Programme booklet issued by the Department of Mathematics contains a list of all available Mathematics courses. MSci students should refer to that booklet for year 4 Mathematics options.

LANGUAGE COURSES FOR STATISTICAL SCIENCE STUDENTS

Language courses are available at the UCL Language Centre. In some cases students may be able to attend courses organised by other departments such as UCL French, German, Italian or Spanish departments or the Modern European Studies department.

The following languages are available from the UCL Language Centre:

French, German, Italian, Japanese, Mandarin, Spanish

All languages are offered as 0.5 unit courses at 7 levels. Two levels may be combined in the same year to form a one-unit course. The correspondence between language levels and those described on page 14 is indicated below.

Selecting a level

The Language Centre tutors will assist students in selecting the right level when they come for their interview as part of the course enrolment procedure in September. **You can only register for language courses following an interview at the Language Centre; if you try and register on the PORTICO system for a language course without the prior agreement of the Language Centre, your registration will not be permitted.** The Language Centre levels are as follows:

- **Level A *(corresponding level for degree classification: First)***
  This is for complete beginners or for students who have had only very little contact with the language.

- **Level B *(corresponding level for degree classification: Intermediate)***
  This is for students who have passed level A at the Language Centre, or have a low GCSE grade or equivalent.

- **Level C *(corresponding level for degree classification: Advanced)***
  This is for students who have passed level B at the Language Centre, or have a high GCSE grade or equivalent.

- **Level D *(corresponding level for degree classification: Advanced)***
  This is for students who have passed level C at the Language Centre, or are reasonably fluent in the language and are able to discuss a range of issues (low A-Level grade or equivalent).

- **Business and Current Affairs *(corresponding level for degree classification: Advanced)***
  This is for students who have passed level D at the Language Centre, or have a high A-level grade or equivalent. The course covers a variety of issues within the scope of Business and Current Affairs such as Europe, society and politics.

- **Current Affairs and Culture (Social, Historical and Political) *(corresponding level for degree classification: Advanced)***
  This is for students who have taken the Business and Current Affairs course. The course provides knowledge and understanding both of the structure of the language and of the business, social, historical and political contexts in which it is currently used.

- **Professional Purposes II *(corresponding level for degree classification: Advanced)***

SEL degree

You can study at most two languages throughout your degree programme. However, you can only enrol for one Level A course throughout the three years. The rules are as follows:

Year 1 compulsory: a 0.5 unit language course, a 1-unit course is not allowed.
Year 2 compulsory: a 0.5 unit language course.
optional: a 0.5 unit language course.
You may combine both to select a 1-unit course in one language.
Year 3 compulsory: a 0.5 unit language course.
optional: a 0.5 unit language course.
You may combine both to select a 1-unit course in one language. If you enrol for a Level A course, it must be a 1-unit course.

In addition to the restrictions outlined here, the number of language courses taken at levels A to D may be limited by the requirements of the scheme for the award of Honours (see page 28).

Statistics degree

In each year, a 0.5 unit language course at *any level* is allowed as an option, subject to a overall maximum of one unit of language courses and to the requirements of the scheme for the award of Honours. However, a 1-unit course in any one year is not normally allowed.

SEF degree

In each of years 2 and 3, a 0.5 unit language course at *any level* is allowed as an option, subject to the requirements of the scheme for the award of Honours. A 1-unit course in any one year is not normally allowed.

Codes for language courses

These are given in the *Student Guidelines* issued by the UCL Language Centre.

COURSE INFORMATION

The following pages give more detail, including outline syllabuses, of the courses offered by the Departments of Statistical Science, Economics, Mathematics and Management Science that are included in the Statistics, SEF and SEL degree programmes. For most Statistics courses, some indication is also given of areas where the course material may be applied in practice; this is to help students decide which options might be most suitable for them.

For details about the European Language courses please refer to the *Student Guidelines* issued by the UCL Language Centre.

The descriptions of the Statistical Science courses also apply to the MASS, SAMB and Econ/Stats degrees.

For details of Economics courses for the Econ/Stats degree, refer to the *Undergraduate Course Booklet* issued by the Department of Economics.

For details of Management courses for the SAMB degree, refer to the Department of Management Science and Innovation web site at http://www.ucl.ac.uk/msi/student-intranet.

For details of Mathematics courses for the MASS degrees, refer to the booklet *Course Modules* issued by the Department of Mathematics.

Much of the information provided in the following pages is based on the courses as taught on the previous occasion and so may be out-of-date. The most likely changes are in the booklists and numbers of exercises.

REMEMBER: you may take only those courses allowed by the structure of your degree programme shown earlier in the handbook

COURSE UNITS FROM THE DEPARTMENT OF STATISTICAL SCIENCE

FIRST YEAR

STAT1004 INTRODUCTION TO PROBABILITY & STATISTICS (0.5 UNIT)

Level: First

Aims of course: To provide an accessible and application-oriented introduction to basic ideas in probability and statistics. Together with STAT1005 and STAT1006, this provides the foundation for further study of statistics in the degree programmes offered by the Department of Statistical Science or jointly with other Departments. It may also serve as a foundation course for students taking a Statistics stream as part of a Natural Sciences degree.

Objectives of course: On successful completion of the course, a student should understand, at an intuitive level, the basic concepts in probability theory; be able to use fundamental laws of probability to solve simple problems; recognise simple situations in which standard univariate probability distributions may be useful, and apply results for these distributions as appropriate in these situations; be able to choose and apply appropriate simple techniques for the presentation and description of data; understand the concepts of a probability model and sampling variability; and be aware of the need to check assumptions made when using a given probability model.

Applications: This course motivates the use of probability and statistics in a wide range of application areas. Recent high-profile statistical applications in areas such as politics, road safety, space travel, public health and criminal justice are discussed. Smaller teaching examples come from astronomy, medicine, meteorology, education, genetics, finance and physics.

Prerequisites: Grade A in GCE Advanced Level Mathematics, or equivalent.

Course content
Idea and rules of probability via proportions in a population. Conditional probability, associated results and applications. Notion of independence. Simple distributions (binomial, geometric, Poisson, uniform, normal and exponential). Concepts of expectation and variance, simple rules (without proof).

Examples of real investigations. Types of data, graphs, tables and summary statistics. Samples and populations. Probability models, unknown parameters, fitting models to data and assessing goodness of fit informally. Notion of uncertainty in estimation; illustration via simulation. Contingency tables (2- and 3-way), row and column proportions. Regression and correlation as bivariate descriptions: principle of least squares, use of transformations.

Texts
A.J.B.Anderson: *Interpreting Data*. Chapman & Hall, 1988
M.G. Bulmer: *Principles of Statistics* (new edition). Dover, 1979.
F.Daly, D.J.Hand, M.C.Jones, A.D.Lunn & K.J.McConway: *Elements of Statistics*. Addison Wesley, 1995.
D.S.Moore & G.P.McCabe: *Introduction to the Practice of Statistics* (5th Edition). Freeman, 2005.
F. Ramsey and D. Schafer: *Statistical Sleuth: a Course in Methods of Data Analysis*. Wadsworth / Duxbury, 1996 / 2001.
S.M. Ross: *A First Course in Probability* (7th edition). Prentice-Hall, 2005.
S.M. Ross: *Introducotry Statistics*. Academic Press, 2005.
R.L. Scheaffer: *Introduction to Probability and its Applications* (2nd edition). Duxbury, 1995.
E.R. Tufte: *The Visual Display of Quantitative Information*. Graphic Press, 2001.

Assessment for examination grading
In-course assessment: one compulsory set of problems.
2 ½ hour written examination in term 3.
The final mark is a 9 to 1 weighted average of the written examination and in-course assessment marks.

Other set work: Weekly sets of exercises. These will not count towards the examination grading.

Timetabled workload
Lectures and problem classes: 3 hours per week in term 1.
Tutorials: 1 hour per week.

STAT1005 FURTHER PROBABILITY AND STATISTICS (0.5 UNIT)

Level: First

Aims of course: To introduce a formal framework for the study of probability and statistics, building on the intuitive concepts introduced in STAT1004. Together with STAT1004 and STAT1006, this provides the foundation for further study of statistics in the degree programmes offered by the Department of Statistical Science or jointly with other Departments. It may also serve as a core course for students taking a Statistics stream as part of a Natural Sciences degree.

Objectives of course: On successful completion of the course, a student should be able to derive simple results in probability using an axiomatic approach; know how to derive properties of discrete and continuous univariate probability distributions; be able to give an informal statement of the Central Limit Theorem for independent identically distributed random variables; and be able to calculate confidence intervals and carry out hypothesis tests in simple situations, and interpret the results.

Applications: Probability and statistics have applications in almost every field of quantitative investigation; this course introduces techniques that are applicable in a variety of simplified real-life situations, and provides the foundations for the advanced methods required in more complex problems.

Prerequisites: Grade A in GCE Advanced Level Mathematics, or equivalent, and prior or simultaneous attendance on STAT1004.

Course content

Axioms of probability, conditional probability, combinatorics. Discrete and continuous random variables: probability mass functions, probability density functions, distribution functions, expectation and variance, revision of necessary integration techniques, moment generating functions. Further distributions (negative binomial, hypergeometric, gamma). Transformations of random variables, idea of Central Limit Theorem, approximation of moments.

Sampling distributions, standard errors, confidence intervals and significance tests (including common nonparametric tests). Methods applicable to binomial, Poisson and normally distributed data for one and two sample problems. Definitions, properties and use of chi-squared, t and F distributions. Tests for association in contingency tables. Inference in the simple linear regression model.

Texts

A.J.B.Anderson: *Interpreting Data*. Chapman & Hall, 1988
F.Daly, D.J.Hand, M.C.Jones, A.D.Lunn & K.J.McConway: *Elements of Statistics*. Addison Wesley, 1995.
D.S.Moore & G.P.McCabe: *Introduction to the Practice of Statistics* (5th Edition). Freeman, 2005.
S.M. Ross: *A First Course in Probability* (7th edition). Prentice-Hall, 2005.
R.L. Scheaffer: *Introduction to Probability and its Applications* (2nd edition). Duxbury, 1995.

Assessment for examination grading

In-course assessment: one compulsory set of problems.
2 ½ hour written examination in term 3.
The final mark is a 9 to 1 weighted average of the written examination and in-course assessment marks.

Other set work: Weekly exercises and/or practical assignments. These will not count towards the examination grading.

Timetabled workload

Lectures: 3 hours per week in term 2.
Tutorials: 1 hour per week.

STAT1006 INTRODUCTION TO PRACTICAL STATISTICS (0.5 UNIT)

Level: First

Aims of course: To provide training in the basic skills of practical statistics using a statistical software package. Together with STAT1004 and STAT1005, this provides the foundation for further study of statistics in the degree programmes offered by the Department of Statistical Science or jointly with other Departments.

Objectives of course: On successful completion of the course, a student should be able to use the MINITAB statistical software package for data analysis and simulation; be able to identify and carry out an appropriate statistical analysis of a simple data set using a computer; and be able to interpret the output from a statistical software package when used for simple statistical analyses.

Applications: Modern statistical analysis in practice is almost entirely computer-based, and statistical software packages are widely used in all areas of quantitative investigation. The MINITAB package used in this course has a similar 'look and feel' to many commercial packages, thereby providing students with a solid basis for using other packages in a wide variety of application areas.

Prerequisites: Grade A in GCE Advanced Level Mathematics, or equivalent, and simultaneous or previous attendance on both STAT1004 *Introduction to Probability and Statistics* and STAT1005 *Further Probability and Statistics.*

Course content
Practical application of the methods taught in STAT1004 and STAT1005, in workshops. Use of the MINITAB statistical computing package for data analysis and simulation.

Texts
A.J.B.Anderson: *Interpreting Data*. Chapman & Hall, 1988
F.Daly, D.J.Hand, M.C.Jones, A.D.Lunn & K.J.McConway: *Elements of Statistics*. Addison Wesley, 1995.
D.S.Moore & G.P.McCabe: *Introduction to the Practice of Statistics* (5th Edition). Freeman, 2005.
S.M. Ross: *A First Course in Probability* (7th edition). Prentice-Hall, 2005.
B.F.Ryan, B.L.Joiner and J. Cryer: *Minitab Handbook* (5th Edition). Brooks Cole, 2004.
R.L. Scheaffer: *Introduction to Probability and its Applications* (2nd edition). Duxbury, 1995.

Assessment for examination grading
3-hour practical examination in Term 3. This will relate directly to a portfolio of material accumulated during workshops throughout the year. Students will be able to take all their notes and computer output from the workshops into the examination with them.

Other set work: Regular exercises and/or practical assignments. These will not count towards the examination grading.

Timetabled workload
Fortnightly two-hour workshops throughout Terms 1 and 2.

ECON1604[7]
ECONOMICS I (COMBINED STUDIES) (1 UNIT)

Aims of course: To provide an analytical introduction to the core concepts of microeconomics and macroeconomics for students on combined-studies programmes with a high quantitative content. To provide the foundations for the second-year course ECON2601.

Objectives of course: On successfully completing the course, students should:
- be familiar with many of the core concepts in modern economics and be able to use these concepts in thinking about a range of issues and problems in the real economy;
- be able to apply these concepts, along with quantitative techniques acquired elsewhere in their degree programme, to solve stylised numerical or algebraic economic problems;
- be able to move without undue difficulty to the more advanced economic analysis encountered in the second year of the programme.

Course content
Microeconomics: Purpose and structure of economic models; supply-and-demand models; consumers and demand analysis; production and cost; business decisions and market structure; market failures and possible policy responses.
Macroeconomics: National income accounting; equilibrium in the goods and financial markets; monetary and fiscal policy in a closed economy; the labour market, unemployment and inflation; economic growth and business cycles; basic concepts in open economy macroeconomics.

Key texts
J.M. Perloff: *Microeconomics (5th edition)*. Pearson, 2008.
Hal Varian: *Intermediate Microeconomics: a Modern Approach (7th edition)*. W.W. Norton, 2005.
D.K. Miles and A. Scott: *Macroeconomics: Understanding the Wealth of Nations (2nd edition)*. John Wiley, 2004.
O.J. Blanchard: *Macroeconomics (3rd edition)*. Pearson, 2002.

[7] This course comes under the Economics Department's examination board, but is taught by staff based in the departments of Statistical Science and Mathematics.

SECOND YEAR

STAT2001
PROBABILITY AND INFERENCE (0.5 UNIT)

Level: Intermediate

Aims of course: To continue the study of probability and statistics beyond the basic concepts introduced in *Introduction to Probability* (STAT1001) and *Introduction to Statistical Methods* (STAT1002). To provide further study of probability theory, in particular as it relates to multivariate random variables, and to introduce formal concepts and methods in statistical estimation.

Objectives of course: on successful completion of the course, a student should have an understanding of the properties of joint distributions of random variables and be able to derive these properties and manipulate them in straightforward situations; recognise the χ^2; t and *F* distributions of statistics defined in terms of normal variables; be able to apply the ideas of statistical theory to determine estimators and their properties satisfying a range of estimation criteria.

Applications: As with other core modules in probability and statistics, the material in this course has applications in almost every field of quantitative investigation; the course introduces general-purpose techniques that are applicable in principle to a wide range of real-life situations.

Prerequisites: STAT1004 and STAT1005 or their equivalent. MATH6401 and MATH6402 or their equivalent.

Course content
Simple examples will be used throughout to motivate and illustrate the topics discussed.
Joint probability distributions: joint and conditional distributions and moments; serial expectation; multinomial and multivariate normal distributions.
Transformation of random variables: distributions; approximation of moments; order statistics.
Moment and probability generating functions: properties; sums of independent random variables; Central Limit Theorem.
Relations between standard distributions: χ^2, *t* and *F* distributions; orthogonal transformation of multivariate normal distribution; Poisson-multinomial connections.
Statistical estimation: bias,mean square error, consistency, best linear unbiased estimators; method of moments, least squares, maximum likelihood, Cramér-Rao lower bound.

Texts
J. A. Rice, *Mathematical Statistics and Data Analysis*. (Third edition; 2006) Duxbury.
D. D. Wackerly, W. Mendenhall & R. L. Scheaffer, *Mathematical Statistics with Applications*. (Sixth edition; 2002) Duxbury.
L. J. Bain & M. Engelhardt, *Introduction to Probability and Mathematical Statistics*. (Second edition; 1992) Duxbury.
R. V. Hogg & E. A. Tanis, *Probability and Statistical Inference*. (Sixth edition; 2001) Prentice Hall.
H. J. Larson, *Introduction to Probability Theory and Statistical Inference*. (Third edition; 1982) Wiley.
A. M. Mood, F. A. Graybill & D. C. Boes, *Introduction to the Theory of Statistics*. (Third edition; 2001) McGraw-Hill.
V. K. Rohatgi & E. Saleh, *An Introduction to Probability and Statistics.* (Second edition; 2001) Wiley.

Assessment for examination grading
In-course assessment: one compulsory set of problems.
2½ hour written examination in term 3.
The final mark is a 9 to 1 weighted average of the written examination and in-course assessment marks.

Other set work
About 8 sets of exercises. These will not count towards the examination grading.

Timetabled workload
Lectures: 3 hours per week during term 1.
Tutorials: 1 hour per week in term 1.

STAT2002
LINEAR MODELS AND THE ANALYSIS OF VARIANCE (0.5 UNIT)

Level: Intermediate

Aims of course: To provide an introduction to linear statistical modelling and to the analysis of variance with emphasis on ideas, methods, applications and interpretation of results.

Objectives of course: On successful completion of the course, a student should have an understanding of the basic ideas

underlying multiple regression and the analysis of variance; be able to analyse, using a statistical package, data from some common experimental layouts and carry out and interpret simple and multiple regression analyses; understand the assumptions underlying these analyses and know how to check their validity.

Applications: Linear models and the analysis of variance (ANOVA) are two basic and powerful statistical tools to model and analyse the relationship between random variables, and thus are widely used in almost all of classical and modern statistical practice. Their use exemplifies the modern, model-based approach to statistical investigations, and provides the foundations for more advanced techniques that may be required for the study of complex systems arising in areas such as economics, natural and social sciences and engineering as well as in business and industry.

Prerequisites: STAT1004 and STAT1005, or equivalent

Course content
Analysis of variance for a variety of experimental designs.
Multiple regression: model fitting by least squares, model assessment and selection. Heteroscedastic and autocorrelated errors.

Emphasis will be placed on ideas, methods, practical applications, interpretation of results and computer output, rather than on detailed theory.

Texts
R.J.Freund & W.J.Wilson, *Regression Analysis: Statistical Modelling of a Response Variable* (1998, Academic Press).
D.S.Moore & G.P.McCabe, *Introduction to the Practice of Statistics* (Third Edition, 1999, Freeman), chapters 11 − 13 only.
B.F.Ryan & B.L.Joiner, *Minitab Handbook* (Fourth Edition, 2001, Duxbury), chapters 10 and 11 only.

Assessment for examination grading
In-course assessment: one compulsory set of problems.
2½ hour written examination in term 3.
The final mark is a 9 to 1 weighted average of the written examination and in-course assessment marks.

Other set work
About 8 sets of practical exercises. These will not count towards the examination grading.

Timetabled workload
Lectures: 3 hours per week in term 1. One of these lectures per week to be used as necessary as a problems class.

STAT2003
INTRODUCTION TO APPLIED PROBABILITY (0.5 UNIT)

Level: Intermediate

Aims of course: To provide an introduction to the study of systems which change state stochastically with time and to facilitate the development of skills in the application of probabilistic ideas.

Objectives of course: On successful completion of the course a student should understand the Markov property in discrete and continuous time; for discrete-time Markov chains, be able to find and classify the irreducible classes of intercommunicating states, calculate absorption or first passage times and probabilities, assess the equilibrium behaviour; for simple examples of continuous-time Markov chains, be able to write down the forward equations, find and interpret the equilibrium distribution.

Applications: Stochastic processes are vital to applications in finance and insurance, and have many applications in biology and medicine, and in the social sciences. They also play a fundamental role in areas such as queueing theory and the study of system reliability. The material in this course can be applied to simplified real-world situations, and provides the foundations for further study of more complex systems.

Prerequisites: STAT2001 or equivalent.

Course content
Revision of conditional probability.
Markov Chains (discrete time and states): transient and equilibrium behaviour, first passage times, classification of states, applications.
Markov processes (continuous time, discrete states): general theory, forward and backward equations, equilibrium distributions; Poisson process, interval and counting properties; birth and death processes and other simple examples.

Texts
S.M. Ross *Introduction to Probability Models* (Academic Press).

Assessment for examination grading
In-course assessment: one compulsory set of problems.
2½ hour written examination in term 3.
The final mark is a 9 to 1 weighted average of the written examination and in-course assessment marks.

Other set work
About 8 sets of exercises. These will not count towards the examination grading.

Timetabled workload
Lectures: 3 hours per week in term 2. One lecture per week to be used as necessary as a problem class.
Tutorials: 1 hour per week in term 2, shared with other Statistics courses.

STAT7001
COMPUTING FOR PRACTICAL STATISTICS (0.5 UNIT)

Level: Intermediate

Aims of course: To extend students' practical experience of statistical computing packages. To use these packages to gain further understanding of ideas and methods already taught. To gain experience in the techniques used in data analysis.

Objectives of Course: On successful completion of the course, a student should be able to use the statistical packages SAS and R to input, edit and manipulate data, produce appropriate graphics and to run data analysis routines.

Applications: This course provides training in two specific statistical software environments. SAS is widely used commercially, for example in the pharmaceutical and insurance industries. R is gaining popularity among many research communities as well as in specialised areas of business and industry, such as finance and reinsurance, where non-routine statistical analyses are increasingly required. The course also provides generic programming skills that are applicable across a wide variety of scientific disciplines as well as in the IT sector.

Prerequisites: STAT1004, STAT1005 and STAT1006. Simultaneous attendance on STAT2001 and STAT2002.

Course content
Introduction to SAS commands, SAS/ASSIST and the R environment. Use of these packages for descriptive statistics, graphics, and for fitting regression and ANOVA Models. Non-linear regression and generalised linear model fitting, simulation, programming and numerical maximisation/minimisation.

Texts
You are not required to purchase any books. The following may be helpful for reference purposes and supplementary reading:

R.J.Elliott, *Learning SAS in the Computer Lab* (Second Edition, 2000, Duxbury Press).
Brian S Everitt, *Statistical Analyses using S-Plus* (First Edition, 1994, Chapman and Hall).

Assessment for Examination Grading
In-course assessment: two pieces of extended coursework (100%). There is no examination for this course. Students submitting neither assessment will automatically be declared non-complete for the course.

Other set work
About 8 sets of exercises. These will not count towards the examination grading.

Timetabled workload
Lectures: about 8 hours during term 2.
Workshops: 9 two-hour computing sessions (compulsory) during term 2.
Problem classes: about 8 hours during term 2.

STAT7002
SOCIAL STATISTICS (0.5 UNIT)

Level: Intermediate

Aims of course: To provide an introduction to the basic mathematical aspects of sample survey design and statistical analysis, to the practical aspects involved in carrying out a survey and to some key concepts in measurement theory.

Objectives of course: On successful completion of the course, a student should have an understanding of the basic principles and methods underlying sample surveys, be able to assess the appropriateness of various

sampling schemes and to calculate precisions and sample sizes required to achieve specific precisions or costs, to have a basic understanding of the ideas underlying the scale type classification and the concepts of validity and reliability, to construct and evaluate a Likert scale and to have a general knowledge of practical survey methods and statistics in society.

Applications: Areas of application of the methods taught in this course include governmental statistics, public health research, opinion polls, market research, and customer relationship management. Sampling techniques are also used, for example, in industrial quality control.

Prerequisites: STAT2001 or equivalent.

Course content
Introduction to sampling, simple random sampling.
Sources of error, practical survey methods.
Planning a survey, questionnaire construction (with some philosophical background) and data collection techniques.
Scale types, Likert scales, validity and reliability.
Basic ideas of stratified, cluster and systematic sampling and ratio estimation.
Analysis of Social Statistics.

Texts
Recommended for the whole course
R.L.Scheaffer, W.Mendenhall & L.Ott, *Elementary Survey Sampling* (Fifth edition, 1996, Duxbury).

Theory
V.Barnett, *Sample Survey: Principles and Methods* (1991, Arnold).

Practice and examples
G.Hoinville, R.Jowell and associates, *Survey Research Practice* (1985, Gower).
C.A.Moser & G.Kalton, *Survey Methods in Social Investigation* (Second edition, 1985, Gower).
Central Statistical Office, *Social Trends*.

Assessment for examination grading
In-course assessment: one compulsory set of problems.
2½ hour written examination in term 3.
The final mark is a 9 to 1 weighted average of the written examination and in-course assessment marks.

Other set work
About 8 sets of exercises. These will not count towards the examination grading.

Timetabled workload
Lectures: 2 hours per week in term 2.
Problem classes: arranged as necessary in term 2.

STAT7003
OPTIMISATION ALGORITHMS IN OPERATIONAL RESEARCH (0.5 UNIT)

Level: Advanced

Aims of course: To provide an introduction to the ideas underlying the optimal choice of component variables, possibly subject to constraints, that maximise (or minimise) an objective function. The algorithms described are both mathematically interesting and applicable to a wide variety of complex real life situations.

Objectives of course: On successful completion of the course, a student should be able to understand the theoretical concepts of linear programming, dynamic programming and finite Markov programming, set up correct models of real life problems, interpret results correctly and check the validity of assumptions.

Applications: Optimisation methods provide the means for successful business strategies, scientific planning and statistical estimation under constraints. They are a critical component of any area where decision making under limited resources is necessary.

Prerequisites: STAT1004 or equivalent.

Course content
Linear programming: graphical solution techniques, simplex method, duality, sensitivity analysis.
Game theory: zero-sum two player games, minimax, maximin, Laplace, Hurwicz and minimax regret strategies, linear programming formulation.
Dynamic programming: systems, states, stages, principle of optimality, forward and backward recurrence.
Markov sequential processes: Markov processes with rewards values-iteration, policy iteration, sequential decision processes.

Texts
F.S. Hillier & G.J. Lieberman, *Introduction to Operations Research* (2005, McGraw Hill).

B.Kolman & R.E.Beck, *Elementary Linear Programming with Applications* (1980, Academic Press).
J.Bather, Decision Theory: *An Introduction to Dynamic Programming and Sequential Decisions* (2000, Wiley)

Assessment for examination grading
In-course assessment: one compulsory set of problems.
2½ hour written examination in term 3.
The final mark is a 9 to 1 weighted average of the written examination and in-course assessment marks.

Other set work
About 6 sets of exercises. These will not count towards the examination grading.

Timetabled workload
Lectures and problems classes: 3 hours per week in term 1.

ECON2601[8]
ECONOMICS II (COMBINED STUDIES) (1 UNIT)

Aims of course: To provide a thorough understanding of core concepts and methods of microeconomics and macroeconomics to second year students on combined-studies programmes with a high quantitative content, and to prepare these students for optional courses in economics taken in the third year.

Objectives of course: On successfully completing the course, students should:
- understand the main elements of microeconomic and macroeconomic theory, at a level appropriate for an economics graduate;
- understand economic models and problems expressed in standard mathematical terms, and be able to solve and interpret problems based on such models at a level of difficulty appropriate for an economics graduate;
- be able to use economic concepts and methods to analyse and interpret real-world economic phenomena, and to assess issues of economic policy.

Course content

[8] This course comes under the Economics Department's examination board, but is taught by staff based in the departments of Statistical Science and Mathematics.

Microeconomics (consumers and producers): Consumer choice (budget constraints, preferences and utility, revealed preference, Slutsky equation, indirect-utility and expenditure functions, consumer surplus and price indices); choice under uncertainty; firm behaviour (technology and production functions, profit maximisation and factor demands, cost functions, conditional factor demands, cost curves).
Microeconomics (markets and equilibrium): Market demand; exchange equilibrium; competitive markets (short and long run behaviour); monopoly; price discrimination; oligopoly models; game theory.
Macroeconomics (growth and fluctuations): Economic growth (Solow-Swan model, technological progress, introduction to endogenous growth); money and inflation; economic fluctuations (real business cycles, unemployment, old and new Keynesian models); fiscal policy and public debt.

Key texts
Hal Varian: *Microeconomic Analysis (3rd edition)*. W.W. Norton, 1992 (**this text is required**)
Hal Varian: *Intermediate Microeconomics: a Modern Approach (7th edition)*. W.W. Norton, 2005.
O.J. Blanchard: *Macroeconomics (3rd edition)*. Pearson, 2002.
C.I. Jones: *Introduction to Economic Growth (2nd edition)*. W.W. Norton, 2001.

THIRD YEAR

STAT3001
STATISTICAL INFERENCE (0.5 UNIT)

Level: Advanced

Aims of course: To provide a grounding in the theoretical foundations of statistical inference and, in particular, to introduce the theory underlying statistical estimation and hypothesis testing, and to provide theory underlying the methods taught in the first and second years of degree courses offered by the Department of Statistical Science or jointly with other Departments.

Objectives of course: On successful completion of the course, a student should be able to:

- describe the principal features of, and differences between, frequentist, likelihood and Bayesian inference;

- define and derive the likelihood function based on data from a parametric statistical model, and describe its role in various forms of inference;
- define a sufficient statistic; describe, calculate and apply methods of identifying a sufficient statistic;
- define, derive and apply frequentist criteria for evaluating and comparing estimators;
- describe, derive and apply lower bounds for the variance of an unbiased estimator;
- define and derive the maximum likelihood estimate, and the observed and expected information;
- describe, derive and apply the asymptotic distributions of the maximum likelihood estimator and related quantities;
- conduct Bayesian analyses of simple problems using conjugate prior distributions, and asymptotic Bayesian analyses of more general problems;
- define, derive and apply the error probabilities of a test between two simple hypotheses; define and conduct a likelihood ratio test; state and apply the Neyman-Pearson lemma.

Applications: The theory of statistical inference underpins statistical design, estimation and hypothesis testing. As such it has fundamental applications to all fields in which statistical investigations are planned or data are analysed. Important areas include engineering, physical sciences and industry, medicine and biology, economics and finance, psychology and the social sciences.

Prerequisites: STAT2001 and STAT2002, or equivalent.

Course content
Frequentist and Bayesian approaches to statistical inference.
Summary statistics, sampling distributions.
Sufficiency, likelihood, and information.
Asymptotic properties of estimators.
Bayesian inference.
Hypothesis testing.
Likelihood ratio tests, application to linear models.

Texts
D.R. Cox, *Principles of Statistical Inference*, Cambridge University Press (2006).
P.H.Garthwaite, I.T.Jolliffe & B.Jones, *Statistical Inference* (2nd edition, 2002, Oxford University Press).
P.M.Lee, *Bayesian Statistics: An Introduction* (2nd edition, 1997,Arnold).
J.A Rice, *Mathematical Statistics and Data Analysis* (3rd edition, 2006, Duxbury).
G.A. Young and R.L. Smith, *Essentials of Statistical Inference* (2005, Cambridge University Press).

Assessment for examination grading
In-course assessment: one compulsory set of problems.
2½ hour written examination in term 3.
The final mark is a 9 to 1 weighted average of the written examination and in-course assessment marks.

Other set work
About 8 sets of exercises. These will not count towards the examination grading.

Timetabled workload
Lectures: 2 hours per week in term 1.
Workshops: 2 two-hour classes in term 1.
Tutorials: 1 hour per week in term 1.

STAT3002
STOCHASTIC SYSTEMS (0.5 UNIT)

Level: Advanced

Aims of course: To provide a continuation of the study of random processes started in Introduction to Applied Probability (STAT2003), but with the emphasis now on Operational Research applications and including queueing theory, renewal and semi-Markov processes and reliability theory.

Objectives of course: On successful completion of the course, a student should understand such concepts for stochastic processes as the Markov property, stationarity and reversibility and be able to determine whether such properties apply in straightforward examples; recognise and apply appropriately a range of models, as listed in the course contents, in a variety of applied situations so as to determine properties relevant to the particular application.

Applications: Stochastic systems arise in many areas of application. They play a fundamental role in Operational Research which addresses real-world problems through the use of mathematics, probability and statistics; topics such as queueing theory and reliability are important examples. Stochastic processes are also vital to applications in finance and insurance, and have many applications in biology and medicine, and in the social sciences. Stochastic process theory

underpins modern simulation methods like Markov-chain Monte-Carlo (MCMC).

Prerequisites: STAT2003 or equivalent.

Course content
Markov processes: revision of general concepts, reversibility and detailed balance equations.
Renewal theory and reliability: regenerative events and renewal processes, alternating renewal processes, renewal reward processes.
Queues: the general single server queue, Markov queueing models (*M/M/k*), limited waiting room, more general queues (*M/G/*1*, G/M/*1*)*, queueing networks.
Semi-Markov processes: properties and simple examples.
Reliability: single repairable units, simple systems of units.

Texts
G. Grimmett and D. Stirzaker *Probability and Random Processes* (3rd edition, 2001, Oxford University Press).
F.P. Kelly *Reversibility and Stochastic Networks*. Wiley (1979)
E.P.C. Kao *An Introduction to Stochastic Processes* (1997, Duxbury)
S.M. Ross *Introduction to Probability Models.* Academic Press (2007, 9th edition)
S.M. Ross *Stochastic Processes.* Wiley (1996, 2nd edition)
D. Stirzaker *Stochastic Models and Processes*. Oxford University Press (2005).

Assessment for examination grading
In-course assessment: one compulsory set of problems.
2½ hour written examination in term 3.
The final mark is a 9 to 1 weighted average of the written examination and in-course assessment marks.

Other set work
About 8 sets of exercises. These will not count towards the examination grading.

Timetabled workload
Lectures: 2 hours per week in term 2.
Workshops: 2 two-hour classes in term 2.
Tutorials: 1 hour per week in term 2.

STAT3003
FORECASTING (0.5 UNIT)

Level: Advanced

Aims of course: To introduce methods of finding and extrapolating patterns in time-ordered sequences.

Objectives of course: On successful completion of the course, a student should be familiar with the most commonly-used models for time series; be able to derive properties of time series models; be able to select, fit, check and use appropriate models for time-ordered data sequences; understand and be able to interpret the output from the time series module of a variety of standard software packages.

Applications: Time series data take the form of observations of one or more processes over time, where the structure of the temporal dependence between observations is the object of interest. Such data arise in many application areas including economics, engineering and the natural and social sciences. The use of historical information to estimate characteristics of observed processes, and to construct forecasts together with assessments of the associated uncertainty, is widespread in these application areas.

Prerequisites: STAT2001 and STAT2002, or equivalent.

Course content
Forecasting as the discovery and extrapolation of patterns in time ordered data. Revision of descriptive measures for multivariate distributions. Descriptive techniques for time series. Models for stationary processes: derivation of properties. Box-Jenkins approach to forecasting: model identification, estimation, verification. Forecasting using ARIMA and structural models. Forecast assessment. State space models and Kalman Filter. Comparison of procedures. Practical aspects of forecasting. Case studies in forecasting.

Texts
J.D. Cryer *Time Series Analysis.* (1986, PWS Publishers)
C. Chatfield *The Analysis of Time Series : An Introduction. Fifth Edition* (1996, Chapman and Hall.)

Assessment for examination grading
In-course assessment: one compulsory set of problems.
2½ hour written examination in term 3.
The final mark is a 9 to 1 weighted average of the written examination and in-course

assessment marks.

Other set work
About 7 sets of exercises. These will not count towards the examination grading.

Timetabled workload
Lectures: 2 hours per week in term 2.
Workshops: 2 two-hour classes in term 2.

STAT3004
DECISION AND RISK (0.5 UNIT)

Level: Advanced

Aims of course: To provide an introduction to the ideas underlying the calculation of risk and the structure of rational, consistent decision making.

Objectives of course: On successful completion of the course, a student should be able to understand special measures of risk, find appropriate probability models for risky events and check the validity of the underlying assumptions, understand the concepts of utility theory, understand Bayesian risk together with its theoretical assumptions, draw complex decision trees and evaluate optimal strategies, understand methods of eliciting subjective probabilities.

Applications: The ideas introduced in this course provide a generic framework for thinking about risk and decision-making in the presence of uncertainty. As such, they can be applied in areas as diverse as business, finance, government policy, management, health service provision and environmental hazard assessment.

Prerequisites: STAT1004 and STAT1005, or their equivalent.

Course content
Basic concepts and general principles of risk. Perception of risk and definition of acceptable risk. Assessment of risk. Management of risk such as in industrial engineering, finance, health and safety. Ethics of risk management. Structure and models of decision processes. Probability, conditional probability, Bayes's formula, expectation and utility. Elicitation of subjective probabilities and utilities. Expert opinion. Criteria for decision making. Comparison of decision rules. Utility theory. Decision trees.

Texts
J.P. Chavas: *Risk Analysis in Theory and Practice* (2004, Elsevier).
L. Eeckhout, C. Gollier and H. Schlesinger: *Economic and Financial Decisions under Risk* (2005, Princeton University Press).
S.H.Kim: *Statistics and Decisions* (1992, Van Nostrand Reinhold).
D. Vose: *Risk Analysis: a Quantitative Guide* (2008, Wiley).

Assessment for examination grading
In-course assessment: one compulsory set of problems.
2½ hour written examination in term 3.
The final mark is a 9 to 1 weighted average of the written examination and in-course assessment marks.

Other set work
About 4 sets of exercises. These will not count towards the examination grading.

Timetabled workload
Lectures: 2 hours per week in term 1.
Workshops: 3 two-hour classes in term 1.
Office hours, during which the lecturer will be available to discuss students' individual problems with the course, will be provided in term 1

STAT3005
FACTORIAL EXPERIMENTATION (0.5 UNIT)

Level: Advanced

Aims of course: To introduce 2^k experiments, fractions and blocking. To introduce designs for response surface modelling. To discuss experimental designs to achieve quality control, including Taguchi ideas.

Objectives of course: On completion of the course, a student should have an understanding of the basic ideas relating to 2^k factorial experiments, including for fractional designs and with blocking; should be able to analyse data from these experiments by the analysis of variance and/or graphical techniques; be able to design experiments for response surface modelling; be able to design experiments for off-line quality control;

Applications: Factorial experiments are useful in any situation in which a complex system has to be investigated or optimised. The applications tend to be in the fields of

science and technology, though that may be a result of a lack of imagination rather than a lack of wider applicability. Some examples are the optimisation of an industrial production process, the design of a new drug, the design of a human-computer interface, and the conservation of works of art.

Prerequisites: STAT2002 or equivalent.

Course content
Experiments: What is an experiment? Advantages over observational studies. Importance of randomisation.
2^k factorials: Advantages over one-at-a-time experiments. Interactions, two-factor and higher order. Estimation of effects including relation with regression and orthogonality of X^TX matrix. Estimation of error using replication and using pre-specified interactions. ANOVA table and relation of sums of squares to effect estimates. Warning about dangers of error estimation using smallest effects. Using normal and half-normal plots for analysis. Fractional factorials, aliasing, choosing a design. Blocking. Model checking and diagnostics.
Response surfaces: 3^k, central composite and Box-Behnken designs. Fitting polynomial response surfaces.
Taguchi's ideas: quality = lack of variability, control and noise factors, exploiting interactions to reduce process variability. Use of inner and outer arrays versus single factorial.

Texts
D.C. Montgomery, *Design and Analysis of Experiments* (5th edition, Wiley, 2000).
G.K.Robinson, *Practical Strategies for Experimenting* (Wiley, 2000).

Assessment for examination grading
In-course assessment: one compulsory set of problems.
2½ hour written examination in term 3.
The final mark is a 9 to 1 weighted average of the written examination and in-course assessment marks.

Other set work
About 8 sets of exercises. These will not count towards the examination grading.

Timetabled workload
Lectures: 2 hours per week in term 2.
Workshops: 2 two-hour classes in term 2.
Office hours, during which the lecturer will be available to discuss students' individual problems with the course, will be provided in term 2.

STAT3006
STOCHASTIC METHODS IN FINANCE (0.5 UNIT)

Level: Advanced

Aims of course: To introduce mathematical concepts and tools used in the finance industry, in particular stochastic models and techniques used for financial modelling and derivative pricing.

Objectives of course: On successful completion of the course, a student should have a good understanding of how financial markets work, be able to describe basic financial products, have a good knowledge of the basic mathematical and probabilistic tools used in modern finance, including stochastic calculus, and be able to apply the relevant techniques for the pricing of derivatives.

Applications: The techniques taught in this course are widely used throughout the modern finance industry, including the areas of trading, risk management and corporate finance. They also have applications in other areas where investment decisions are made under uncertainty, for example in the energy sector where decisions on whether or not to build (i.e. invest in) new power plants are subject to uncertainty regarding future energy demand and prices.

Prerequisites: STAT2001 or equivalent.

Course content
Financial markets, products and derivatives. The time value of money. Arbitrage Pricing. The binomial pricing model. Brownian motion and continuous time modelling of asset prices. Stochastic calculus. The Black-Scholes model. Risk-neutral pricing. Extensions and further applications of the Black-Scholes framework.

Texts
J.Hull, *Options Futures and Other Derivative Securities* (2000, Prentice Hall).
M.Baxter & A.Rennie, *Financial Calculus* (1996, Cambridge University Press).

Assessment for examination grading
In-course assessment: one compulsory set of problems.
2½ hour written examination in term 3.
The final mark is a 9 to 1 weighted average of

the written examination and in-course assessment marks.

Other set work
Several sets of exercises. These will not count towards the examination grading.

Timetabled workload
Lectures: 2 hours per week in term 1.
Workshops: 2 two-hour classes in term 1.
Office hours, during which the lecturer will be available to discuss students' individual problems with the course, will be provided in term 1.

STAT3008
MEDICAL STATISTICS 1 (0.5 UNIT)

Level: Advanced

Aims of course: To provide an introduction to the fields of clinical trials and epidemiology, with emphasis on the statistical ideas and methodology most widely used in these areas.

Objectives of course: On successful completion of the course, a student should have an understanding of types of observational studies and design issues, measures of disease, and types of clinical trials and design issues; be able to implement and interpret results from basic standard methods, logistic regression and basic methods of survival analysis in analyses of health studies

Applications: This course, together with STAT3009, has applications in both medicine and epidemiology. Important areas include the design and analysis of medical research studies, including randomised controlled trials.

Prerequisites: STAT2002 or equivalent; simultaneous attendance on STAT3001.

Course content
Introduction to Epidemiology and trials.
Basics of study design for health studies.
Introduction to statistical software STATA.
Types of observational studies: case-control, cohort, cross-sectional.
Types of trials: introducing parallel, crossover, factorial, equivalence and different phases of a drug trial.
Key design issues specific to trials: randomisation, blocked and stratified randomisation, blinding, placebo.
Measures of disease used in observational studies and trials: risk, rate, odds, relative and absolute measures.
Confounding, interaction , stratification, Mantel Haenzel test, Woolf's test.
Logistic regression: variable selection, MLE, LR and Wald tests, dealing with categorical covariates, interaction terms, checking assumptions of linearity for continuous covariates, interpretation.
Key issues related to statistical analysis of parallel group trials and calculation of sample size.
Trial reporting and ethical issues; critical appraisal of published papers.
Basics of survival analysis: features of survival data from trials and observational studies, hazard and survivor function, Censoring, Kaplan Meier Curve, Log rank Test.

There will be practical sessions on design issues, randomisation, measures of disease, confounding and interaction, logistic regression, analysis of trials and sample size calculation, survival analysis.

Texts
B.R. Kirkwood & J.A.C. Sterne. *Essential Medical Statistics* (Second Edition, 2003, Blackwell).
S.J.Pocock. *Clinical Trials. A Practical Approach* (1983, Wiley).
K.J.Rothman & S.Greenland, *Modern Epidemiology* (Third Edition, 2008, Lipinncott, Williams & Wilkins).
S.Senn, *Statistical Issues in Drug Development* (Second Edition, 2008, Wiley).
D. Collett. *Modelling Binary Data* (Second Edition, 2003, Chapman and Hall)
D.Collett. *Modelling Survival Data in Medical Research* (Second Edition, 2003, Chapman and Hall).
D.Clayton and M.Hills. *Statistical Models in Epidemiology* (1993, Oxford).
N.E.Breslow & N.E.Day, *The Analysis of Case Control Studies*. Statistical Methods in Cancer Research, Volume 1 (1980, IARC).
N.E.Breslow & N.E.Day, *The Design and Analysis of Cohort Studies*. Statistical Methods in Cancer Research, Volume 1 (1987, IARC).

Assessment for examination grading
In-course assessment: one compulsory set of problems.
2½ hour written examination in term 3.
The final mark is a 9 to 1 weighted average of the written examination and in-course assessment marks.

Other set work
Several sets of exercises. These will not count towards the examination grading.

Timetabled workload
Lectures: 1 hour per week in term 1.
Workshops: 1 hour per week in term 1.
Office hours, during which the lecturer will be available to discuss students' individual problems with the course, will be provided in term 1.

STAT3009
MEDICAL STATISTICS 2 (0.5 UNIT)

Level: Advanced

Aims of course: To provide a continuation of the study of medical statistics started in STAT3008, with emphasis on more advanced topics in epidemiological methods and the design and analysis of clinical trials.

Objectives of course: On successful completion of the course, a student should have an understanding of standardised rates in epidemiology; be able to analyse matched data; be able to carry out further survival analysis; have an undertanding of prognostic models, cross-over trials, interim analysis and subgroup analysis in trials; be able to analyse clustered data and carry out meta analysis.

Applications: This course, together with STAT3008, has applications in both medicine and epidemiology. Important areas include the design and analysis of medical research studies, including randomised controlled trials.

Prerequisites: STAT3008 or equivalent.

Course content
Further Survival analysis: (Exponential, Weibull and Cox Models. MLE, LR tests, checking assumptions of proportionality for Cox model, dealing with time dependent covariates).
Standardisation of rates in Epidemiology, (direct and indirect, standardised mortality ratio).
Analysis of matched or paired data: conditional logistic regression and McNemars test.
Prognostic Models: developing and validating models for prediction of risk for health outcomes.
Cross over trials: analysis and sample size.
Advanced issues in trials (interim analysis, subgroup analysis, cluster randomised trials).
Analysis of clustered data 1 (covering trials and observational studies): examples, features, Summary statistic methods and multilevel models
Clustered data 2 (covering trials and observational studies): marginal Models based on GEE.
Systematic reviews and meta analysis:(covering trials and observational studies): rationale, fixed and random effects analysis, publication bias.

In addition, there will be weekly practical sessions on the topics listed above.

Texts
B.R. Kirkwood & J.A.C. Sterne. *Essential Medical Statistics* (Second Edition, 2003, Blackwell).
S.J.Pocock. *Clinical Trials. A Practical Approach* (1983, Wiley).
K.J.Rothman & S.Greenland, *Modern Epidemiology* (Second Edition, 1998, Lipimcott-Raven).
S.Senn, *Statistical Issues in Drug Development* (1997, Wiley).
D. Collett. *Modelling Binary Data* (Second Edition, 2003, Chapman and Hall)
D.Collett. *Modelling Survival Data in Medical Research* (Second Edition, 2003, Chapman and Hall).
D.Clayton and M.Hills. *Statistical Models in Epidemiology* (1993, Oxford).
N.E.Breslow & N.E.Day, *The Analysis of Case Control Studies*. Statistical Methods in Cancer Research, Volume 1 (1980, IARC).
N.E.Breslow & N.E.Day, *The Design and Analysis of Cohort Studies*. Statistical Methods in Cancer Research, Volume 1 (1987, IARC).

Assessment for examination grading
In-course assessment: one compulsory set of problems.
2½ hour written examination in term 3.
The final mark is a 9 to 1 weighted average of the written examination and in-course assessment marks.

Other set work
Several sets of exercises. These will not count towards the examination grading.

Timetabled workload
Lectures: 1 hour per week in term 2.
Workshops: 1 hour per week in term 2.
Office hours, during which the lecturer will be available to discuss students' individual problems with the course, will be provided in term 2.

STAT3901
PROJECT (1.0 UNIT)

Level: Advanced

Aims of course: To enable students, under supervision, to apply Statistical Science to real world problems and learn how to communicate technical ideas both by oral and written presentations.

Objectives of course: On successful completion of the course, a student should be able to obtain or access relevant background information and data; select and apply appropriate formal and informal statistical methods, using appropriate computer software; assess what has been achieved and point to further research; use appropriate word processing skills to write up the project report efficiently; communicate and defend the main points in a short verbal presentation; communicate the whole project in a word processed report.

Prerequisites: First and second year of degree courses offered by the Department of Statistical Science or jointly with other Departments.

Assessment for examination grading
Written report (about 15000-20000 words, i.e. about 50 pages, A4 size, double-spaced typing, excluding graphs, tables and computer output), to be submitted by the start of term 3 (80%). Over-length reports will be penalised (see earlier section in the handbook).
Oral presentation (15 minutes, plus a few minutes for questions) at the start of term 3 (20%).

Timetabled workload
Lectures: about 6 hours, terms 1 and 2.
Oral presentations: about 6 hours, terms 1 and 2.
Tutorials: about 30 hours, terms 1 and 2.

Individual study
Project work (including reading) and preparation of the oral and written presentation are expected to take about 260 hours. Students are expected to attend and actively participate in the oral presentations by other students.

STAT3902
PROJECT (0.5 UNIT)

Level: Advanced

Aims of course: To enable students, under supervision, to apply Statistical Science to real world problems and learn how to communicate technical ideas both by oral and written presentations.

Prerequisites: First and second year of degree courses offered by the Department of Statistical Science or jointly with other Departments.

Objectives of course: On successful completion of the course, a student should be able to obtain or access relevant background information and data; select and apply appropriate formal and informal statistical methods, using appropriate computer software; assess what has been achieved and point to further research; use appropriate word processing skills to write up the project report efficiently; communicate and defend the main points in a short verbal presentation; communicate the whole project in a word processed report.

Assessment for examination grading
Written report (about 7500-10000 words, i.e. about 25-30 pages, A4 size, double-spaced typing, excluding graphs, tables and computer output), to be submitted by the start of term 3 (80%). Over-length reports will be penalised (see earlier section in the handbook).
Oral presentation (15 minutes, plus a few minutes for questions) at the start of term 3 (20%).

Timetabled workload
Lectures: about 6 hours, terms 1 and 2.
Oral presentations: about 6 hours, terms 1 and 2.
Tutorials: about 15 hours, terms 1 and 2.

Individual study
Project work (including reading) and preparation of the oral and written presentation are expected to take about 130 hours. Students are expected to attend and actively participate in the oral presentations by other students.

FOURTH YEAR
(INTERNATIONAL PROGRAMME)

STATM001
STATISTICAL MODELS AND DATA

ANALYSIS

Aims of course: To introduce the theory of linear and generalised linear models and associated data analysis.

Objectives of course: On successful completion of the course, a student should have an understanding of the exponential family of distributions and their use in the formulation of generalised linear models, and should be able to interpret the results of fitting such models in both a technical and non-technical manner.

Applications: The statistical methods introduced in STATM001 are very general, and they are used in almost all areas in which statistics is applied. In the course, we will analyse data sets from, among other areas, industrial quality control, astronomy, social sciences, and biology.

Prerequisites: STAT2001 and STAT2002. Prior or simultaneous attendance on STATM012 or equivalent.

Course content

Multiple Linear Regression: inference techniques for the General Linear Model, applications, variable selection.
Generalised Linear Models: structure incorporating an introduction to the exponential family of distributions, inference procedures.
Categorical data: special cases of generalised linear models leading to logistic regression and log-linear models, use in data analysis.
Introduction to non-linear modelling, mixed modelling, generalised estimating equations.
(Students are expected to obtain the computing skills to implement the methodology discussed in this course in the course STATM003.)

Texts

A.J. Dobson, *An Introduction to Generalised Linear Models* (2nd edition, 2002, Chapman and Hall).
W.J.Krzanowski, *An Introduction to Statistical Modelling* (1998, Arnold).
T. Hastie, R. Tibshirani, J. Friedman, *The Elements of Statistical Learning*, (2001, Springer).
P.McCullagh \& J.A.Nelder, *Generalized Linear Models* (2nd edition, 1989, Chapman and Hall).
F. E. Harrell, *Regression Modeling Strategies* (2001, Springer).

Assessment for examination grading

Two-hour written examination in term 3.

Other set work

Exercises will be set during the course, which will not count towards the examination grading.

Timetabled workload

Lectures: 3 hours per week for first 7 weeks in term 1.
Tutorials: 1 hour per week, shared with the other courses.

STATM002
STATISTICAL DESIGN OF INVESTIGATIONS.

Aims of course: To provide an introduction to the statistical aspects relating to the design of experimental and observational studies, and to introduce associated methods of statistical analysis.

Objectives of course: On completion of the course, a student should have an understanding of the basic ideas of experimental design and observational studies; should be able to analyse data from a variety of experimental designs by the analysis of variance; should be able to assess the appropriateness of various sampling schemes and perform appropriate analyses.

Applications: this course addresses the issues of what data are needed to answer a particular substantive question, and conversely what questions can reasonably be answered using data that may be available. These issues are fundamental to quantitative analyses in all application areas.

Prerequisites: STAT2001 and STAT2002.

Course content

Principles of experimental design; planning of experiments; comparative experiments; common designs: completely randomised, randomised blocks, Latin square; factorial experiments; nested and split-plot; fixed and random effects; associated analyses - analysis of variance.
Observational studies v. experiments: problems of bias, confounding, difficulty of causal interpretation; planning observational studies; analysis: matching, adjusting for confounding variables; cohort studies; case-control studies.

Sampling: target and sampled populations, finite populations, simple random sampling, stratification and cluster sampling, ratio and regression estimators, randomised response methods; introduction to questionnaire design.

Texts
D.C. Montgomery, *Design and Analysis of Experiments* (5th edition, 2000, Wiley).
W.G. Cochran, *Planning and Analysis of Observational Studies* (1983, Wiley).
V. Barnett *Sample survey principles and methods* (2nd edition, 1991, Arnold)

Assessment for examination grading
In-course assessment: two compulsory assignments. One of these involves working in pairs to design, carry out and report the results of an experiment. There is no written examination. Any student who fails to submit any coursework will automatically be declared non-complete for the course.

Other set work
Exercises will be set during the course which will not count towards the examination grading.

Timetabled workload
Lectures and workshops: 2 hours per week in term 1.
Tutorials: 1 hour per week, shared with the other courses.

STATM003
STATISTICAL COMPUTING

Aims of course: To introduce the statistical package R with particular application to statistical modelling and a selection of computational techniques.

Objectives of course: On successful completion of the course, a student should be able to use the statistical package R to input, edit and manipulate data, produce appropriate graphics and implement statistical methods taught in courses STATG001 and STATG002. In addition, the student should be familiar with some basic principles of programming, and should be able to carry out simple programming in R with application to a variety of computational and numerical techniques.

Applications: the generic programming skills acquired in this course are applicable across a wide variety of scientific disciplines as well as in the IT sector. More specifically, the R programming environment is gaining popularity among many research communities as well as in specialised areas of business and industry, such as finance and reinsurance, where non-routine statistical analyses are increasingly required.

Prerequisites: STAT2001 and STAT2002. Simultaneous attendance on STATM001 and STATM002.

Course content
Using R: expressions, assignments, objects, vectors, arrays and matrices, lists and data frames, functions, control structures, graphics. Efficiency considerations.

Statistical modelling in R (in collaboration with STATM001 and STATM002): linear and generalised linear modelling, analysis of variance, residual plots, non-linear modelling.

Computational techniques: function minimisation (in particular for mle's and in non-linear modelling), quadrature, simulation (general methods, Monte Carlo).

R versus S-Plus.

Texts
B.S.Everitt, *A Handbook of Statistical Analyses using S-Plus* (Second Edition, 2002, Chapman and Hall).

Assessment for examination grading
In-course assessment: by compulsory coursework.
There is no written examination

Timetabled workload
About 10 two-hour workshops spanning terms 1 and 2.

STATM004
APPLIED BAYESIAN METHODS

Aims of course: To introduce the Bayesian approach to statistical inference, to develop relevant theory, methodology and computational techniques for its implementation; and to develop basic skills in use of the WinBUGS software for Bayesian modelling.

Objectives of course: On successful completion of this course, a student should be able to give an account of the underlying principles of Bayesian inference, and contrast these with those of other schools of inference; manipulate probability formulae to derive

posterior and predictive distributions; perform conjugate prior-to-posterior analysis for simple Binomial, Poisson and Normal models; analyse these, and more complex Normal models such as arise in linear regression and analysis of variance, using priors representing great prior uncertainty; use hierarchical and graphical modelling to represent and analyse complex systems; describe and implement Gibbs sampling methods for estimating posterior quantities; and use WinBUGS software to estimate complex Bayesian models.

Applications: Bayesian methods are currently gaining increasing popularity, largely because advances in computing facilities and in modern simulation-based Markov Chain Monte Carlo (MCMC) methods provide a means of analysing the complex data structures that arise in application areas as diverse as artificial intelligence, biology, genetics and environmental science. This course focuses on fundamental concepts and techniques, and introduces the computational tools needed to apply Bayesian methods in challenging research-level problems.

Prerequisites: STAT2001, STAT2002 and prior or simultaneous attendance on STATM012 or equivalent.

Course content
Introduction to Bayesian statistics. Bayesian inference. Prior distributions. Graphical models. Hierarchical models. Markov chain Monte Carlo (MCMC: Gibbs sampling). WinBUGS software.

Texts
P. M. Lee, *Bayesian Statistics: An Introduction* (third edition, 2004), Chapters 1-3. Arnold
J. Whittaker, *Graphical Models in Applied Multivariate Statistics* (1990), Chapters 1-3. John Wiley & Sons.
C.M. Bishop, *Pattern Recognition and Machine Learning* (2006), Chapter 8. Springer.
A. Gelman, J. B. Carlin, H. S. Stern and D. B. Rubin, *Bayesian Data Analysis* (second edition, 2003), Chapter 5. Chapman and Hall / CRC.
W.R. Gilks, S. Richardson & D.J. Spiegelhalter (eds), *Markov Chain Monte Carlo in Practice* (1996), Chapters 1, 2 and 5. Chapman & Hall/CRC.

Assessment for examination grading
Two-hour written examination in term 3.

Other set work
About 5 sets of exercises. These will not count towards the examination grading.

Timetabled workload
Lectures: 2 hours per week in term 2. Some of these may be devoted to workshops or coursework feedback.
Tutorials: 1 hour per week, shared with the other courses.

STATM019
ADVANCED TOPICS IN STATISTICS

Aims of course: To provide an introduction to, and practical experience of, key ideas in selected specialized topics that are at the forefront of developments in modern statistical research and practice. The module is aimed specifically at students who may be considering going on to do research in statistics or related areas.

Objectives of course: On successful completion of the module, students should be able to: explain the motivation for, and key ideas involved, in the topics that have been studied; identify situations in which the studied techniques are potentially applicable, while recognizing their potential limitation; use software packages that are available in R to apply the techniques to real-world examples where appropriate; and understand the context of research papers in the areas that have been studied.

Applications: the availability of huge and often complex data sets, coupled with cheap computing power makes it possible to contemplate analyses that were inconceivable even two decades ago. The development of statistical methodology has made full use of these opportunities, so that modern statistics has made significant contributions in a wide range of application areas. The material covered in this course will vary from year to year so that the specific applications will vary; however, it will provide students with some insight into the state of the art. As such it would be suitable for students contemplating research in statistics or, indeed, in any other subject where complex problems require the use of advanced statistical methods.

Prerequisites: STAT2001, STAT2002 and prior or simultaneous attendance on

STATM003 or equivalent.

Course content: This course will provide an introduction to two or three advanced topics in modern statistics. The precise topics covered will vary from year to year, depending on teaching staff availability and research interests. Examples of topics might include: bootstrap and related methods; extreme value theory; multivariate analysis; nonparametric smoothing; robust methods; spatial statistics; applied probability; and estimating functions. Where appropriate, the methods will be illustrated using software available in the R package.

Texts: the texts will depend on the topics being taught; course lecturers will provide reading lists.

Assessment for examination grading
Two-hour written examination in term 3.

Other set work
About 8 sets of exercises. These will not count towards the examination grading.

Timetabled workload
Lectures: 2 hours per week in term 2.
Workshops: 2 two-hour classes in term 2.
Office hours, during which the lecturer will be available to discuss students' individual problems with the course, will be provided in term 2.

STATM901
PROJECT (1.0 UNIT)

Level: Masters

The arrangements and details for this course are the same as those for course STAT3901.

STATM902
PROJECT (0.5 UNIT)

Level: Masters

The arrangements and details for this course are the same as those for course STAT3902.

Other options

For details of the remaining Masters-level courses for the fourth year of the International Programme (except for method of assessment), refer to the corresponding third year options. The Masters-level courses are listed below with the corresponding third year course code given in parentheses.

STATM009 DECISION AND RISK (STAT3004)

STATM010 STOCHASTIC SYSTEMS (STAT3002)

STATM011 FORECASTING (STAT3003)

STATM012 STATISTICAL INFERENCE (STAT3001)

STATM015 MEDICAL STATISTICS 1 (STAT3008)

Prerequisite: STAT3001 or equivalent, or simultaneous attendance on STATM012.

STATM016 MEDICAL STATISTICS 2 (STAT3009)

Prerequisite: STATG015.

STATM017 STOCHASTIC METHODS IN FINANCE (STAT3006)

STATM018 FACTORIAL EXPERIMENTATION (STAT3005)

Assessment for examination grading
For each of the courses listed above, assessment is by a two-hour written examination in term 3.

COURSE UNITS FROM THE CENTRE FOR THE ADVANCEMENT OF LEARNING AND TEACHING (CALT)

EDUC6002
WRITING IN ACADEMIC CONTEXTS (0.5 UNIT)

This 10-week workshop series offers students a formal space for the sustained development of academic writing. Students will be encouraged to consider writing practices and conventions from the perspective of their own disciplines. Additionally, participants will have the opportunity to draw on writing practices from across a range of subjects. The course also aims to enable students to become more reflective readers of their own and others' work.

COURSE UNITS FROM THE DEPARTMENT OF COMPUTER SCIENCE

SECOND OR THIRD YEAR

COMP6006
FINANCIAL COMPUTING (0.5 UNIT)

See Computer Science department pages: http://www.cs.ucl.ac.uk/teaching/syllabus/ug/.

COURSE UNITS FROM THE DEPARTMENT OF ECONOMICS

FIRST YEAR

ECON1604
ECONOMICS I (COMBINED STUDIES) (1 UNIT)

This course is described in the section "Course units from the Department of Statistical Science".

SECOND YEAR

ECON1002
APPLIED ECONOMICS (0.5 UNIT)

Aims of course: To illustrate the application of economic analysis and empirical methods to current economic problems and policy design. To develop an understanding of simple and commonly used econometric techniques. To impart an ability to understand and interpret results both statistically and economically.

Course content
OLS regression: coefficients, standard errors, hypothesis testing. Wage equations. Consumer demand: choice of functional form, Engel curves, demand systems. Labour Supply. Consumption: permanent income, intertemporal substitution.
Investment. Distribution of income: measurement of household living standard, the Lorenz curve, indices of inequality, poverty.

Key texts
D.Gujarati, *Basic Econometrics* (Third edition, McGraw Hill, 1995).
A. Griffiths and S. Wall, *Applied Economics* (Eighth Edition, 1999).
A. Atkinson, *The Economics of Inequality* (Second Edition, 1983).

ECON2601
ECONOMICS II (COMBINED STUDIES) (1 UNIT)

This course is described in the section "Course units from the Department of Statistical Science".

THIRD YEAR

ECON3014
GAME THEORY (0.5 UNIT)

Aims of course: To provide students with an intellectual framework to analyse situations in which the behaviour of agents is driven by strategic considerations and, with a set of analytic tools, to interpret a wide range of phenomena in the social sciences.

Objectives of course: On completion of the course students should be able to use the concept of Nash equilibrium in simple

oligopolistic games and voting games; understand the concept of Subgame Perfect Equilibrium and apply
it to games of lobbying and bargaining; understand the logic of Bayesian games and use them to analyse real world selling mechanisms such as auctions.

Course content
Game theory studies the interaction among decision makers who are rational in the pursuit of their objectives, and who take into account the rationality of the decision makers with whom they interact. Game theory is used by economists to model such diverse phenomena as price determination by oligopolistic firms, bidding in auctions, bargaining among employers and trade unions, and voting in committees. Game theory is today the most important of the tools which economists use when developing new theories.
Many illustrative examples will be presented.

Texts
M.Osborne, *An Introduction to Game Theory* (in preparation: copies of relevant chapters will be made available to students at the start of the course).
H.S.Bierman & L.Fernandez, *Game Theory with Economic Applications* (Addison-Wesley, 1993).
K.Binmore, *Fun and games* (Heath, 1992).
A.Dixit & B.Nalebugg, *Thinking Strategically* (Norton, 1991).
P.Dutta, *Strategies and Games* (MIT Press, 1999).
R.Gibbons, *A Primer in Game* Theory (Harvester Wheatsheaf, 1992).

ECON3017
ECONOMICS OF CORPORATE FINANCE (0.5 UNIT)

Aims of course: To investigate the process of obtaining and employing debt and equity to invest in real assets to produce real goods and services. This module introduces and applies the analytical methods of information economics to problems in corporate finance. It is intended for highly motivated students who are interested in understanding recent developments in the theory of corporate finance.

Objectives of course: On completion of the course students should have some understanding and the capability to solve problems of risk and valuation; market efficiency; financing decisions and capital structure; options, debt and hedging; financial planning and decision-making; and international finance.

Course content
Time, uncertainty and liquidity; Intermediation; Asset markets; Intermediation and financial markets; Optimal Capital Structure; Agency and Information; Financial Contracting

Texts
Allen F. and Gale D., *Understanding Financial Crises*, Oxford University Press, 2007.
Brealey R., Myers S. and Allen F., *Corporate Finance*, 8th ed., McGraw Hill International Edition, 2006.
Danthine Jean-Pierre and Donaldson John, *Intermediate Financial Theory*, (second edition), Prentice Hall, 2005.
De Matos J.A., *Theoretical Foundations of Corporate Finance*, Princeton University Press, 2001.
Tirole, J., *The Theory of Corporate Finance*, Princeton University Press, 2006.

ECON7002
ECONOMICS OF FINANCE (0.5 UNIT)

Aims of course: To provide an overview of UK financial markets and institutions; to provide a comprehensive introduction to the theory of finance; to introduce some of the most important theories explaining the formulation of prices of financial assets and the role of financial markets in the optimal allocation of risk bearing.

Objectives of course: On successfully completing the course, students should be familiar with the basic principle and concepts in finance, including optimal portfolios, equilibrium asset pricing and allocation and optimality in financial markets, the role of derivative securities, efficiency of financial markets, the Capital Asset Pricing Model.

ECON7003
MONEY AND BANKING (0.5 UNIT)

Aims of course: To investigate why we have central banks and what central banks should do and in fact do – particularly concerning monetary policy and banking regulation. Along the way to learning something about this, to discover something of what money is and why banks exist at all. The course will mix both micro- and macro-

economic elements, and show linkages between the two spheres.

Course content: What money is and what it is for; monies and near monies; lending and capitalism; private and central banks; moral hazard and contagion; regulation and instruments; rules and discretion; independence; benign dictatorship and democracy; quantity theories, targets, and other monetary policy rules.

Texts
M. & R. Friedman, *Free to Choose,* chapter 9, "the cure for Inflation" (the quantity theory). (As an alternative to the above: M.Friedman, *Monetarist Economics,* chapters 1,2, & perhaps 4.)
F.S.Mishkin, *The Economics of Money, Banking and Financial Markets* (main course text).
B.Hillier, *The Economics of Asymmetric Information,* chapter 2 (simple maths of debt contract).
B.Bernanke *et al, Inflation targeting,* chapters 1 to 3.

ECON7007
ENVIRONMENTAL ECONOMICS (0.5 UNIT)

Aims and objectives of course: The primary aim of this course is to make students conversant with relevant economic theories and solutions for contemporary environmental and natural resource problems. The focus of the course is on the application of economic theory to issues like acid rain, traffic congestion, global warming and forest destruction. The course thus involves many practical examples of environmental economics in a public policy framework. The benefit of this course for students is that it provides an opportunity to develop their core economic training in practical issues that are increasingly commanding attention and career opportunities at industry, nation and international levels.

Course content
***The environment and the economy*.** How do the environment and the economy interact? The theory of externalities. Property rights, open access and common access problems.
***Using Economics to solve environmental problems*.** Achieving optimal levels of environmental pollution using economic instruments; regulations, taxes, subsidies and permits.
***Valuing the environment*.** What price the environment? Attaching values to the environment and resources. Making decisions using cost-benefit analysis. Discounting the future. Shadow pricing.
***Using natural resources*.** How much to take and when? Renewable resources (fish and forests) optimal rate of harvesting, maximum sustainable yields, the extinction of species. Exhaustible resources (minerals, gas and oil) optimal resource depletion, depletion under uncertainty and imperfect competition, the role of backstop technologies.
***Sustainable development*.** Can economies grow forever? Limits for growth, definitions of sustainability, irreversibility and the precautionary principle, green national accounting.

Key text
D.W.Pearce & R.K.Turner, *Economics of Natural Resources and the Environment* (Harvester Wheatsheaf, 1990).

COURSE UNITS FROM THE LANGUAGE CENTRE

LCEN6801
ACADEMIC WRITING IN ENGLISH FOR NON-NATIVE SPEAKERS (0.5 UNIT)

The course aims to raise awareness of the conventions of written academic literacy among students from other learning cultures. The course will also help to improve writing ability in a variety of text types, focusing on sentence-level lexis and syntax, text coherence and cohesion, and appropriate style. In doing so, we aim to help improve the ability to perform in all written tasks on students' own degree programme: course assignments and reports, examination essays and dissertations.

Details of other language centre courses are given on pages 52 onwards.

COURSE UNITS FROM THE DEPARTMENT OF MANAGEMENT SCIENCE AND INNOVATION (MSI)

For further details of the courses below and other MSI optional courses, see the MSI web site at http://www.ucl.ac.uk/msi/current/undergraduate .

FIRST YEAR

MSIN1001
FOUNDATIONS OF MANAGEMENT (0.5 UNIT)

Note: for Statistical Science students not registered for the SAMB degree, the course is offered as MSIN6001: Management Principles.

Aims of course: To bring the student to an awareness of what managers do, and why their activities are crucial to the success of any business or public sector agency.

Objectives of course: The emphasis will be upon the processes of management, and teaching will aim at engendering a sense of the whole of management activity. The range of topics to be discussed is deliberately broad. The intention is to give students an understanding of the "whole" of managing an organisation. Topics will not be treated in depth but introduced in terms of their relationships to each other in preparation for later development. Throughout, the presentation of the issues will be informed by the fundamental management problem coping with uncertainty. The issues of discrimination and equal opportunities will be addressed within the course by using appropriate forms of language and choices of examples.

MSIN1002
COMMUNICATION AND BEHAVIOUR IN ORGANISATIONS (0.5 UNIT)

Aims of course: To study the application of behavioural sciences to people centred problems in organisations.

Objectives of course: By the end of the course, a student should be able to study individual, group and organisational processes; be able to discuss and evaluate how such studies can enhance the effectiveness of individuals and organisations; have developed capability for working co-operatively with others.

MSIN1003
INFORMATION WORLD (0.5 UNIT)

Aims of course: The course aims to provide an introduction to information management together with an opportunity to develop relevant transferable skills. Students will consider how information can be managed in organizations and study the technologies available to do this.

The course will also provide an introduction to the information, communication and technology sector (ICTs) and consider the nature and type of the information resources and systems that the sector provides.

Objectives of course: At the end of the course the student will understand the scope of information management; know how information resources and systems are used and exploited in organizations; have an awareness of the ICT sector and the information resources and systems it provides; understand how information resources and systems influence information management; be able to work in a team and understand how to communicate effectively.

MSIN1004
FINANCIAL ACCOUNTING (0.5 UNIT)

Aims of course: To provide a theoretical framework for examining the validity of assumptions held by accountants; to develop students' ability to read and understand financial statistics disclosed in accounting statements; and to emphasise the role of accounting as provision of information for decision-making.

Objectives of course: By the end of the course, students should be able to demonstrate an understanding of the terminology used in financial statements; an ability to make sense of company financial reports; and an appreciation of the lack of certainty in accounting and the problems of choosing among equally logical, defensible, consistent accounting conventions.

SECOND YEAR

MSIN7001
MANAGEMENT INFORMATION & CONTROL (0.5 UNIT)

Aims of course: To focus on the information available to management from

within the organisation; to describe the systems used to store, organise and retrieve this information; and to explain how this information can be used to control and direct the organisation.

Objectives of course: By the end of the course, a student should be able to discuss the purpose and types of management information; be able to explain the delivery mechanisms of management information and consider their design, implementation and management; have been introduced to the use of financial and operational management information for control, measurement, planning and decision-making.

MSIN7002
BUSINESS IN A COMPETITIVE ENVIRONMENT (0.5 UNIT)

Aims and objectives of course: To help you understand the ways in which businesses (whether profit-seeking or not) relate to their environments (whether structured as markets or not) and to each other. With this understanding, you will be able to understand the forces acting upon your future employer, and to read intelligently the quality business press.

THIRD YEAR

MSIN3001
PROJECT MANAGEMENT (0.5 UNIT)

Aims of course: To define the concept of the project in relation to industrial and commercial organisations. To introduce the needs, tools and the success/failure indicators for managing projects. To exemplify project management by illustrative case studies, guest speakers and practical exercises. To assist students in developing the skills, knowledge, attributes and behaviour of a project manager.

MSIN7014
STRATEGIC HUMAN RESOURCE MANAGEMENT (0.5 UNIT)

The purpose of this half unit is to introduce the students to the nature and content of strategic and operational human resource (HR) management. The strategy, principles and practice of HR have developed piecemeal, like so much of management, both in response to events and environmental changes, and also in the wake of some pioneering initiatives.

Additionally, for many years, HR was perceived and in many cases actually regarded as being little more than personnel practice. This is in spite of the fact that there is a long history of attention to that most critical part of management practice – how to create the conditions in which staff give of their best, and how to create mechanisms for the resolution of disputes and conflicts should these arise.

COURSE UNITS FROM THE DEPARTMENT OF MATHEMATICS

FIRST YEAR

MATH1101
ANALYSIS I (0.5 UNIT)

Aims of course: To begin the study of analysis, which is one of the most important and well-developed strands of pure mathematics with applications to many areas of mathematics and mathematical physics; and to introduce students to the ideas of formal definitions and rigorous proofs (one of the fundamental features of modern mathematics, and something that is not familiar from A-level), and to develop their powers of logical thinking.

Prerequisites: An A-level in Mathematics e.g. Pure and Applied or Pure with Statistics.

Course content
Starting only with the basic properties of real numbers, rigorous proofs are given of the main results in elementary differential calculus. Topics covered include sequences, series, continuity and differentiability of functions and the properties of the exponential function.

MATH6401
MATHEMATICS I (0.5 UNIT)

Aims of course: To introduce Mathematical Methods and their Applications for students of Economics, Statistics and related disciplines. The emphasis of the course is on technique rather than full rigour, and this is developed

through the use of many examples.

Prerequisites: An A-level in Mathematics e.g. Pure and Applied or Pure with Statistics.

Course content: Function of a real variable: elementary treatment of continuity and differentiability, differentiation, stationary points, curve sketching including asymptotes and convexity, linear approximation.
Methods of integration: substitution, integration by parts, partial fractions, use of hyperbolic and inverse trigonometric functions.
Infinite series: simple treatment of convergence with examples e.g. geometric series; series for simple functions: e^x, $\log(1 + x)$, trigonometric functions, $(1 + x)^\alpha$ for arbitrary α.
Functions of several variables: partial differential, total derivative, chain rule, implicit function theorem, stationary values, maxima, minima and saddle point. Homogeneous functions and Euler's theorem.
Matrices and systems of linear equations: solution by reduction to echelon form, geometric interpretation of vectors and matrices, examples of linear dependence and independence, matrix algebra, rank, transpose, inverse, 2x2 and 3x3 determinants.

MATH6402
MATHEMATICS II (0.5 UNIT)

Aims of course: To continue on from the MATHB51A course on Mathematical Methods and their Applications. Again the emphasis is placed on developing technique rather than full rigour.

Prerequisites: MATH6401 or equivalent.

Course content
Optimisation problems with a constraint: use of Lagrange multipliers, simple examples with inequality constraints.
Complex numbers, De Moivre's theorem, roots of polynomials.
First and second order difference equations.
First order differential equations: variables separable, general linear equation, Bernoulli's equation. Second order equations with constant coefficients, particular integrals for simple functions.
Double integration: change of variables, Jacobian, polar co-ordinates.
Gamma and Beta functions, Stirling's formula, Taylor's Theorem.
Eigenvalues, eigenvectors, diagonalisation.

SECOND YEAR

MATH6403
MATHEMATICS III (0.5 UNIT)

Aims of course: To develop the theory of matrices with real number entries, which is fundamental to economic problems associated with the linear programming problem. Although a number of examples are used to illustrate the use of matrices, the emphasis is on gaining an understanding of the mathematics and how it is applied.

Prerequisites: MATH6401 and MATH6402, or their equivalent.

Course content
Matrices for modelling problems. Euclidean space, matrix conventions, revision of elementary row operations, rank of matrix, solution of linear equations $Ax = B$, linear space $\mathbb{R}^n$. Dimension of subspaces, bases, projection and least squares. Determinants and applications to the solution of linear equations. Angle and orthogonality on $\mathbb{R}^n$, Schmidt process, metric and norm in $\mathbb{R}^n$, Cauchy-Schwartz and triangle inequalities. Eigenvalues and eigenvectors of square matrices, in particular of symmetric matrices. Application to quadratic forms. Positive definitiveness. Cholesky decomposition.
Some topics from: decomposition of matrices, similarity, matrix polynomials, the Cayley-Hamilton theorem, sum and product of eigenvalues, trace, linear programming problems. Linear differential equations and stability. Non-negative matrices and the Perron-Frobenius theorem.

COURSE UNITS FROM THE DEPARTMENT OF SCIENCE AND TECHNOLOGY STUDIES

HPSC1001
HISTORY OF SCIENCE (0.5 UNIT)

This course surveys the origins and development of science from the ancient Greeks to 1800. Main themes are the origins of science in the ancient world, the nature of the scientific revolution and the spread of science during the Enlightenment.

HPSC1003
PHILOSOPHY OF SCIENCE (0.5 UNIT)

An introductory course in the philosophy of science. The focus is on several central problems regarding the nature of scientific knowledge: the demarcation between science and non-science, progress in science, and the empirical testing of theories. These issues are studied through the writings of twentieth-century philosophers such as Popper, Kuhn, Lakatos, Feyerabend and Hempel.

HPSC1004
INTRODUCTION TO SCIENCE POLICY STUDIES (0.5 UNIT)

An introduction to social and political thinking about the role of science and technology in society and the relationship between science and the state. Also, a historical overview of science policy. Topics normally include: the intellectual foundations of science policy, the role of the state in the promotion, regulation, and shaping of science and technology, the idea of scientific autonomy, the relationship between science and the military, the moral responsibility of the scientist, the commercialization of science, feminism and science, and the challenge of environmentalism for science policy.

HPSC1008
INTRODUCTION TO SCIENCE COMMUNICATION (0.5 UNIT)

This course introduces the public dimension of science and technology. It explores the relationship between the professional world of science and the social, cultural and personal spaces in which science contributes to the shaping of society, including the news media, science fiction, activism, advertising and museums.

The information given in this document is as far as possible accurate at the date of publication but the Department reserves the right to amend it.

Department of Statistical Science, UCL, September 2010.