**University of Melbourne**  
Department of Mathematics and Statistics

**Honours Guide 2007**

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Key Dates

Recommended Application Dates for Honours/PDGip Programmes:
  Commencement in Semester 1: by Thursday 30 November 2006
  Commencement in Semester 2: by Monday 2 July 2007
(Applications may be accepted after these dates. Talk to the Honours Coordinators.)

ICE-EM/AMSI Summer School Registration (if applicable): November 2006 (first round)

ICE-EM/AMSI Summer School (if applicable): 15 January – 9 February 2007 (U. of Sydney)

Submission of “Proposed Course Details” form for students commencing in Semester 1: 31 January 2007

Honours/PGDip Commencement: Ten days before the start of lectures.

Thesis Submission Deadline:  2:00pm, Friday 2 November 2007 (end-of-year completion)
  2:00pm, Friday 1 June 2007 (mid-year completion)
(For those students who do not meet the submission deadline, the Examiners will take this into account at the Examiners Meeting.)

Honours Project Seminars: Friday 23 November 2007 (end-of-year completion)
  Friday 22 June 2007 (mid-year completion)

Useful Web Sites

Department of Mathematics and Statistics:  http://www.ms.unimelb.edu.au
Department Honours Website: http://www.ms.unimelb.edu.au/Students/Honours
Faculty of Science Honours Website: http://www.science.unimelb.edu.au/honours/
Melbourne Scholarships Office: http://www.services.unimelb.edu.au/scholarships/
Australian Mathematical Sciences Institute (AMSI): http://www.amsi.org.au
Key Centre for Statistical Sciences (KCSS): http://www.buseco.monash.edu.au/centres/kcss/
University Career and Employment Website: http://www.services.unimelb.edu.au/careers/

Note

This Guide has been prepared to assist you in deciding whether to apply to enter Honours, and to design your course.

You are advised that the rules governing the Honours program are definitively stated in the official University Handbook. In the event of a disagreement between this guide and the Handbook, it is the Handbook that is to prevail.

The information given in this guide is correct at time of printing.

October, 2006
(Updated February 23, 2007)
# General Information

## Why Do An Honours Year?

The following Honours programs are offered in the Department of Mathematics and Statistics:

- BSc (Hons) in Mathematics and Statistics;
- BSc (Hons) in Applied Statistics;
- Combined BSc (Hons) in Mathematics and Statistics/Computer Science;
- Combined BSC (Hons) in Mathematics and Statistics/Physics.

Honours is an extremely valuable year of study. The Honours program in Mathematics and Statistics is designed to train graduates in advanced mathematics and statistics topics, and to provide an opportunity for students to participate in research. The Honours program in Applied Statistics is designed to train graduates in applications of statistical methods, with supporting studies in theoretical statistics and stochastic processes. The year involves the completion of an Advanced Coursework subject and a Research Project subject.

## Honours Coordinators

The Department of Mathematics and Statistics Honours Coordinators for 2007 are:

- **Associate Professor Kostya Borovkov**  
  phone: (03) 8344 7992  
  email: K.Borovkov@unimelb.edu.au

- **Dr Sanming Zhou**  
  phone: (03) 8344 3453  
  email: smzhou@ms.unimelb.edu.au

## Opportunities After Honours

### Study Towards a Higher Degree

The skills and qualifications obtained as an Honours graduate can lead on to a higher degree such as a Master of Science or Doctor of Philosophy.

### Career

An Honours degree is a strong entry point into careers in industry, science and technology. There are many career options for our honours graduates. Some examples of where past graduates have found careers are:

<table>
<thead>
<tr>
<th>actuarial analyst</th>
<th>applied mathematician</th>
<th>business analyst</th>
</tr>
</thead>
<tbody>
<tr>
<td>market researcher</td>
<td>physical chemist</td>
<td>economist</td>
</tr>
<tr>
<td>geophysicist</td>
<td>strategic planning manager</td>
<td>applied statistician</td>
</tr>
</tbody>
</table>
How is An Honours Year Different From Undergraduate Studies?

Students enrol in an Advanced Coursework subject and a Research Project subject.

Project

The Research Project subject accounts for 25% of the total assessment and involves an independent research project completed under the guidance of an academic who specialises in your area of interest.

Information about the Department, in particular the research activities of the various groups, can be obtained from the web site: http://www.ms.unimelb.edu.au

Intending fourth year students should approach individual staff members to discuss possible research projects. Research interests of individual staff members in the Department can be searched online in the Honours website: http://www.ms.unimelb.edu.au/Students/Honours

Project titles and supervisors should be finalised by 31 January 2007 and recorded on the form “Proposed Course Details 2007”, which can be found at the end of this booklet.

Performance in the research project will be assessed by a Project Report to be examined by the supervisor and one other departmental member nominated by the fourth year coordinator. The reports are assessed on:

(a) clarity and exposition;
(b) mathematical insight displayed; and
(c) coverage of field, references.

Copies of previous years’ research reports can be perused in the Mathematical Sciences Library.

Deadline for Project Submission

The final project submission dates are 2:00pm, Friday 2 November 2007 for end-of-year completion and 2:00pm, Friday 1 June 2007 for mid-year completion. For those students who do not meet the submission deadline, the Examiners will take this into account at the Examiners Meeting.

Each student will be required to give a seminar on the subject of their Project on Friday 23 November 2007 (end-of-year) or Friday 22 June 2007 (mid-year).

Course Work

The Advanced Coursework subject accounts for 75% of the total assessment. All Honours Mathematics and Statistics students must complete 6 subjects of Honours course work. Each subject will be of one semester length and will normally consist of 24 lectures (usually 2 lectures per week). Full time students usually undertake 4 subjects in the first semester and two subjects in the second semester. The subjects will be selected from some of the following areas:

• Algebra
• Analysis
• Applied Statistics
• Discrete Mathematics
• Geometry and Topology
• Mathematical Physics and Statistical Mechanics
• Methods and Modelling
• Operations Research
• Probability and Stochastic Processes
• Statistics
ICE-EM/AMSI Summer School Courses

One coursework subject in the Honours program can be replaced by a 24-lecture course offered through ICE-EM (International Centre of Excellence for Education in Mathematics) and AMSI (Australian Mathematical Sciences Institute) during Summer 2007. Note that ICE-EM/AMSI Summer School courses will be held from 15 January to 9 February 2007 at The University of Sydney. Students who plan to incorporate one of these subjects into their Honours program should check the Summer School website:

http://www.maths.usyd.edu.au/u/amsiss07/

for enrolment, support, key dates and descriptions of the Summer School courses. Information can be also found in the website of AMSI:

http://www.amsi.org.au

AMSI is a national institute established through a grant from the Victorian Government and funds from over twenty Australian institutions.

Standard Required

To be awarded an Honours qualification, students enrolled in the BSc (Honours) must achieve an overall weighted average of at least 65% for their Honours studies.

Seminars

Honours students should consider themselves a part of the research strength of the Department and view departmental seminars as a method of broadening their knowledge. It is therefore expected that students will attend all research seminars in the broader area of their chosen field. They are also expected to give two seminars during the Honours year, one on their Project.

Tutoring

Honours students are encouraged to consider undertaking some part-time tutoring in the department. For further information please see Karen Baker (Director of the Mathematics and Statistics Learning Centre) as early as possible to register your interest.

Bachelor of Science (Honours) Entry Requirements

To apply for a place in the Honours program you must satisfy the entry requirements of the Faculty of Science and the Department of Mathematics and Statistics.

♦ The Faculty of Science requirements for the Bachelor of Science Honours program are as follows:

• Applicants must hold a Bachelor of Science (BSc), Bachelor of Arts and Sciences (BASc) or equivalent qualification recognised by the Faculty of Science.

• Graduates of the University of Melbourne BSc single degree must have a Faculty Honours Score of at least 65%. The Faculty Honours Score is a weighted average based on a student’s performance in their best 87.5 points of science study at the 300-level (3rd year). A Faculty Honours Score is not calculated for University of Melbourne BASc or BSc combined course students. For these students the Faculty calculates a weighted average mark for the 300-level science subjects that have been completed. A weighted average of 65% or more is usually required for entry into Honours.

• Applicants who have completed their degree at other institutions must demonstrate that they have achieved an average of 65% or more for the third year science subjects they have studied.

♦ The Department of Mathematics and Statistics requirement is:

• An H3 or better in at least four 300-level Mathematics/Statistics subjects.
Students who do not meet this requirement, but who have achieved very good results in other areas, may be considered for entry to Honours on the recommendation of the Head of the Department of Mathematics and Statistics.

Prospective Honours students should consult the 2007 University Handbook for guidelines to selecting their 300-level Mathematics/Statistics subjects. It is important that they be selected to provide prerequisites for the desired course of Honours study.

**General Enrolment Information**

**Duration and Commencement of the Course**

Honours involves one year of full-time study between February and November. A midyear intake is also offered.

**Deferment**

The Faculty of Science does not allow students who have been offered a place in Honours to defer commencement of the course. Students need to advise the Department of Mathematics and Statistics in writing that they are unable to accept the course offer, and re-apply for a place in the Honours program at a later stage.

**Leave of Absence**

The Faculty of Science allows students to take leave from the Honours program in exceptional circumstances only. Students wishing to apply for leave from the Honours program must complete a Postgraduate Variation to Enrolment form (available from the Faculty of Science).

**HECS**

The Faculty of Science offers its Honours degrees to students with Australian permanent residence on a HECS basis.

**Scholarships, Awards and Prizes**

**Faculty of Science**

It is expected that there will be 36 Melbourne Honours Scholarships available to domestic Faculty of Science students in 2007. All international students who attain a FHS equivalent to or greater than the 36th ranked domestic Melbourne Honours Scholarship recipient will also be offered a 25% fee remission scholarship. For further information about Melbourne Honours Scholarships, visit:


or contact the Melbourne Scholarships office:

phone: 8344 7467 or 1800 772 244 (free call within Australia)
email: ug-schols@unimelb.edu.au
web: http://www.services.unimelb.edu.au/scholarships/

In addition, the Faculty of Science offers a number of other scholarships, awards and prizes. Details can be found at:

Studentships

For those full-time Honours/PGDip students who enrol solely in the Department of Mathematics and Statistics and who have not awarded any major scholarship, the department will provide a $1,000 studentship as a lump sum subject to successful completion of the first semester and continuing enrolment. Successful completion of the first semester is defined as having completed at least three subjects with an average of at least 65 (for Honours students) or 50 (for PGDip students).

Other Prizes

The department also awards the following prizes and scholarship for which Honours students are eligible.

Wyselaskie Scholarship: This is awarded to the best Honours student in Mathematics and Statistics.

Maurice Belz Scholarships: These prestigious scholarships are aimed at students with the potential to undertake postgraduate study in Statistics to give them the opportunity to work with internationally recognised researchers. You are eligible for a Maurice Belz Honours Scholarship if you are enrolled in the Bachelor of Science Honours Degree specialising in Statistics and your Honours project is in one of the following areas: Applied Statistics, Probability, Stochastic Processes, Operations Research. The awards will be made on academic merit determined on your third year University of Melbourne Science Faculty Honours Score or equivalent. Contact Hannah Simmonson in the department office for details, including method of application.

Dwight’s Prize: This is awarded to the best Honours student in Statistics.

Nanson/Wilson Prizes: These are separate prizes, and both are awarded to best original memoir by a student within seven years of first enrolment.

Urquhart Prize: The department awards two Urquhart Prizes each year, one for third year Operations Research student(s) and one for Honours student(s).

How Do I Apply?

Application forms can be obtained from the Departmental Office and also available online:

http://www.ms.unimelb.edu.au/Student/Honours/forms.html
http://www.science.unimelb.edu.au/honours/application.html#how

There is also a copy of the Application Form at the end of this Guide. Forms should be completed and lodged with the Mathematics and Statistics Office by Thursday 30 November 2006 for commencement in Semester 1. Under certain circumstances students may be eligible for mid-year commencement; in this case the applicant should contact the Honours Coordinators by Monday 2 July 2007. After these dates talk to the Honours Coordinators.

Although there is no mid-year intake in the Physics Honours Program in 2007, subject to the approval of the Departments of Physics and Mathematics & Statistics, an applicant who is able to devise an appropriate course plan in conjunction with both departments may be considered for mid-year entry for Combined BSc (Honours) in Mathematics and Statistics/Physics. The same policy applies to mid-year entry for Combined BSc (Honours) in Mathematics and Statistics/Computer Science.

Letters of acceptance will be sent by Faculty of Science in mid-December. See the Faculty of Science Honours website for the application process and timeline.
Prerequisites and Recommended Subjects at 300 Level

The following is a list of suggested 300-level subjects to be taken in order to do honours in one or more research streams in the Department of Mathematics and Statistics.

**Algebra:** To do Honours/PGDip in algebra, a student is required to do 620-321 and should normally have done 620-322. (Students missing one or both of these courses but interested in taking a course in the algebra stream should discuss possibilities with the appropriate lecturer well before the start of semester.) It is also recommended that students do 620-311, 620-312 and 620-351.

**Analysis:** To do Honours/PGDip in analysis, a student is required to do 620-311 and 620-312.

**Applied Statistics:** To do Honours/PGDip in applied statistics, usually a student is required to do 620-371, 620-372 and 620-374.

**Discrete Mathematics:** To do Honours/PGDip in discrete mathematics and combinatorics, usually a student is required to do 620-221 or 620-252, 620-352 and 620-353. It is suggested that 620-301, 620-321, and 620-351 make good supplementary subjects.

**Geometry and Topology:** To do Honours/PGDip in geometry and topology, a student is required to do 620-322 and normally should have done 620-311 and 620-321. Students without these units should talk to the appropriate lecturers in the Honours courses.

**Mathematical Physics and Statistical Mechanics:** To do Honours/PGDip in mathematical physics and statistical mechanics, usually a student is required to do 620-221 or 620-252 and 620-331. The subject 620-332 is also highly recommended.

**Methods and Modeling:** To do Honours/PGDip in methods and modeling, usually a student is required to do 620-331 and 620-342. It is suggested that 620-332 and 620-381 make good supplementary subjects.

**Probability and Stochastic Processes:** To do Honours/PGDip in probability and stochastic processes, usually a student is required to do 620-301 and 620-302. It is also recommended that students do 620-312, 620-361 and 620-371.

**Operations Research:** To do Honours/PGDip in operations research, usually a student is required to do 620-361 and 620-362. It is also recommended that students do 620-301, 620-352 and 620-381.

**Statistics:** To do Honours/PGDip in statistics, usually a student is required to do 620-301, 620-371 and 620-372. It is also recommended that students do 620-302 and 620-374.
Honours Program Information

BSc (Hons) in Mathematics and Statistics

620-496 BSc (Hons) Mathematics and Statistics Research Project
620-497 BSc (Hons) Mathematics and Statistics Coursework

Coordinators: Dr Sanming Zhou, Associate Professor Kostya Borovkov
Semester: All Year
Credit: 100 points
Prerequisites: As approved by the Coordinators

BSc (Hons) Applied Statistics

620-493 BSc (Hons) Applied Statistics Research Project
620-494 BSc (Hons) Applied Statistics Advanced Coursework

Coordinator: Associate Professor Kostya Borovkov
Semester: All Year
Credit: 100 points
Prerequisites: As approved by the Coordinator

Applied Statistics advanced coursework

Students must complete six (6) subjects chosen from those offered through the Key Centre for Statistical Sciences (KCSS) at La Trobe and Monash Universities and RMIT as well as The University of Melbourne. Each subject consists of 24 hours of lectures presented in one 2-hour session per week during either first or second semester. Full details of these subjects are set out in the KCSS booklet that is available from the Mathematics and Statistics department office from mid-October, 2006.

Subject selection requires departmental approval. In some cases, approval may be given to substitute subjects of comparable standard from other areas such as Mathematics and Statistics, Economics and Computer Science.

Coursework Assessment

The assessment of the Advanced Coursework subject entails assignments (up to 50 pages) and a 2 two-hour written exam for each of the six KCSS subjects. Examinations are held at the end of each semester. All KCSS subjects are of equal weight.

BSc (Hons) Combined Mathematics and Statistics/Physics

620-476 BSc (Hons) Combined Mathematics and Statistics/ Physics Research Project
620-477 BSc (Hons) Combined Mathematics and Statistics/ Physics Coursework

Coordinators: Dr Sanming Zhou (Mathematics and Statistics)
Dr C. T. Chantler (Physics)
Semester: All Year
Credit: 100 points
Prerequisites: As approved by the Coordinators
BSC (Hons) Combined Mathematics and Statistics/ Computer Science

620-486 BSc (Hons) Combined Mathematics and Statistics/ Comp Sci Research Project
620-487 BSc (Hons) Combined Mathematics and Statistics/ Comp Sci Coursework

Coordinators: Dr Sanming Zhou (Mathematics and Statistics)
              Dr T. Baldwin (Computer Science)

Semester: All Year
Credit: 100 points
Prerequisites: As approved by the Coordinators

Postgraduate Diplomas in Science

Postgraduate Diplomas in Mathematics & Statistics, and in Applied Statistics are also available. The main differences between these programs and the BSc (Hons) programs are that the entry requirements are not as stringent and it is possible to replace up to two fourth-year courses by third-year ones, subject to approval by the head of department. These programs may be more suitable than the Honours programs for students coming from overseas and for local students who have not majored in Mathematics or Statistics.

Upon approval by the department head, a student may transfer from PGDip to Honours subject to the following Faculty eligibility conditions:

1. the student has completed a Bsc, BbiomedSc or equivalent;
2. the student has achieved an average of at least 65% over the assessed advanced coursework component of their course after one semester; and
3. the student has made satisfactory progress in the research component of their course as determined by their supervisor and hence may reasonably be considered to be on track to achieve an overall mark of at least 65% at the conclusion of the Fourth Year program.

For more information about the PGDip program, please contact either Dr Sanming Zhou or Associate Professor Kostya Borovkov.
# Course Work Timetable

## Semester One

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<th>Subject</th>
<th>Prerequisites</th>
<th>Lecturer</th>
</tr>
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<tr>
<td>620-402</td>
<td>Probability for Inference</td>
<td>201</td>
<td>A/Prof Aihua Xia</td>
</tr>
<tr>
<td>620-411</td>
<td>Measure Theory</td>
<td>312</td>
<td>Prof Greg Hjorth and A/Prof Jerry Koliha</td>
</tr>
<tr>
<td>620-421</td>
<td>Combinatorial Group Theory</td>
<td>321; 322 recommended</td>
<td>Dr Lawrence Reeves</td>
</tr>
<tr>
<td>620-422</td>
<td>Commutative Algebra</td>
<td>321</td>
<td>A/Prof John Groves</td>
</tr>
<tr>
<td>620-424</td>
<td>Smooth Dynamical Systems</td>
<td>231 or 233; 311, 322 recommended</td>
<td>Prof Hyam Rubinstein</td>
</tr>
<tr>
<td>620-426</td>
<td>Algebraic Topology</td>
<td>322; 321 recommended</td>
<td>Dr Iain Aitchison</td>
</tr>
<tr>
<td>620-431</td>
<td>Mathematical Biology</td>
<td>331</td>
<td>A/Prof Kerry Landman &amp; A/Prof Barry Hughes</td>
</tr>
<tr>
<td>620-432</td>
<td>Computational Mathematics</td>
<td>331+ ability to program</td>
<td>Dr Steve Carnie</td>
</tr>
<tr>
<td>620-442</td>
<td>Phase Transition and Critical Phenomena</td>
<td>One of 620-331, 620-332, 620-353</td>
<td>A/Prof Paul Pearce</td>
</tr>
<tr>
<td>620-444</td>
<td>Topics in Discrete Mathematics</td>
<td>353</td>
<td>Dr Richard Brak and Prof Peter Forrester</td>
</tr>
<tr>
<td>620-462</td>
<td>Integer and Dynamic Programming</td>
<td>no strict prereq.</td>
<td>A/Prof Natasha Boland &amp; A/Prof Moshe Sniedovich</td>
</tr>
<tr>
<td>620-463</td>
<td>Network Optimisation</td>
<td>261 or 352</td>
<td>Dr Sanming Zhou</td>
</tr>
<tr>
<td>620-471</td>
<td>Analysis of Hierarchical Data</td>
<td>371</td>
<td>Dr Andrew Robinson</td>
</tr>
<tr>
<td>620-473</td>
<td>Statistical Inference</td>
<td>202 and any two 300-level subjects</td>
<td>Professor Richard Huggins</td>
</tr>
<tr>
<td>620-474</td>
<td>Consulting and Applied Statistics</td>
<td>371, 372</td>
<td>A/Prof Ian Gordon</td>
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</table>

## Semester Two

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<thead>
<tr>
<th>Code</th>
<th>Subject</th>
<th>Prerequisites</th>
<th>Lecturer</th>
</tr>
</thead>
<tbody>
<tr>
<td>620-401</td>
<td>Stochastic Optimisation Methods</td>
<td>301</td>
<td>A/Prof Felisa Vázquez-Ahad</td>
</tr>
<tr>
<td>620-403</td>
<td>Stochastic Processes &amp; their Applications</td>
<td>301</td>
<td>A/Prof Kostya Borovkov</td>
</tr>
<tr>
<td>620-413</td>
<td>Complex Analysis</td>
<td>either 221 or 252 and 332</td>
<td>Dr Paul Norbury</td>
</tr>
<tr>
<td>620-423</td>
<td>Representation Theory</td>
<td>321</td>
<td>TBA</td>
</tr>
<tr>
<td>620-427</td>
<td>Differential Geometry</td>
<td>231 or 233, 311; 322 recommended</td>
<td>A/Prof Craig Hodgson</td>
</tr>
<tr>
<td>620-433</td>
<td>Advanced Material Modelling</td>
<td>342</td>
<td>A/Prof John Sader and Dr Antoinette Tordesilas</td>
</tr>
<tr>
<td>620-441</td>
<td>Integrable Models</td>
<td>620-331 and one of 620-221 or 252</td>
<td>Dr Omar Foda</td>
</tr>
<tr>
<td>620-443</td>
<td>Topics in Graph Theory &amp; Enumeration</td>
<td>221 or 252</td>
<td>A/Prof A. Owczarek and Prof Tony Guttmann</td>
</tr>
<tr>
<td>620-445</td>
<td>Experimental Mathematics</td>
<td>no strict prereq.</td>
<td>Dr J. de Gier &amp; Dr O. Warnaar</td>
</tr>
<tr>
<td>620-461</td>
<td>Modelling of Business, Management and Industrial Problems</td>
<td>no strict prereq.</td>
<td>Professor Taylor &amp; A/Profs Boland &amp; Sniedovich</td>
</tr>
<tr>
<td>620-472</td>
<td>Data Mining</td>
<td>None</td>
<td>Dr Owen Jones</td>
</tr>
</tbody>
</table>
Honours Courses in 2007

For details about the courses offered by ICE-EM/AMSI Summer School in 2007, see the following website:

http://www.maths.usyd.edu.au/u/amsiss07/

For subjects offered by Key Centre for Statistical Sciences (KCSS), visit:

http://www.buseco.monash.edu.au/centres/kcss/

Introduction

In 2007 the department will offer 26 Honours subjects which cover a number of areas in Mathematics and Statistics.

Algebra: Algebraic and discrete structures arise naturally in an enormous variety of mathematical and nonmathematical disciplines. The algebra group at Melbourne is particularly interested in algebraic structures that describe symmetry, be it concrete symmetry of a geometric or physical object or a more abstract symmetry from higher dimensions that might appear in function theory, Galois theory, number theory and physics. Combinatorial Group Theory uses the presentation of a symmetry group and other group theoretic constructions to derive powerful structural results. The theory also enters into the field of logic, giving insight into the realm of formally unsolvable problems! Commutative Algebra studies the properties of commutative rings and their modules, and is a core tool in algebraic geometry, and algebraic number theory as well as in group theory and algebraic topology. Depending on interest this course may emphasise the subject as an introduction either to algebraic geometry or to algebraic number theory. Representation theory is the art of representing an algebraic structure by matrices. Because matrices are easier to work with and arise in so many fields representation theory has applications in and gives insight into almost every field where either symmetry or matrices play a role. Many branches of mathematics make substantial use of algebraic methods.

Analysis: Analysis is one of the broadest areas of modern mathematics, with applications to an enormous range of scientific areas. Analysis in turn splits into several subfields, such as 'Real Analysis', 'Complex Analysis', ‘Functional Analysis’, and ‘Harmonic Analysis’.

In very broad terms, analysis deals with the foundations of calculus. This is seen most clearly in Real Analysis, which studies real valued functions. At its most concrete, Real Analysis deals with the explicit solution of differential equations and integrals. The more abstract parts of the subject border Topology and Set Theory.

Complex Analysis arises from the remarkable discovery that a coherent and powerful system of so called ‘imaginary numbers’ arises when one introduces a formal device to obtain a square root to negative one. It is amazing discovery of modern mathematics that many problems involving purely real numbers in their formulation and in their solution can only be solved by the aid of a detour through the imaginary numbers. The use of contour integration to calculate real valued integrals is an example of this kind discussed in the department’s Complex Analysis course.

In very broad terms, ‘Functional Analysis’ can be view as the study of linear operators on infinite dimensional spaces. In this sense the objects of its study can be seen as a kind of infinite analogue of a matrix. Since modern quantum physics is phrased in the language of infinite dimensional Hilbert spaces, Functional Analysis has close connections to the foundations of physics.
Subjects offered in this stream introduce students to key theories and important techniques in analysis. Measure theory is a key topic in solutions of partial differential equations and in stochastic processes. As part of this course, ergodic theory will be introduced, which is useful in dynamical systems as well as areas such as Brownian motion in physics. Complex analysis is a fundamental tool in solution of many problems arising from physics as well as geometry, engineering etc. Often problems in real analysis can only be tackled by reformulation in terms of complex functions.

**Applied Statistics:** Four subjects are offered which are essential training for an applied statistician. The subjects include some important modern techniques, the theory behind them as well as examples of their application. There is much more to applied statistics, but these subjects (in addition to the full range of undergraduate applied statistics courses) provide a solid base of applicable tools for a statistician. An honours graduate with a major in Applied Statistics is in demand: there is an increasing demand for statistical expertise in industry, business and in research science. In some cases, permission will be given for students to replace one or more of the subjects listed below by subjects from the Applied Statistics Honours program, as offered through the Key Centre for Statistical Sciences. Students interested in pursuing this option should contact Associate Professor Kostya Borovkov.

**Discrete Mathematics:** Discrete mathematics and combinatorics are essential subjects for the task of exact computation, whether it be by pen and paper, or by a computer. Underlying exact computations are rich mathematical structures, and one quickly encounters connections with algebra, analysis and geometry. Logical reasoning, a most generic skill in mathematical training, also plays a major role. The popularity of this specialisation on an international level may well be that the questions being asked are well motivated and make good sense, while the answers are as challenging and clever as in any other subject.

**Experimental Mathematics:** In 2007 the department will offer a new Honours subject (620-445) on experimental mathematics. The course will discuss some of the great advances made in using computers to discover (and prove!) nontrivial mathematical theorems.

**Geometry and Topology:** Topology relates to the position of objects, for example knotted circles in 3-dimensional space. It is also concerned with the overall structure of spaces, for example if there are holes or singu-larities. Algebraic topology seeks to convert problems about spaces and mappings between them, into questions in algebra. In Geometry, curvature and distance are studied in spaces like higher dimensional surfaces, which are called manifolds. Manifolds occur naturally in physics, engineering, economics, when one is measuring a number of quantities varying simultaneously. Geometry and Topology have developed powerful new tools which have been used to solve key problems in other areas of mathematics, such as number theory and dynamical systems. There are important interactions with analysis and algebra. Difficult problems in geometry, such as deformations of metrics and minimisation questions, require non-linear analysis. New invariants in differential geometry and topology have come from topological field theories, suggested by ideas in physics. Geometric concepts such as curvature have been introduced into group theory. In dynamical systems, the interaction between the underlying topology of a space and behaviour of flows on the space is studied. Special orbits are of particular interest in understanding general properties of solutions of systems of differential equations. In Algebraic topology, methods of homology and cohomology theory enable questions about the structures of spaces to be converted into commutative algebra. Differential geometry is the study of curvature of spaces which can be surfaces or higher dimensional analogues called manifolds. There are fundamental connections to many branches of physics.

**Mathematical Physics and Statistical Mechanics:** Physics has provided major impetus for the development of novel mathematics for the past thousand years at least! Mathematical physics is a broad subject covering every area of mathematics and physics. In the units here integrable dynamical systems and statistical mechanics, both of which have been foci of mathematical physics in the past hundred years, are explored.
Studying these units will bring one into a voyage of discovery with unexpected connections between different areas of mathematics including differential equations, probability theory, algebra and group theory.

**Methods and Modelling:** The subjects offered under this section are designed to provide students with experience in defining and formulating problems in a variety of applications and with skills to develop relevant quantitative solutions of these problems. We believe these are important academic and professional attributes for Honours students to acquire whether they intend to enter the workplace or to continue with postgraduate studies.

The subjects on offer serve as basic training in applied mathematics for students with a strong background and interest in mathematics but perhaps have limited experience in mathematical modelling, approximation and computation. You will have the opportunity to learn how to:

- formulate a well-posed problem in mathematical terms from a possibly sketchy description
- carry out necessary mathematical analysis which may require exact treatment or reasonable approximate methods
- develop appropriate numerical methods to obtain quantitative results using software packages and/or writing computer code
- interpret the results and where necessary refine the original model

While the mathematical techniques and topics have broad applications, the specific topics are guided by the research interests and expertise of members of the Continuum Modelling Group. Our research covers areas in colloid science, developmental biology, chemical engineering and materials science. The research is motivated and supported by our association with the Particulate Fluids Processing Centre (a Special Research Centre funded by the Australian Research Council), the Royal Childrens’ Hospital and the US Army Research Agency. Specific interest and strengths are in the areas of mechanics of granular media, contact mechanics of deformable bodies such as liquid drops and emulsions, mechanical, electrical and optical properties of nano-particles, the proliferation and movement of cells in embryonic development and random walks, random networks and random environments.

**Operations Research:** In undergraduate operations research, the focus was on basic methods, modelling real-world problems, and problem-solving. The Honours subjects in operations research are all about getting to the guts of the matter; they are about understanding at a deeper level both the modelling and the mathematics of operations research. They also take you beyond the linear, linear integer and convex non-linear models that you would have seen as an undergraduate, into a much richer realm, from parametric problems, to infinite dimensional problems (optimal control problems), to combinatorial and network problems and to much more general ideas about underlying concepts such as convexity. You will also have the opportunity to work on the formulation and analysis of applied stochastic models, and to explore the relationship between these models and the optimization techniques you have discussed elsewhere.

These subjects will take you to the edge; you will see where new research is happening, get an angle on unresolved issues, and see where the open problems lie. These courses provide a launching pad into research in operations research, in both the academic and commercial worlds.

**Probability and Stochastic Processes:** Almost every phenomenon in the world – be it of a physical, social, medical, or financial nature - involves a degree of randomness. Therefore to understand many phenomena it is necessary to understand randomness. Theory of stochastic (or random) processes is part of mathematics describing systems that evolve randomly in time or space. It has applications in various areas and enables one to answer such diverse questions as:
• how to decide on the capacity necessary for a computer network to perform adequately;
• how to decode the DNA sequence on the human genome;
• how to describe the properties of a series of counts of radioactive emissions;
• how to price an option on a financial market.

In the courses described in this section of the Guide, you will learn:
• the formalities of a rigorous understanding of stochastic processes;
• techniques for calculating important characteristics of different stochastic processes;
• limiting distributions arising in standard situations and their applications;
• the application of stochastic processes to many different problems.

In Probability for Inference the basic techniques of modern probability which are useable in statistical inference are described. Examples of applications of these techniques are provided.

In Stochastic Processes and Applications such techniques are used to lay the foundations of the theory of stochastic processes and then to study a number of the basic models of stochastic processes. We also discuss applications of the theory in a variety of situations.

Subjects

Subject: 620-421 Combinatorial Group Theory
Lecturer: Dr Lawrence Reeves
Prerequisites: 620-321; 620-322 is recommended
Semester: 1

Presentations of groups by generators and relations; properties of group theoretic constructions, normal forms, residual properties, subgroups theory, decision problems, geometric properties.

Subject: 620-422 Commutative Algebra
Lecturer: Associate Professor John Groves
Prerequisite: 620-321
Semester: 1

Properties of commutative rings and their modules. The course will usually focus on an application, most often number theory or algebraic geometry. Other applications such as group theory or homological algebra are also possible. The choice of application is open to negotiation.

Subject: 620-423 Representation Theory
Lecturer: TBA
Prerequisite: 620-321
Semester: 2

The course will focus on teaching the basics of representation theory through some favourite examples: symmetric groups, diagram algebras, matrix groups, reflection groups. In each case we will analyze the irreducible characters and irreducible modules for the group (or algebra), developing more and more powerful tools as we proceed.

Subject: 620-411 Measure Theory
Lecturer: Professor Greg Hjorth and Associate Professor Jerry Koliha
Prerequisites: 620-312
Semester: 1
There will be a general introduction to measure spaces, standard Borel spaces, complex measures, and the general theory of integration. After this, the course will move on to discuss the Radon-Nikodym derivative, the Riesz representation theorem, and Stone-Weierstrass theorem. As time allows, we explore topics in ergodic theory.

**Subject:** 620-413 Complex Analysis  
**Lecturer:** Dr Paul Norbury  
**Prerequisites:** either 221 or 252 and 332  
**Semester:** 2

This course is a basic course in complex analysis. It is expected that students have completed a first course in complex analysis, usually offered as an undergraduate course. Complex analysis is a powerful tool that can be applied in many problems from pure and applied mathematics and in numerical problems. Some applications will be discussed in the last few lectures of the course. Applications are listed below and will be chosen according to the tastes of the students.

**SYLLABUS:** holomorphic/complex analytic functions, Cauchy's theorem maximum principle and Schwarz's lemma, residue theorem and argument principle, power series, elliptic functions, Riemann mapping theorem and explicit constructions, harmonic functions, multiple-valued functions and Riemann surfaces.

**APPLICATIONS:** heat flow, random walks, fluid flow, electrostatics, prime number theorem

**Subject:** 620-471 Analysis of Hierarchical Data  
**Lecturer:** Dr Andrew Robinson  
**Prerequisites:** 620-371  
**Semester:** 1

Many areas of science are asking questions that require datasets with hierarchical structure. For example, in natural resources, numerous measurements might be made for a set of trees nested inside plots nested inside forests. Analysis and modelling of such data are complicated by that hierarchical structure: our ordinary regression assumptions fail. We need more refined tools. This course will focus on the development, fitting, and analysis of mixed-effects models for hierarchical data, using REML, in the open-source statistical environment R.

**Subject:** 620-472 Data Mining  
**Lecturer:** Dr Owen Jones  
**Prerequisites:** None required, however students would benefit from having completed an introductory statistics unit, such as 620-131, 620-160, 260-201 or 620-370.  
**Semester:** 2

Data Mining refers to the management and analysis of large data sets. As it has matured it has developed a more statistical flavour, but Data Mining still owes much of its character to disciplines such as machine learning, pattern recognition, database design and high performance computing. Techniques covered by the course include: Market Basket Analysis; Tree based classification (e.g. C4.5, C5.0 and CHAID); Neural Networks; Logistic Regression; Hierarchical clustering and B-splines.

**Subject:** 620-473 Statistical Inference  
**Lecturer:** Professor Richard Huggins  
**Prerequisites:** 620-402 (recommended) or 620-202 and any two 300-level subjects from the Department of Mathematics and Statistics.  
**Semester:** 1
Modern statistical inference still owes much to the classical maximum likelihood based methods. However, modern methods such as quasi-likelihood, robust methods and nonparametric regression relax the assumptions necessary for likelihood based inference. An understanding of the theory underlying these methods is important for those planning to go on to develop new statistical methods or apply existing methods. Topics include: A review of classical maximum likelihood methods. The estimating equation approach, robust inference and nonparametric regression methods.

Subject: 620-474 Consulting and Applied Statistics  
Lecturer: Associate Professor Ian Gordon  
Prerequisites: 620-371, 620-372; 620-374 recommended  
Semester: 1  
This subject is about the application of statistics in real situations. It deals with thinking about data in a broad context; the client-consultant relationship; consulting sessions; verbal and written communication skills; organizing the structure of a statistical problem; professional ethics; case studies; teamwork; presentation of results including graphical methods, tables, report writing; project work; supervised consulting; developing models; searching the literature for relevant background material; critical assessment.

Subject: 620-443 Topics in Graph Theory and Enumeration  
Lecturer: Assoc. Prof. Aleks Owczarek and Professor Tony Guttmann  
Prerequisites: 620-221 or 620-252 or equivalent  
Semester: 2  
The use of generating functions for enumeration of combinatorial structures, including partitions of numbers and of sets, permutations with restricted cycle structure, connected graphs and other types of graph; solution of recurrence relations; methods of asymptotic enumeration; some applications in statistical mechanics.  
This course is very general. The methods covered have widespread applicability, including areas of pure and applied mathematics and computer science. It is based on the book ‘Generating functionology’ by H. S. Wilf.

Subject: 620-444 Topics in Discrete Mathematics  
Lecturer: Dr Richard Brak and Professor Peter Forrester  
Prerequisites: 620-353 (may be waived at the discretion of the lecturer)  
Semester: 1  
The main theme of this course will be tilings. This branch of discrete mathematics has applications in both theoretical computer science, and theoretical physics. One class of problem relates to existence type theorems, where one would like to determine if it is possible to cover a certain board with copies of a specified shape. Another class of problem is to enumerate all possible ways to tile a board with a given shape. A third class of problem relates to tilings which have a recursive structure, for example the well known aperiodic Penrose tiling of the plane. The course is designed to be self contained, but at the same time an extension of the 620-353 Discrete Mathematics course, where Penrose tilings are first introduced, as are existence theorems for tilings.

Subject: 620-445 Experimental Mathematics  
Lecturer: Dr Jan de Gier and Dr Ole Warnaar  
Prerequisites: No strict prerequisites  
Semester: 2  
Modern computers have developed far beyond BEING great devices for doing numerical simulations or tedious but straightforward algebra; and in 1990 the first mathematical research paper was published whose sole author was a thinking machine, known as Shalosh B Ekhad.
This course will discuss some of the great advances made in using computers to discover (and prove!) nontrivial mathematical theorems in, for example, Number Theory, Algebra and Combinatorics. Students will be given ample opportunity to develop their own Ekhad using symbolic software packages.

**Subject:** 620-424 Smooth dynamical systems  
**Lecturer:** Professor Hyam Rubinstein  
**Prerequisites:** 231 or 233; 311 and 322 recommended  
**Semester:** 1

Vector fields and flows; smooth manifolds; Poincare Hopf and Poincare Bendixson theorems for flows on surfaces; and a selection of topics from Anosov flows, structural stability, strange attractors and chaotic dynamical systems.

**Subject:** 620-426 Algebraic Topology  
**Lecturer:** Dr Iain Aitchison  
**Prerequisites:** 620-322, and 620-321 is recommended  
**Semester:** 1

This subject studies some fundamental questions in topology: classification of topological spaces and continuous maps between them. The aim is to reduce problems in topology to problems in algebra by introducing algebraic invariants associated to spaces and continuous maps. These concepts play a fundamental role in pure mathematics, and in theoretical physics, related to generalizations of Stokes theorem and the Euler characteristic, and enable us to generalize the intersections of subspaces in vector spaces to intersections of objects in more general spaces.

Topics will include: homology theory, CW complexes, cohomology theory and products, homology and cohomology of manifolds, Poincare duality.

**Subject:** 620-427 Differential Geometry  
**Lecturer:** Associate Professor Craig Hodgson  
**Prerequisites:** 231 or 233 and 311; 322 is recommended  
**Semester:** 2

This subject studies the geometry of curves, surfaces and higher dimensional manifolds using techniques from calculus.

Topics will include: smooth manifolds, Riemannian metrics, connections, geodesics and curvature. Applications to topology, hyperbolic geometry, minimal surfaces, or geometric evolutions equations may also be included.

**Subject:** 620-441 Integrable Models  
**Lecturer:** Dr Omar Foda  
**Prerequisites:** 620-331 and one of 620-221 or 252  
**Semester:** 2

Integrable models are dynamical systems whose equations of motion are nonlinear PDE's that can be integrated exactly.

They are interesting because of the wealth of mathematical tools that one is required to learn in order to study them.

In this course we use KdV, KP and related systems as examples of rich but integrable nonlinear PDE's, and on the way we introduce (the very basics of) at least 3 of the following topics:
1. Soliton solutions,
2. infinite dimensional Lie algebras,
3. free quantum fields,
4. symplectic geometry,
5. algebraic geometry, and
6. algebraic combinatorics.

Subject: 620-442 Phase Transitions and Critical Phenomena
Lecturer: Associate Professor Paul Pearce
Prerequisites: One of 620-331, 620-332, 620-353
Semester: 1

Gibbs ensembles in statistical mechanics, the thermodynamic limit, ideal gas, Tonks and van der Waals gasses, spin chains, mean-field theories of fluids and ferromagnets, phase transitions, critical exponents, universality and scaling, introduction to exactly solvable lattice models.

Subject: 620-431 Mathematical Biology
Lecturer: Associate Professor Kerry Landman and Associate Professor Barry Hughes
Prerequisites: 620-331
Semester: 1

Modern techniques have revolutionised biology and medicine, but interpretative and predictive tools are needed. Mathematical modelling is such a tool. It provides explanations for counter-intuitive results and predictions leading to new experimental directions. Mathematical techniques are beginning to play a key role in tackling challenges in the medical sciences. This subject will use discrete and continuum techniques to model the migration of individual cells and cell populations. Applications will be drawn from animal pattern formation, tumour growth, developmental biology and tissue engineering. The techniques covered will include some of partial differential equations, stability and perturbation techniques, random walk processes, evolving networks, random spatial structures, transforms, generating functions, asymptotic methods and simulation.

Subject: 620-432 Computational Mathematics (Honours)
Lecturer: Dr Steven Carnie
Prerequisites: 620-331 and ability to program in something, e.g. C, Matlab, Mathematica, Perl, Fortran
Semester: 1

In Computational Mathematics you will learn how to write and implement numerical solutions to a variety of problems commonly encountered in science and engineering. Understanding the behaviour of the mathematical problem gives insight into the pitfalls for the unwary in using canned packages inappropriately or uncritically.

The subject will cater for students who have done 620-381 (or equivalent), as well as those who have not. Topics will be selected from: solving an algebraic equation, solving linear and non-linear systems of equations, solving initial value problems for ordinary differential equations, stiff solvers, differential-algebraic equations (DAE), boundary value problems for ordinary differential equations (by shooting methods and relaxation) and the solution of parabolic, hyperbolic and elliptic partial differential equations or other topics, based on the interests of students. Assessment is by assignments and an oral presentation. Students will be expected to use Matlab for their assignments.

Subject: 620-433 Advanced Materials Modelling
Lecturer: Associate Professor John Sader and Dr Antoinette Tordesillas
Prerequisites: 620-342
Semester: 2
This subject focuses on physical principles and techniques for modelling the behaviour of advanced materials, which find applications in modern technological advances ranging from nanoelectromechanical (NEMS) systems and Atomic Force Microscopy to processes in the pharmaceutical industry involving the manipulation of fine powders and grains. Particular attention will be paid to development of continuum techniques and discrete models for describing the deformation and mechanical behaviour of elastic bodies and granular materials. As such, this subject will draw directly on fundamental knowledge gained by students in the field of fluid mechanics (620-342). Topics to be covered include basic properties of granular flow, friction, dilatation, mixing and segregation, and fundamentals of elastic deformation including indentation, deformation of beams and plates and variational principles governing their behaviour.

Advanced mathematical techniques will also be introduced enabling both exact and approximate solutions.

Subject: 620-461 Modelling of Business, Management and Industrial Problems
Lecturer: Professor Peter Taylor, Assoc/Professors Natasha Boland and Moshe Sniedovich
Prerequisites: No strict prerequisites
Semester: 2

The main thrust of this subject is the art and science of applied mathematical modelling. Although the subject will be problem-driven, it will cover in a systematic way the foundations of three distinct (yet obviously related) modelling paradigms:

- Integer Programming
- Sequential Decision Processes
- Stochastic Processes

This subject offers an excellent opportunity to non-OR students to gain useful generic OR skills.

Subject: 620-462 Integer and Dynamic Programming
Lecturer: Assoc/Professors Natasha Boland and Moshe Sniedovich
Prerequisites: 620-362 recommended
Semester: 1

- A tour of modern integer programming techniques, including polyhedral theory, branch-and-bound methods, cutting plane methods, valid combinatorial inequalities, and alternative relaxations and duals such as the Lagrangian relaxation and Lagrangian dual.

- A very gentle introduction to the art of and science of sequential decision-making including the theoretical and algorithmic aspects of dynamic programming and their applications in the context of practical problems.

Subject: 620-463 Network Optimization
Lecturer: Dr Sanming Zhou
Prerequisites: 620-261 or 620-352 (may be waived at the discretion of the lecturer)
Semester: 1

Network optimisation problems arise from a diversity of areas such as Industry, Management, VLSI Layout, Transportation, Telecommunication, Computer Networking, Information Processing, etc. This subject is an introduction to Network Optimization with focus on important ideas, theoretical results, algorithms and modelling. It covers classical problems that can be solved in polynomial-time, and some more difficult (NP-hard) problems for which polynomial-time algorithms are unlikely to exist. Topics are selected from: Problems and Algorithms, Minimum Spanning Trees, Shortest Paths, Maximum Flows, Minimum Cost Flows,
Multicommodity flows, Maximum Matching and Assignment Problems, Matroids and Greedy Algorithms, Computational Complexity, and Approximation Algorithms.

**Subject:** 620-401 Stochastic Optimisation Methods  
**Lecturer:** Associate Professor Felisa Vázquez-Abad  
**Prerequisite:** 620-301; 620-302 recommended  
**Semester:** 2

Discrete and continuous optimisation methods in stochastic environment. Reading subject, literature chosen from various topics including search methods, Q-learning, gradient-based methods, Markov Chain Monte Carlo, simulated annealing. Convergence analysis for off-line optimisation and on-line learning.

**Recommended References:**

**Subject:** 620-402 Probability for Inference  
**Lecturer:** Associate Professor Aihua Xia  
**Prerequisites:** 620-201; 620-301 and 620-302 recommended  
**Semester:** 1

Probability spaces and random variables, a measure theoretical approach. Expectation and conditional expectation, distribution-free and distribution-based approaches with applications to mean square estimation and to sufficient statistics. Modes of convergence and limit theorems with applications to estimation and hypothesis testing.

**References:**

**Subject:** 620-403 Stochastic Processes and their Applications  
**Lecturer:** Associate Professor Kostya Borovkov  
**Prerequisite:** Second year probability and some second year mathematics; 620-301; and 620-302 recommended
Semester: 2

References:
Procedures for Honours Program*

Introduction

The Honours program in Mathematics and Statistics is designed to:

- train students to enable them to proceed to postgraduate study at the University of Melbourne or other institutions; and
- equip students with a range of skills demanded by today’s employers that will make them highly employable.

For many students Honours is the most exciting and valuable year at university. Following up their special interests enables students to develop their research and analytic techniques and substantially extend the knowledge gained in earlier years. In some areas there is a possibility of applying theory to real world problems.

The Honours program in Mathematics and Statistics provides an opportunity for students to carry out an individual research project under the supervision of a staff member who is an expert in the area. They will learn how to effectively present their findings in print by using document preparation programs such as LaTeX, and how to prepare and deliver an oral presentation.

During the Honours program, students complete advanced Coursework consisting of at least six units, acquaint themselves with internet and other tools essential in mathematical and statistical research, such as MathSciNet (Mathematical Reviews online), and attend a series of seminars designed to further extend students’ specialized knowledge and to inform them about research and job opportunities in Mathematics and Statistics. The students will have the opportunity to share the findings of their research project with other students and staff in a presentation at the end of the program.

Every year the Department of Mathematics and Statistics publishes an Honours Guide which gives up to date information about the Honours Program, including the details of the subjects making up the Coursework component together with their prerequisites, as well as giving principal dates for the Honours year.

Honours students are a part of the Australian mathematical and statistical community, and should consider membership in professional organizations. The Australian Mathematical Society offers one year’s free membership to Honours students; the Statistical Society of Australia offers membership at half rate.

Structure of the Program

Mathematics and statistics Honours students are required to undertake six 24-lecture coursework units for assessment.

The subjects taught by the department that can be counted towards the coursework component will be listed in the Honours Guide each year. A great deal of flexibility is allowed for the structure of the coursework. With the prior approval of both the supervisor and the Honours Coordinator, a student may substitute an equivalent subject taught by another department, either within the University of Melbourne or at another university, for a mathematics and statistics coursework subject. One summer AMSI course (equivalent to 24 lectures) can be substituted for one coursework unit.

* Part of the department’s Honours Procedures.
With the assistance of the Student Administration Officer, the Honours Coordinator will keep a record of the subjects that each student is doing. It is the responsibility of the student to inform the Coordinator if they change subjects. Such a notification should be endorsed by the student’s supervisor.

Honours coursework subjects should be subject to the same rules about information given to students, subject homepages etc. as the university mandates for undergraduate subjects. In particular, all components of assessment must be clearly described before the beginning of the subject, and a subject description posted on the Honours noticeboard.

In addition to their coursework, Honours students are required to complete a thesis, which is equivalent to two units of coursework. The marks for the thesis thus count for 25% of the student’s assessment.

**Assessment**

It is desirable to have a significant component of the assessment for each subject as a written examination. The exam component should be worth at least 20%. Other forms of assessment can be by oral examination, by assignment, extended project or computer laboratory. If a lecturer does not want to offer an exam, he/she will have to state the case to the Honours Committee.

There will be two examiners’ meetings for the Honours Program, one after the end of each semester when the results of the coursework (projects) have been compiled. The purpose of these meetings is to finalize Honours results, with a power to adjust marks in certain cases. The examiners’ meeting also decides the allocation of the Wyselaskie scholarship for best overall Honours student in Mathematics and Statistics, chooses candidate Honours theses for the Nanson/Wilson prizes, and decides the allocation of the Dwight prize for the best Honours student in Statistics.

**Supervision**

At the beginning of their candidature a supervisor and a second examiner will be appointed for each Honours student. To assist in this process, a student is expected to contact a potential supervisor ahead of the beginning of the program. The Honours Coordinators should be advised after a supervisor is assigned.

- The role of the supervisor is to suggest the content and aim of the project, discuss relevant sources including textbooks, papers, reports, industry materials, etc., as well as the timeline for the project and the best strategy for combining the coursework and project. During the year, the supervisor should oversee the student’s progress, and provide advice and feedback.
- The role of the second examiner is to act as an advisor to the student during the year, and to carry out the role of the supervisor when the supervisor is unavailable.

The student is expected to provide a draft of the Thesis in good time for the supervisor to read and comment, and is responsible for submitting two final copies of the thesis by the deadline specified in the Honours Guide. The supervisor and the second examiner will be responsible for marking the thesis. They should submit independent written assessments to the Honours Coordinators, together with a written report, which ought to contain a section that will be provided to the student as feedback. The marking of the projects should be completed within a week of the submission of the deadline for submission of the Theses.

The general criteria for examining of the projects are set out in the next section. They will be made known to the students at the beginning of the year.
Examination of Honours Projects

It is expected that Honours projects will be prepared to a professional standard using a document preparation program such as LaTeX. Most projects are in the range of 45–50 pages, excluding references, appendices, tables, etc., slightly more for applied and statistics topics and less for pure topics. Samples of recent projects can be found in a dedicated section of the departmental library. In addition, a LaTeX style file for the projects will be put on departmental web.

The project will be assessed on several criteria which will be interpreted in the context of the mathematical/statistical category (pure mathematics, applied mathematics, operations research, probability, applied statistics, etc.), and will take into account the nature of the project (such as predominantly survey, new research, biological or industrial application, modelling, etc).

These criteria will include:

- clarity of exposition;
- mathematical accuracy;
- mathematical insight displayed;
- coverage of the field and references;

and may be complemented by one or more of the following:

- description of the application and/or business context;
- mathematical modelling;
- presentation and analysis of numerical results.

The weight given to these components will take into account the nature of the project.

The two examiners will assess the project independently. If there is a large discrepancy between the marks of the supervisor and the second examiner, the Honours Coordinator should ask them to consult about the case and either update their marks or provide a written explanation as to why they are different significantly.

Written reports by both examiners will be provided for the examiners’ meeting and then released to the students.

Examiners are expected to attend the talks by the students whose projects they are examining.

Honours Project Seminars

In all walks of life, including academia, presentation skills need to be developed and practised. So, whether they are heading towards a research career, or to a job in teaching, government or industry, it is very important for our Honours graduates to have good oral presentation skills. Because of this, the department places a high degree of importance on Honours talks.

During their candidature, students should give at least two talks. The first could be a progress talk on their project or on another related topic, and may be given before their research group. The second will be presented as part of a mini ‘Honours conference’ which is an all-departmental activity, and which will be held at the end of the final semester (in early July for the students finishing mid year and in late November otherwise).

No student should be expected to give a talk without at least one or two practices in presence of their supervisor.
Forms

BSc (Honours) and/or PGDip in Science Application Form

This form can be found at the end of this Guide. It is also available from the Department Office or the following websites:

http://www.science.unimelb.edu.au/honours/application.html#how

http://www.ms.unimelb.edu.au/Students/Honours/forms.html

The form should be completed and lodged with the Mathematics and Statistics Office by Thursday 30 November 2006 for commencement in Semester 1, and by Monday 2 July 2007 for commencement in Semester 2. After these dates please talk to the Honours Coordinators.

Alternatively, the application form can be submitted to A/Prof Kostya Borovkov or Dr Sanming Zhou.

Registration of Subject Interest and Project Details

There are two forms for registration of subject interest and project details, which can be found in the next two pages. Please fill in the appropriate one and submit it to one of the coordinators as specified on the form.
BSc (Honours) in Mathematics and Statistics

PROPOSED COURSE DETAILS 2007

Please return this form to Dr Sanming Zhou by January 31, 2007.

Name ___________________________ Student Number __________________

Email address ___________________________ Tel. (Mobile) No. __________

Program:  
- Honours in Mathematics and Statistics ❑
- Combined Honours in Mathematics and Statistics/Physics ❑
- Combined Honours in Mathematics and Statistics/Computer Science ❑

Status:  
- Part time ❑
- Full time ❑

Expected Completion Time:  June _______ (Year)  December _______ (Year)

Proposed Course Details (at least six to be chosen, including ICE-EM/AMSI courses)

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ICE-EM/AMSI Summer School Courses  ____________________________________________

Enter all subjects including subjects offered by other Departments and/or ICE-EM/AMSI; these should have been previously discussed with the Coordinator.

List of Potential Supervisors  (contact the supervisors by end of December 2006)

________________________________________________________________________

Approved by ___________________________ Date __________________

(Signature of the Supervisor)

________________________________________________________________________

Date __________________

(Signature of the Coordinator)
BSc (Hons) in Applied Statistics

PROPOSED COURSE DETAILS 2007

Please return this form to Associate Professor Kostya Borovkov by January 31, 2007.

Name ___________________________________ Student Number __________________

Email address ___________________________ Tel. (Mobile) No. _____________

Program: Honours in Applied Statistics ❑

Status: Part time ❑ Full time ❑

Expected Completion Time: June __________ (Year) December __________ (Year)

Proposed Course Details (at least six to be chosen, including KCSS, ICE-EM/AMSI courses)

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ICE-EM/AMSI Summer School Courses __________________________________________

Enter all subjects including subjects offered by other Departments, KCSS and/or ICE-EM/AMSI; these should have been previously discussed with the Coordinator.

List of Potential Supervisors (contact the supervisors by end of December 2006)

__________________________________________________________________________

Approved by ______________________ Date ________________
(Signature of the Supervisor)

______________________ Date ________________
(Signature of the Coordinator)