Note: The structure of KCSS is in a transitional stage this year. The role of the University of Melbourne is only as a provider of subjects to KCSS. Therefore, please note the following:

1. KCSS students enrolled at Monash, La Trobe and RMIT Universities are allowed to enrol, for credit, in certain subjects taught at the University of Melbourne. The details are provided later in this Handbook.

2. KCSS understands that students enrolled in the Honours Math/Stat program at the University of Melbourne would not be allowed by the University of Melbourne to enrol in any of the subjects taught at Monash, La Trobe and RMIT Universities for credit. For any queries, please contact Dr. Kostya Borovkov on K.Borovkov@ms.unimelb.edu.au

Please visit the following official KCSS web site for an on-line version of this handbook, late changes to subject details and important notices:


This printed version of the handbook was produced on 7 May 2009.
Contents

1 Key Centre for Statistical Science courses 2
   1.1 Master of Statistical Science (M.Stat.Sc.): La Trobe ................. 2
   1.2 Master of Applied Econometrics (M.App.Econometrics): Monash University 3
   1.3 Master of Applied Science (M.App.Sc.): RMIT .......................... 4
   1.4 Honours Year: La Trobe, Monash and RMIT ............................. 4
   1.5 Generic skills ........................................................................... 4

2 Components and timetable 5
   2.1 Lecture timetable .................................................................... 5

3 Elective components 7
   AMD: Analysis of Medical Data ....................................................... 8
   EDA: Exploratory Data Analysis .................................................... 9
   FE2: Financial Econometrics 2 ....................................................... 10
   GTA: Game Theory and Applications ............................................ 11
   PEC: Principles of Econometrics .................................................. 12
   RA: Regression Analysis .............................................................. 14
   SIL: Statistical Inference - La Trobe ............................................ 15
   SQPI: Statistics for Quality and Productivity in Industry ............... 16
   SPA: Spatial Analysis ................................................................. 17
   STP: Stochastic Processes ............................................................ 18
   SCFM: Stochastic Calculus and Financial Mathematics ............... 19

4 Minor thesis 20
1 Key Centre for Statistical Science courses

The Key Centre for Statistical Science (KCSS) links statisticians and econometricians from La Trobe University, Monash University and RMIT University.

The main function of the KCSS is to offer courses leading to a BSc (hons), BCom(Hons), or a masters degree. Students must apply for admission at one of the participating universities. They should first discuss their proposed course with the course coordinator of the department, and complete the university’s application form for admission to candidature.

For honours students, enrolments will need to be completed at the required time for that university.

For students applying for the RMIT M.Appl.Sc. course, there are two rounds of applications. Please contact the RMIT coordinator for details.

Applicants may enrol either on a full-time or a part-time basis. Depending on the course components chosen, candidates may be required to attend lectures at more than one university.

1.1 Master of Statistical Science (M.Stat.Sci.): La Trobe

To be eligible to enrol in this course, students must have already completed an appropriate honours degree with sufficiently high marks. Students with a pass degree or an honours degree with lower marks may be accepted into the course provided they first complete other appropriate preliminary work as determined by the department.

NOTE: The M.Sc. (by coursework) degree is no longer available at The University of Melbourne and at Monash University.

The course consists of

1 Consulting and Applied Statistics (CAS)
2 Four approved elective components
3 Supervised consulting experience
4 Minor thesis.

This is a one year full-time or two years part-time course. However, if necessary, extra time may be allowed to those students who have difficulty in completing the minor thesis.

In order to complete the course satisfactorily, a student must

- achieve an average grade of 65 or more in the four components (with no more than one result less than 50);
- pass CAS; and
- submit a thesis which is deemed satisfactory by two examiners, (at least one of whom must be external to the student’s home university).

This is suitable for graduates in areas such as Business, Economics, Econometrics, and Statistics. Students may elect to specialize in any one of the following areas:

- Econometrics
- Business Law and Taxation
- Economics
- Finance
- International Business
- Marketing

The subjects may be selected from a wide range to suit the training and other requirements of each individual student. Graduates from disciplines other than econometrics would find this course particularly suitable to enhance their career in the industry. For example, graduates in finance may include advanced subjects in finance and choose research projects and/or minor thesis in financial econometrics; similarly graduates in marketing may complete a minor thesis that covers marketing and econometrics. On the other hand, graduates with specialized training in econometrics/statistics, may choose more theoretically oriented units (i.e. subjects) offered by the Department of Econometrics and Business Statistics.

Students enrolled in this course may choose any subjects offered under the auspices of KCSS and also those offered by the Faculty of Business and Economics of Monash University subject to approval by the Department. Up to four 9000 and/or 5000 level elective units from another Department in the Faculty of Business and Economics (for example, Finance, Marketing, Accounting, etc) may be chosen. Thus, this course could be tailor made to suit a broad range of needs.

To be eligible to enrol in this course, students must have already completed an appropriate degree with sufficiently high marks. Students who successfully complete the Graduate Diploma in Applied Econometrics or equivalent with an average grade of Credit or above may apply for credit exemptions for up to 50% of the value of the masters program - only certain subjects qualify for such credit exemptions. The course consists of coursework, research projects and a minor thesis. The length of the program is three semesters full-time, or six semesters part-time.

For more details about this course, please refer to the Monash University - Postgraduate Handbook, or visit

1.3 Master of Applied Science (M.App.Sc.): RMIT

To enrol in this course, candidates must have a Science or Engineering degree. The course can be taken on a four-year part-time or two-year full-time basis. Students are required to complete at least fifty percent of the course components at RMIT. The course consists of

1. Consulting Workshop
2. Minor Thesis
3. Twelve approved elective components selected from the KCSS and RMIT Masters Degree Courses.

To qualify for the award of the Master’s Degree, students must

- achieve an average grade of 65 or more in the twelve elective components;
- pass Consulting Workshop; and
- submit a thesis which is deemed satisfactory by two examiners (at least one of whom must be external to RMIT).

Students with an honours degree in Mathematics or an approved Graduate Diploma can claim exemptions for up to a maximum of eight elective components, that is, the equivalent of the full-time first year of the course.

1.4 Honours Year: La Trobe, Monash and RMIT

The Key Centre elective subjects may be taken by students completing an honours degree as part of their coursework. Students should consult their home institution for details about other components of their honours year.

1.5 Generic skills

In addition to learning specific technical skills that will assist you in your future careers in science, engineering, commerce, education or elsewhere, you will have the opportunity to develop in this program, generic skills that will assist you whatever your future career path.

- You will develop problem-solving skills including engaging with unfamiliar problems, and identifying relevant strategies.
- You will develop analytical skills - the ability to construct and express logical arguments and to work in abstract or general terms to increase the clarity and efficiency of the analysis.
- Through interactions with fellow students, you will develop the ability to work in a team. The department distinguishes between ethical collaboration, which is strongly encouraged, and plagiarism, which is prohibited.
- You will develop your oral presentation skills, practicing presentation of technical solutions. This practice will assist you in learning how to present material in a well-organized, well-structured, lucid and persuasive fashion.
- With assessable material to be submitted throughout the semester, you will learn to manage your time, balance competing commitments and set and meet regular deadlines.
2 Components and timetable

Several components require some background in statistical computing packages. Students should ensure that they have familiarity with the computing facilities at their home institution and have an adequate background in the computing required in the components of their choice.

The weeks for lectures in each KCSS component are determined by the semester dates for the institution offering that component.

2.1 Lecture timetable

IMPORTANT: Please check the official KCSS web site for late changes and other up to date information/notices.

This timetable may change before, or after, classes start.

For more information about the time-table for the electives, please contact the lecturer or the KCSS Coordinator of your home institution. The KCSS Coordinator’s name and contact details for each institution are given on the page after the title-page.

For information about subjects at the University of Melbourne, please see the next page.

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<tr>
<th>FIRST SEMESTER</th>
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<td>Component</td>
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<td>RA</td>
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<td>SPA</td>
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<tr>
<td>SQPI</td>
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<tr>
<td>STP</td>
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<td>SCMF</td>
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<tr>
<th>SECOND SEMESTER</th>
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<tbody>
<tr>
<td>Component</td>
</tr>
<tr>
<td>SIL</td>
</tr>
<tr>
<td>AMD</td>
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<tr>
<td>GTA</td>
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<td>EDA</td>
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<td>PEC</td>
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<td>FE 2</td>
</tr>
</tbody>
</table>
Information about subjects offered at the University of Melbourne and available for KCSS students:

The following subjects offered at the University of Melbourne will be available to students undertaking subjects within the KCSS structure.

Semester 1:
620638 Consulting and Applied Statistics
620618 Probability for Inference
620620 Statistical Inference

Semester 2:
600655 Business Forecasting
620639 Data Mining
620624 Stochastic Processes

Any probability or statistics subject from the new MSc (research training) program will be available to KCSS students as well; these subjects are also available to the honours students at the University of Melbourne.

Semester 1 timetable can be downloaded from the Web page,

http://www.ms.unimelb.edu.au/Students/MSc_Honours/Current_MSc_Honours.php

For descriptions of individual subjects, please check the MSc/Honours guide for 2009 (also downloadable from the same Web page).

Semester 2 timetable is not available yet. For individual subjects, you may wish to find their timetables at

https://sis.unimelb.edu.au/cgi-bin/subjects.pl

using the subject codes (see above)
3 Elective components

The following list of components contains a brief summary of syllabus, references and prerequisite knowledge that will be assumed in each of the components. Students should use this information to choose suitable components and to revise their knowledge in preparation for attending those components.

The KCSS grades results in elective components as follows:

<table>
<thead>
<tr>
<th>Grade</th>
<th>Description</th>
<th>Percentage Mark</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>very good to excellent</td>
<td>75 to 100</td>
</tr>
<tr>
<td>B</td>
<td>satisfactory</td>
<td>65 to 74</td>
</tr>
<tr>
<td>C</td>
<td>unsatisfactory</td>
<td>50 to 64</td>
</tr>
<tr>
<td>D</td>
<td>poor</td>
<td>0 to 49</td>
</tr>
</tbody>
</table>

Further information concerning the lecturer, the semester in which the component is to be offered and the venue are also given for each component in the list. Refer to Section 2.1 (Lecture Timetable) for information on lecture times and room numbers.
Lecturer  Associate Professor Robert G. Staudte, La Trobe.

Syllabus
Calibrating evidence in a test, variance stabilizing transformations, one- and two-sample Binomial models (including risk difference, relative risk and odds ratios). Evaluating and comparing Poisson rates. Evidence in one and two-sample Welch t-tests, and chi-squared tests, including the Cochran Q test for heterogeneity of fixed and random effects. Combining evidence from independent studies, using fixed and random effects models. Compensating for publication bias. The evidence obtained by variance stabilization will be the basis for confidence intervals for effects, which are demonstrably more accurate than those obtained by traditional large-sample methods.

Prerequisites  A third year unit in statistical inference, and some knowledge of the software package R.

References

EDA Exploratory Data Analysis

Lecturer Dr. Yan Wang, RMIT.
Details are not yet available.
**FE2 Financial Econometrics 2**

**Lecturers:** Associate Professor Gael Martin and Dr. Catherine Forbes

Offered in the second semester at the Clayton Campus.

**Syllabus**

This unit introduces students to a range of advanced, current techniques used in analysing financial data. Topics covered include the analysis of the time series and distributional features of financial data; the use of stochastic volatility and realized volatility models to capture time-varying volatility, including long memory in volatility; the use of econometric methods to estimate Value at Risk; the modelling of transactions data using trade duration models and transaction-based volatility models; continuous time processes and the application of econometric techniques to option pricing; and the use of generalized method of moments in financial models.

The subject code for this unit at Monash University is ETC4460. Please refer to Monash University Handbook for more details.

**Assessments:** Written/Computer-based: 40%; Examination (3 hours): 60%

**Contact Hours:** 2 1.5 hour lectures per week for 11 weeks.

**Prerequisites**

Equivalent to the following offered at Monash University: ETC3460 or ETC4346 and at least one of ETC3400, ETC3410, ETC3450.
GTA Game Theory and Applications

Lecturers Professor P. Zeephongsekul, RMIT.

Syllabus
Basic Concepts in Game Theory: examples; Strategic (normal) and extensive form of representing games; Equilibria concepts in game theory; two-person zero-sum games; mixed strategies and minimax theorem; 2x2 games and graphical solutions; matrix games and linear programming; infinite games; Bayesian games; sequential games; cooperative games; characteristic function form.

Prerequisites
Basic knowledge of calculus, probability theory, linear algebra and linear programming.

References There are no prescribed texts for this subject. A set of class notes covering all the materials covered will be made available to students.
**Principles of Econometrics**

**Lecturer**  Associate Professor Gael Martin, Monash University.

**Syllabus**

This unit provides a formal treatment of the core principles underlying econometric and statistical analysis, with particular focus given to likelihood-based inference. Topics covered include the likelihood principle and maximum likelihood estimation; minimum variance unbiased estimation; maximum likelihood asymptotic distribution theory; likelihood-based hypothesis testing; and quasi-maximum likelihood inference. The theoretical developments are supplemented by numerical results produced using computer simulation. Consideration is also given to the numerical optimization techniques used to implement likelihood-based procedures in practice.

**UNIT OBJECTIVES:**

The learning objectives of this unit are to:

- consolidate the core principles underlying econometric and statistical analysis;
- understand and implement the technique of maximum likelihood estimation and develop an appreciation of the associated asymptotic distribution theory;
- understand and implement likelihood-based hypothesis testing and quasi-maximum likelihood inference;
- develop the skills needed to demonstrate and explore theoretical sampling properties using computer simulation;

**READING**

**Prescribed Text**

There is no single prescribed text for this unit, as the printed lecture notes are very complete. However, the main recommended texts will be frequently referenced and are available both in the book shop and the library (including on reserve)

**Main Recommended Texts**

Additional (More Advanced) Texts


ASSESSMENT:

Regular assignments worth 40% in total. One final exam worth 60%.

COMPUTING:

The computer package used in this course is EVIEWS. Some programing in EVIEWS will be used in the completion of the tutorial exercises and assignments.

PREREQUISITE:

ETC2410 Introductory Econometrics (or equivalent)
Regression Analysis

Lecturer Dr Luke Prendergast.

Syllabus
Multiple linear regression; classical estimation and testing; residual analysis; practical experience using the statistical package R; diagnostics; weighted least squares; ridge regression; robust regression; an introduction to modern dimension reduction techniques including Sliced Inverse Regression.

Prerequisites Least squares fitting of multiple linear regression models. Exposure to t and F tests for ordinary least squares and familiarity with statistical inference concepts at a 3rd year level. At least an intermediate knowledge of linear algebra concepts including matrix addition and multiplication, matrix inversion, span, basis of a vector space, orthogonal vectors, eigenvalues and eigenvectors. A suitable level would be Ayres, Theory and problems of matrices Schaum’s Outline Series, although not all that book need be known. Familiarity with the software package R would be useful but not essential.

References
Lecturer  Associate Professor Paul Kabaila, La Trobe University.

Syllabus

This unit covers a selection of topics in classical statistical inference at the fourth year level. It consists of a selection of material from the following chapters of Casella and Berger (2002): Chapter 6 (Principles of Data Reduction), Chapter 7 (Point Estimation), Chapter 8 (Hypothesis Testing), Chapter 9 (Interval Estimation) and Chapter 10 (Asymptotic Evaluations). A knowledge of this material is helpful in almost any statistical endeavour. SI complements SIM.

Assignments will be given out weekly, starting in week 2. Students will be given 2 weeks to complete these assignments, so as to provide them with plenty of opportunity to ask for help with these assignments. It is planned to teach this unit in the Access Grid Room in the Department of Mathematics and Statistics at La Trobe University.

Prerequisites

A knowledge of statistical inference at the third year level.

References

Lecturer Dr. Mali Abdollahian, RMIT.

Syllabus

Prerequisites
Probability and Statistics at 3rd year university level.

References
Lecturer Dr Andriy Olenko, La Trobe University

Syllabus
The unit surveys the theory of random fields, spatial statistics models, and their applications to a wide range of areas, including image analysis and GIS (geographic information system). The course will cover the methodology and modern developments for spatial-temporal modelling, estimation and prediction, and spectral analysis of spatial processes. All the methods presented will be introduced in the context of specific datasets.

Prerequisites Basic knowledge of calculus, probability theory, and statistical inference at the third year level. Familiarity with the software package R would be useful but not essential.
STP  Stochastic Processes

**Lecturer** Dr. B. Miller, Monash, Clayton.

For further details, please contact the lecturer.
Lecturer  Professor F.C. Klebaner, Monash.

For further details, please contact the lecturer.
4 Minor thesis

Each coursework master’s candidate is required to write a Minor Thesis under the supervision of a staff member from the candidate’s home university (that is, the university where the candidate is enrolled).

In keeping with the objectives of the coursework master’s program, the thesis should normally be on a topic of applied statistics. Typically, a thesis might give a critical review of some statistical analyses and illustrate their application to an original data set, possibly incorporating adjustments to the analyses which the chosen data set and the objectives of the study demand. Substantial original research is not expected, but a display of ingenuity will be highly regarded.

The abilities which should be demonstrated by a good thesis are as follows:

(a) a command of the knowledge and skills pertinent to the area;
(b) an ability to communicate in correct English and present the information in a form consistent with the scientific conventions for Statistics;
(c) an ability to survey critically the relevant literature;
(d) an ability to state objectives clearly, to pursue them methodically and to argue clearly and critically;
(e) a critical appreciation and understanding of the relationship of the candidate’s own work to that of others;
(f) an ability to contribute to the knowledge of the subject.

The abilities are ranked. The further up the ranking the demonstrated abilities the better the thesis. Thus, an excellent thesis would be one showing an ability to contribute to the subject. To pass, a reasonable level of abilities (a)–(d) must be demonstrated.

Past experience shows that full-time students spent 25 to 50 percent of their study time (in the final year) working on the thesis.

There will be two examiners for each thesis, at least one of whom will be an external examiner (i.e. not from the home university). The supervisor cannot be an examiner for the thesis. If examiners return conflicting reports, a third examiner will be appointed.

Role of your supervisor

The supervisor is expected to:

• provide guidance in selecting a topic;
• give you references to books and papers etc.;
• advise on any problems encountered during the process and regularly discuss with you the progress of your research;
• point out the typing or other errors in the thesis, as far as possible leaving the corrections to be made by you;
• advise about the presentation of the thesis and final talk.

The supervisor is not expected to derive formulae or interpret the results for you.

You should keep in touch with your supervisor throughout your candidature. Fix a time to meet with your supervisor once per week or fortnight.

Research the topic

Most theses will involve the following stages of research.

LITERATURE REVIEW Almost all research is based on previous work which has been reported in the literature, and it is very important for you to be aware of relevant earlier work and to understand it. You must learn to use the libraries effectively to find the material you need. You then need to come to grips with the background of the problem you are investigating. Where does it come from? Why is it important? What is the state of the art? Are there controversies in the area? If so, how do they arise? Can they be resolved?

SUMMARIZE After this, we expect you to first précis the material; that is, give a summary in your own words of what the various researchers have written. Do not simply duplicate what other people have written. In synthesizing material from various authors, be aware that they may use different notation; your notation will need to be consistent.

APPRAISAL Then we ask you to embark on an appraisal; that is you judge the significance, correctness and efficiency of the papers and books you have read and summarized. Just because something has appeared in print, even in a reputable scientific journal, does not mean it is correct or useful.

When reading journal papers and research monographs, we suggest you ask yourself some basic questions.
• What is the paper about?
• What mathematical techniques are used?
• How rigorous is the discussion?
• Are controversial issues involved?
• How else might the problem have been tackled?
• Has the paper contributed insight or merely detail?

When you read a journal article you will find a list of references to other papers, judged by the author(s) to be relevant. These can be checked as additional references for you. It is often also helpful to find subsequent papers which reference the paper you are reading so that you can follow later work on that topic and find what influence it has had on other researchers. This information can be found from the Science Citation Index in the Reference section of the Library.
Form of the thesis

The actual form of the thesis and the type of work involved depend very much on the subject matter. Again, this requires collaboration with your supervisor. There are several common traps you should avoid.

- Do not aim to write an encyclopedia; your reading and summary of the literature should focus on the problem at hand, but should be broad enough to put these into their statistical context.
- Do not allow the project to degenerate into a massive computational exercise. You may need to do some computer programming as part of your project, but this should not be your major task.
- Keep a careful record of the references you consult so that you can construct a bibliography easily when you write up. See the bibliographies in the research papers you read for the style which is used in mathematical research.

Things that would detract from a thesis would include:

- mistakes in the mathematics or in the interpretation;
- a lack of coherent theme;
- poor presentation or proof-reading in the submitted text;
- lengthy quotations or quotations from unnamed sources;
- inconsistent notation (which suggests the student has copied the material);
- little evidence of understanding of the material, or critical appraisal of controversial matters;
- references in the main text for which details are not included in the bibliography;
- references in the bibliography which are never referenced in the main text.

When you come to write up, do so for the benefit of an intelligent reader. A good rule is to imagine a reader with your general background, but without your specific familiarity with the topic. Your report should certainly be intelligible to other Masters students. Make the writing clear and concise, but keep in mind that colloquialisms and slang are seldom acceptable in writing even if they may be acceptable in speech.

Note that explicit quotations must be acknowledged. It should be realized that the direct use of another author’s words are often an admission that you are unable to express yourself. Such admissions lose marks if they become too frequent. Explicit quotation without acknowledgment is plagiarism and will be severely penalized.

The thesis should normally consist of approximately 60 typed A4 pages excluding tables, graphs, references, etc. A 100 page thesis is too long, and usually shows the author has failed to understand what are the key issues.

All universities require the final thesis to be properly bound but are willing to accept a thesis that is loosely bound for the purpose of examining. Loose binding makes it easier, and cheaper, for corrections to be made, if required, and candidates are strongly advised to submit their thesis loosely bound, in the first instance.

You are encouraged to use a typesetting package (such as \LaTeX) for producing your thesis.