THE DEPARTMENT
OF
MATHEMATICS & STATISTICS

Honours Guide for 2008

University of Melbourne
Department of Mathematics and Statistics

Honours Guide 2008

Contents Page

Key Dates

Recommended Application Dates for Honours/PDGip Programmes in 2008:
Commencement in Semester 1: by Friday 30 November 2007
Commencement in Semester 2: by Friday 27 June 2008
(Applications may be accepted after these dates. Talk to the Honours Coordinators.)

ICE-EM/AMSI Summer School Registration (if applicable): See the website of the Summer School

ICE-EM/AMSI Summer School (if applicable): 14 January – 8 February 2008 (Monash U.)

Submission of "Proposed Course Details" form for students commencing in Semester 1: 31 January 2008

Honours/PGDip Commencement: One week before the start of lectures (for those who start their Honours/PGDip studies in February 2008)

Thesis Submission Deadline: 2:00pm, Friday 7 November 2008 (end-of-year completion)
2:00pm, Friday 6 June 2008 (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 28 November 2008 (end-of-year completion)
Friday 27 June 2008 (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/

ICE-EM/AMSI Summer School (2008): http://www.maths.monash.edu.au/amsiss08/

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 or PGDip studies, 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 12, 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 2008 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:

actuarial analyst	applied mathematician	business analyst
market researcher	physical chemist	economist
geophysicist	strategic planning manager	applied statistician

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 2008 and recorded on the form "Proposed Course Details 2008", 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 7 November 2008* for end-of-year completion and *2:00pm, Friday 6 June 2008* 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 28 November 2008* (end-of-year) or *Friday 27 June 2008* (mid-year).

Course Work

The Advanced Coursework subject accounts for 75% of the total assessment. All Honours Mathematics and Statistics students must complete 6 units of Honours course work. Each unit will be of one semester length and will normally consist of 24 lectures (usually one two-hour lecture per week). Full time students usually undertake 4 units in the first semester and two units in the second semester. The units 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 unit 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 2008. Note that ICE-EM/AMSI Summer School courses will be held from 14 January to 8 February 2008 at Monash University. Students who plan to incorporate one of these units into their Honours program should check the Summer School website:

http://www.maths.monash.edu.au/amsiss08/

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 Dr Deb King (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 reserves the right to scale the applicant's results to make them comparable to the marks of the University of Melbourne students.

♦ 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 2008 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

For information about possible Melbourne Honours Scholarships, visit:

http://www.science.unimelb.edu.au/scholarships.php

http://www.science.unimelb.edu.au/honours/smhs.php

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/

For information about the Faculty of Science scholarships, awards and prizes, please visit:

http://www.science.unimelb.edu.au/honours/scholarships.php

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 units 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.

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 Friday 30 November 2007 for commencement in Semester 1, 2008. Under certain circumstances students may be eligible for mid-year commencement; in this case the applicant should contact the Honours Coordinators by Friday 27 June 2008. After these dates talk to the Honours Coordinators.

Applications can also be mailed to:

Honours Program

Department of Mathematics & Statistics

The University of Melbourne

Parkville, VIC 3010, Australia

Although there is no mid-year intake in the Physics Honours Program in 2008, 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) units chosen from those offered through the *Key Centre for Statistical Science (KCSS)* at La Trobe and Monash Universities and RMIT as well as The University of Melbourne. Each unit consists of 24 hours of lectures presented in one 2-hour session per week during either first or second semester. Full details of these units are set out in the KCSS booklet that is available from the Mathematics and Statistics department office from mid-October, 2007.

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

Coursework Assessment

The assessment of the Advanced Coursework subject normally entails assignments (up to 50 pages) and a two-hour written exam for each of the six KCSS units. Examinations are held at the end of each semester. All KCSS units 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 units 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 program 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 Associate Professor Kostya Borovkov or Dr Sanming Zhou.

Course Work Timetable

The department reserves the right to alter the Honours units and their contents, times and lecturers under certain circumstances when necessary.

Semester One

Code	*Unit*	*Prerequisites*	*Lecture*
620-402	Probability for Inference	201	A/Prof Aihua Xia
620-411	Measure Theory	312	Prof Greg Hjorth
620-421	Geometric Group Theory	321; 322 recommended	Dr Lawrence Reeves
620-422	Commutative Algebra	321	A/Prof John Groves
620-424	Dynamical Systems	231 or 233; 311, 322 recommended	Prof Hyam Rubinstein
620-426	Algebraic Topology	322; 321 recommended	A/Prof Craig Hodgson
620-428	Operator Theory	312	A/Prof Jerry Koliha
620-431	Mathematical Biology	331	Prof Kerry Landman & A/Prof Barry Hughes
620-432	Computational Mathematics	331+ ability to program	Dr Steve Carnie
620-442	Phase Transition and Critical Phenomena	One of 331, 332, 353	A/Prof Paul Pearce
620-443	Topics in Graph Theory & Enumeration	221 or 252	A/Prof A. Owczarek and Prof Tony Guttmann
620-461	Modelling of Business, Management and Industrial Problems	no strict prereq.	Professor Taylor & A/Prof Boland
620-462	Integer Programming	no strict prereq.	Dr Heng-Soon Gan and Dr Kerem Akartunali
620-471	Analysis of Hierarchical Data	371	Dr Andrew Robinson
620-473	Statistical Inference	202 and any two 300-level subjects	Professor Richard Huggins
620-474	Consulting and Applied Statistics	371, 372	A/Prof Ian Gordon

Semester Two

Code	*Unit*	*Prerequisites*	*Lecture*
620-401	Stochastic Optimisation Methods	301	A/Prof Felisa Vázquez-Abad
620-403	Stochastic Processes & their Applications	301	A/Prof Kostya Borovkov
620-413	Complex Analysis	either 221 or 252 and 332	Dr Paul Norbury
620-423	Representation Theory	321	Prof Arun Ram
620-427	Differential Geometry	231 or 233, 311; 322 recommended	TBA
620-433	Advanced Material Modelling	342	A/Prof John Sader and A/Prof Antoinette Tordesilas
620-441	Integrable Models	331 and one of 221 or 252	Dr Omar Foda
620-444	Topics in Discrete Mathematics	353	Dr Richard Brak and Prof Peter Forrester
620-445	Experimental Mathematics	no strict prereq.	Dr J. de Gier
620-463	Network Optimisation	261 or 352	Dr Sanming Zhou
620-472	Data Mining	None	Dr Owen Jones

Honours Units in 2008

For details about the courses offered by ICE-EM/AMSI Summer School in 2008, see the following website:

http://www.maths.monash.edu.au/amsiss08/

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

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

Introduction

In 2007 the department will offer 27 Honours units 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.

** The department of Mathematics and Statistics reserves the right not to run an advertised unit.*

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.

Units 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 units are offered which are essential training for an applied statistician. The units 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 units (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 units by units 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: This 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 integra-

ble 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 units 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 units 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 deformablebodies 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 units 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 units 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.

Units

Unit: **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:
Hogg and Craig (1970) *Introduction to Mathematical Statistics*, Macmillan, 3rd ed.

Billingsley (1986) *Probability and Measure*, Wiley Series in Probability and Mathematical Statistics.

Shiryayev (1984) *Probability*, Graduate Texts in Mathematics Springer-Verlag.

Unit: **620-411 Measure Theory**
Lecturer: **Professor Greg Hjorth**
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.

Unit: **620-421 Geometric 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.

Unit: **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.

Unit: **620-424 Dynamical systems**
Lecturer: **Professor Hyam Rubinstein**
Prerequisites: **620-231 or 620-233; 620-311 and 620-322 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.

Unit: **620-426 Algebraic Topology**
Lecturer: **Associate Professor Craig Hodgson**
Prerequisites: **620-322, and 620-321 is recommended**
Semester: **1**

This unit 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.

Unit: **620-428 Operator Theory**
Lecturer: **Associate Professor Jerry Koliha**
Prerequisites: **620-312**
Semester: **1**

The unit is concerned with bounded linear operators between Banach and Hilbert spaces. These operators subsume matrices and differential and integral operators between function spaces. Of particular interest are functions of operators f(T), where f is a function originally of complex variable taking operators as its argument. The spectrum of an operator generalizes the set of eigenvalues of a finite matrix, and is shown to pack a great deal of information about the operator. Special classes of operators include compact, Kato, Fredholm and Browder operators. Theory of self-adjoint, normal and unitary operators on a Hilbert space forms a basis for a mathematical description of quantum physics initiated by von Neumann.

Unit: **620-431 Mathematical Biology**
Lecturer: **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 unit 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.

Unit: **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 unit 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.

Unit: **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.

Unit: **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: **1**

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.

Unit: **620-461 Modelling of Business, Management and Industrial Problems**
Lecturer: **Professor Peter Taylor and Assoc/Professors Natashia Boland**
Prerequisites: **No strict prerequisites**

Semester: 1

The main thrust of this unit is the art and science of applied mathematical modelling. Although the unit 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 unit offers an excellent opportunity to non-OR students to gain useful generic OR skills.

Unit: 620-462 Integer Programming
Lecturer: Dr Heng-Soon Gan and Dr Kerem Akartunali
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.

Unit: 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.

Unit: 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.

Unit: 620-474 Consulting and Applied Statistics
Lecturer: Associate Professor Ian Gordon

Prerequisites: 620-371, 620-372; 620-374 recommended
Semester: 1

This unit 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.

Unit: 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 unit, 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:

Kushner, Yin (2003), Stochastic Approximation and Recursive Algorithm and Applications. Series: Stochastic Modelling and Applied Probability Vol 35, 2nd ed., Springer Verlag, NY.

Robbins, H. and Munro, S. "A Stochastic Approximation Method." Ann. Math. Stat. 22, 400-407, 1951.

Kiefer, J. and Wolfitz, J. "Stochastic Estimation of the Maximum of a Regression Function." Ann. Math. Stat. 23, 462-466, 1952.

Peter W. Glynn, Ward Whitt. The asymptotic efficiency of simulation estimators Source,

Operations Research, Volume 40, Issue 3, May-June 1992, 505.

L'Ecuyer and Yin. "Budget-Dependent Convergence Rate of Stochastic Approximation.", SIAM Journal on Optimization 8(1) (1998), 217--247.

Tsitsiklis. "Asynchronous Stochastic Approximation and Q-Learning." Machine Learning16 (1994), 185-202.

Bertsekas, D. P., and Tsitsiklis, J. N. 1996. Neuro-Dynamic Programming. Belmont, MA: Athena Scientific.

Yin, Krishnamurthy and Ion (2004). "Regime Switching Stochastic Approximation Algorithms with Application to Adaptive Discrete Stochastic ", SIAM J. Optim. Vol. 14, No. 4, pp. 1187-1215.

Unit: 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

Basic concepts of the theory of stochastic processes. Finite dimensional distributions and path properties. Convergence of stochastic processes and Skorokhod theorem. Theory of martingales with applications. Processes with independent increments. Markov processes. Applications to modelling throughout the course.

References:
Ross, S.M (1996) *Stochastic Processes*. Wiley, New York.

Grimmett, G.R. and Stirzaker, D.R. (1981) *Probability and Random Processes*. Clarendon Press, Oxford.

Unit: **620-413 Complex Analysis**
Lecturer: **Dr Paul Norbury**
Prerequisites: **either 620-221 or 620-252 and 620-332**
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 form 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

Unit: **620-423 Representation Theory**
Lecturer: **Professor Arun Ram**
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.

Unit: **620-427 Differential Geometry**
Lecturer: **TBA**
Prerequisites: **620-231 or 620-233 and 620-311; 620-322 is recommended**
Semester: **2**

This unit 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.

Unit: **620-433 Advanced Materials Modelling**
Lecturer: **Associate Professor John Sader and Dr Antoinette Tordesillas**
Prerequisites: **620-342**
Semester **2**

This unit 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 unit 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.

Unit: **620-441 Integrable Models**
Lecturer: **Dr Omar Foda**
Prerequisites: **620-331 and one of 620-221 or 620-252**
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.

Unit: **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: **2**

The bulk of the course will be on enumerative combinatorics with an emphasis on bijective techniques. It is based on the books ``Constructive Combinatorics'' by D. Stanton and D. White, ``Enumerative Combinatorics'' Vol.1 by R. Stanley and a set of lecture notes. Topics will be selected from: Binomial Paths & Identities, Lattice Paths, Binary and other trees, Algebraic languages, Permutations, Partitions, Involution's, Symmetric functions, orthogonal polynomials and Young Tableaux.

Unit: **620-445 Experimental Mathematics**
Lecturer: **Dr Jan de Gier**
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 do develop their own Ekhad using symbolic software packages.

Unit: **620-463 Network Optimization**
Lecturer: **Dr Sanming Zhou**
Prerequisites: **620-261 or 620-352 (may be waived at the discretion of the lecturer)**
Semester: **2**

Network optimisation problems arise from a diversity of areas such as Industry, Management, VLSI Layout, Transportation, Telecommunication, Computer Networking, Information Processing, etc. This unit 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.

Unit: **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.

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 units 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 units 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 unit taught by another department, either within the University of Melbourne or at another university, for a mathematics and statistics coursework unit. 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 units that each student is doing. It is the responsibility of the student to inform the Coordinator if they change units. Such a notification should be endorsed by the student's supervisor.

Honours coursework units should be subject to the same rules about information given to students as the university mandates for undergraduate subjects. In particular, all components of assessment must be clearly described before the beginning of the unit, and a unit 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 unit 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 asssist 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 on the following websites:

http://www.science.unimelb.edu.au/honours/application.php

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

The form should be completed and lodged with the Mathematics and Statistics Office by Friday 30 November 2007 for commencement in Semester 1, and by Friday 27 June 2008 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 2008

Please return this form to Dr Sanming Zhou by January 31, 2008.

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)

Semester 1	Semester 2

ICE-EM/AMSI Summer School Courses _____

Enter all units including units 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 2007)

_____

Approved by _____ **Date** _____
(Signature of the Supervisor)

_____ **Date** _____
(Signature of the Coordinator)

BSc (Hons) in Applied Statistics
PROPOSED COURSE DETAILS 2008

Please return this form to Associate Professor Kostya Borovkov by January 31, 2008.

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)

Semester 1	Semester 2

ICE-EM/AMSI Summer School Courses _____

Enter all units including units 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 2007)

_____

Approved by _____ **Date** _____
(Signature of the Supervisor)

_____ **Date** _____
(Signature of the Coordinator)

Bachelor of Science (Degree with Honours) and/or Postgraduate Diploma in Science

Application for Admission in 2008

THE UNIVERSITY OF MELBOURNE

This application form must be submitted to the department where you wish to be considered for selection (not to the Faculty of Science Office).

All applicants must complete this application form to be considered for either the Bachelor of Science (Degree with Honours) or Postgraduate Diploma in Science in 2008. The only exception is applicants for the Bachelor of Science (Degree with Honours) in Psychology who must apply on-line via the Student Information System: https://sis.unimelb.edu.au/

International applicants who were not studying at the University of Melbourne in 2007 (i.e. international applicants who have completed or are completing an undergraduate science program at an institution other than the University of Melbourne) must also apply separately to the International Admissions Office. On-line applications for international applicants and a downloadable international application form (pdf) are available at the following URL:

http://www.futurestudents.unimelb.edu.au/int/iug/iugapply.html

ALL APPLICANTS: Before submitting your application to the relevant department, please:

1. Read the information pertaining to the Bachelor of Science (Degree with Honours) or the Postgraduate Diploma in Science available on the Web at the following addresses: http://www.science.unimelb.edu.au/honours/ and/or http://www.science.unimelb.edu.au/pgrad/index.php Additional information on Fourth Year programs can also be found on the websites of each of the teaching departments of the Faculty of Science.
2. Liaise with the relevant departmental course coordinators to discuss potential supervisors and other departmental application requirements. Applicants for formal combined Honours programs (i.e. conducted across two departments) must liaise with both departments before submitting their applications.
3. Complete the relevant sections of this application, and submit the application along with the required documentation as detailed below, to the relevant department. If you wish to apply to more than one department, you must submit a separate application form and a certified copy of complete documentation to each department.

APPROVALS: All applications require the approval of the Head of Department (or nominee) and the Faculty of Science.

CLOSING DATES: Applications should normally be submitted to the department by 30 November 2007 for commencement in semester 1 and by 30 June 2008 for commencement in semester 2. Some departments may accept late applications. All enquiries regarding late applications should be directed towards the relevant department.

1. PERSONAL DETAILS

Family Name:	Given Names:	
(University of Melbourne students only): Student Number:	Title:	Date of Birth:
Postal Address:		
Postcode:	Email:	
Telephone:	Mobile Telephone:	

If you are a previous or current student of The University of Melbourne you are reminded that it is your responsibility to ensure that your contact details are correct on the student database. You can update these details on-line via the Student Information System: https://sis.unimelb.edu.au/

Citizenship/Residency Status at the time of application (please tick one only):

❏ Australian Citizen
❏ Australian Permanent Resident
❏ New Zealand Citizen
❏ International Student (includes New Zealand Permanent Residents)

2. COURSE DETAILS

2.1 I wish to be considered for the following program (please tick one or both):

❑ Bachelor of Science (Degree with Honours) ❑ Postgraduate Diploma in Science

(Note: not all programs are available as PGDipSc)

2.2 I wish to undertake the course/s indicated above through the Department of

_____

(if you are applying for a combined Honours program e.g. Chemistry/Biochemistry, please name both departments)

2.3 I wish to undertake this course on a: ❑ Full time basis ❑ Part time basis

(Note: not all programs are available on a part time basis)

2.4 I wish to commence this course in: ❑ Semester 1, 2008 ❑ Semester 2, 2008

(Note: not all programs have a mid year intake)

2.5 FEE TYPE (Australian Citizens, Australian Permanent residents and New Zealand citizens only)

❑ I wish to apply for a Commonwealth-Supported place

❑ I wish to apply for an Australian Fee-paying place

3. ACADEMIC HISTORY

Please list details of all tertiary qualifications completed or attempted:

Name of Qualification	Name of Institution and State/Country	Year/s

REQUIRED DOCUMENTATION: refer to page 4 of this application form.

4. APPLICANT DECLARATION

- I acknowledge that this application is submitted on the understanding that the University of Melbourne may obtain copies of my academic transcripts from any tertiary institution.
- I declare that to the best of my knowledge the information supplied herein is correct and complete and I acknowledge that the provision of incorrect information or the withholding of relevant information relating to my application may result in the withdrawal by the University of any place which may be offered, and that this withdrawal may take place at any stage during the course I undertake.
- I understand that if I have completed or will be completing studies at an institution other than the University of Melbourne, I am required to provide an original or certified copy of my transcript(s) as outlined on page 4, along with an original or certified copy of an official letter indicating that I have completed my degree if this is not clearly stated on my transcript.
- I acknowledge that, if requested, I am willing to provide evidence of my citizenship/residency status, or I am an international applicant who has already supplied citizenship documentation to the International Admissions Office.
- I agree that if I am offered a place in the Bachelor of Science (Degree with Honours) or Postgraduate Diploma of Science on a full-time basis, I will not undertake more than seven hours paid employment per week during my candidature.
- I have discussed my application with appropriate staff in the Department (e.g. potential supervisors, Fourth Year coordinators).
- I understand that the University of Melbourne may disclose the personal information I have given in this application form to the Department of Education, Science and Training (DEST) and that DEST will collect and store my personal information in the Higher Education Information Management System.

Applicant Signature:_____ Date: _____

The University of Melbourne's Privacy Statement can be viewed online at:
http://www.unimelb.edu.au/unisec/privacy/studentinfo.html

5. TO BE COMPLETED BY HEAD OF DEPARTMENT OR DELEGATED AUTHORITY

5.1 Commencement Date (please list exact date if possible, otherwise nominate semester) _____

Attendance Type: ❑ Full time or ❑ Part time (part time is 50% load for two years)

5.2 Supervisor/s (List principal supervisor first):

Note: It is the Department's responsibility to ensure that the load for any supervisor does not exceed the recommended maximum of seven equivalent full-time students.

Title	Name	Department

5.3 Animal/Human Experimentation

Does the program include any component that falls within the terms of reference of the University's Ethics Committee?

❑ Yes ❑ No

Note: It is the responsibility of the Head of Department to ensure that appropriate approval has been obtained from the relevant Ethics committee before the commencement of any experimentation.

5.4 Head of Department's (or delegated authority's) Recommendation and Declaration

I recommend that this applicant (please tick one box only):

- ❑ Be selected for the Bachelor of Science (Degree with Honours).
- ❑ Be selected for the Postgraduate Diploma in Science.
- ❑ Be selected for the Postgraduate Diploma in Science with the possibility of transferring to the Bachelor of Science (Degree with Honours) after making satisfactory progress in their research component and achieving an average of at least _____% in their coursework component (65% is the normal requirement) after one semester of full-time study (equivalent).
- ❑ Not be selected for either the Bachelor of Science (Degree with Honours) or Postgraduate Diploma in Science. (Please indicate the reason/s for non-selection in comments field, below).
- ❑ No longer be considered for selection as the application has been withdrawn.

Where this applicant has been selected,

- I certify that this candidate will receive at least 30 hours of advanced teaching (400-level) per year (equivalent full time) in the form of either tutorials or formal lectures given by members of staff.
- I acknowledge my responsibility in relation to obtaining appropriate Ethics Committee approvals on behalf of the candidate.
- I am satisfied that the candidate has sufficient time available to devote to research in order to complete the course.

Comments: _____

_____

_____

_____

_____

Name: _____ Signature: _____

Date: _____

Faculty Office Use Only

Notes:

REQUIRED DOCUMENTATION to accompany this application form

Applicants who have completed their degree (or who are currently completing their degree) at the University of Melbourne are not required to supply transcripts of their studies at the University of Melbourne. These applicants must however, provide documentation as indicated below, for any qualifications attempted at tertiary institutions other than the University of Melbourne.

Applicants from institutions other than the University of Melbourne:

- Must provide an original or certified copy of their official transcript on official university stationery which contains that university's logo, indicating all subjects and results in all years of study for each qualification completed or attempted, along with an explanation of that university's grading system. Applicants are advised that documents other than an original or certified copy of their official transcript, including faxed documents, documents obtained via the internet or documents that indicate results for one year only, will not be accepted.
- Must ensure that if their transcript does not include a statement that they have successfully completed their degree, they will provide an original or certified copy of an official letter from their institution explicitly indicating this achievement.
- Who are currently completing their degree (i.e. have not yet completed) should submit this application by the due date with a transcript indicating their results to date. Once their final results are available, they should submit a transcript indicating their final results, along with an official letter explicitly indicating that they have successfully completed their degree (if this is not stated on the transcript) to the relevant department.

CERTIFICATION OF DOCUMENTS

A certified copy is a photocopy of the original document which has the signature and official stamp of one of the following persons, indicating that they have sighted the original document: Barrister or Solicitor, Police Officer in Charge of Station, Pharmacist, Doctor (MBBS), Dentist, Principal of School, Justice of the Peace or Clerk of Court. The signature and stamp must appear on every page. A photocopy or facsimile of a certified copy is unacceptable.

Photocopies of academic transcripts from another institution that have been certified by an officer of that institution are not acceptable (unless that person is also qualified to certify documents, as described in the preceding paragraph).

Please note that if any of the above documents do not include your current name, i.e. the name under which you have applied for the course, you will need to provided certified copies of legal evidence of your change of name (e.g. Marriage Certificate)