STAT4102

Applied Time Series Analysis

This course considers statistical techniques to evaluate processes occurring through time. It introduces students to time series methods and the applications of these methods to different types of data in various contexts (such as actuarial studies, climatology, economics, finance, geography, meteorology, political science, risk management, and sociology). Time series modelling techniques will be considered with reference to their use in forecasting where suitable. While linear models will be examined in some detail, extensions to non-linear models will also be considered. The topics will include: deterministic models; linear time series models, stationary models, homogeneous non-stationary models; the Box-Jenkins approach; intervention models; nonlinear models; time-series regression; time-series smoothing; case studies. Statistical software R will be used throughout this course. Heavy emphasis will be given to fundamental concepts and applied work. Since this is a course on applying time series techniques, different examples will be considered whenever appropriate.

<table>
<thead>
<tr>
<th>Mode of Delivery</th>
<th>On campus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prerequisites</td>
<td>STAT2001/STAT6039 and STAT2008/STAT6038</td>
</tr>
<tr>
<td>Incompatible Courses</td>
<td>STAT8002</td>
</tr>
<tr>
<td>Co-taught Courses</td>
<td>STAT8002</td>
</tr>
<tr>
<td></td>
<td>Graduate students attend joint classes with undergraduates but are assessed separately</td>
</tr>
<tr>
<td>Course Convener</td>
<td>Dr Tao Zou</td>
</tr>
<tr>
<td>Office Location</td>
<td>Room 3.60, ANUCBE Bldg. 26C</td>
</tr>
<tr>
<td>Phone</td>
<td>02 6125 6221</td>
</tr>
<tr>
<td>Email</td>
<td><a href="mailto:tao.zou@anu.edu.au">tao.zou@anu.edu.au</a></td>
</tr>
<tr>
<td>Office hours for student consultation</td>
<td>1:30-3:30pm, Tuesday, during the 12 teaching weeks</td>
</tr>
<tr>
<td>Research Interests</td>
<td>Financial statistics, time series analysis</td>
</tr>
<tr>
<td>Tutor(s)</td>
<td>Please check Wattle site for the latest information</td>
</tr>
<tr>
<td>Student administrators</td>
<td><a href="mailto:enquiries.rsfas@anu.edu.au">enquiries.rsfas@anu.edu.au</a></td>
</tr>
<tr>
<td>Phone:</td>
<td>TBA</td>
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<tr>
<td>Email:</td>
<td>TBA</td>
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SEMESTER 1

2018
COURSE OVERVIEW

Learning Outcomes

Upon successful completion of the requirements for this course, students will be able to:

LO1: Understand and apply the concept of stationarity to the analysis of time series data in various contexts (such as actuarial studies, climatology, economics, finance, geography, meteorology, political science and sociology).

LO2: Run and interpret time-series models and regression models for time series.

LO3: Use the Box-Jenkins approach to model and forecast time-series data empirically.

LO4: Use multivariate time-series models such as vector autoregression (VAR) to analyse time series data.

LO5: Develop fundamental research skills (such as data collection, data processing, and model estimation and interpretation) in applied time series analysis.

LO6: Use existing R functions and packages for analysing time series data, and develop their own R code for problem at the end of each chapter in the textbook as well as additional exercises.

Assessment Summary

<table>
<thead>
<tr>
<th>Assessment Task</th>
<th>Value</th>
<th>Due Date</th>
<th>Date for Return of Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Quiz (online)</td>
<td>10% (compulsory but redeemable)</td>
<td>12:00pm, Wed, Week 5</td>
<td>The week after submission.</td>
</tr>
<tr>
<td>2. Assignment 1</td>
<td>15% (optional and redeemable)</td>
<td>12:00pm, Wed, Week 8</td>
<td>The week after submission.</td>
</tr>
<tr>
<td>3. Assignment 2</td>
<td>15% (optional and redeemable)</td>
<td>12:00pm, Wed, Week 11</td>
<td>The week after submission.</td>
</tr>
<tr>
<td>4. Final exam</td>
<td>60%</td>
<td>TBA</td>
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</table>

Due to the redeemable nature of the quiz and assignments, late submission will not be accepted without appropriate documentation.

Research-Led Teaching

Where possible, topics covered will be related to current research problems and reflect real world situations to emphasize the use of the techniques covered.

Feedback

Staff Feedback

Students will be given feedback (through both verbal and written comments) in the following forms in this course:

• To the whole class during lectures.
• Within tutorials.
• Individually during consultation hours.

Students will also be given online quiz feedback on Wattle and written comments in the marked assignments.

Student Feedback

ANU is committed to the demonstration of educational excellence and regularly seeks feedback from students. One of the key formal ways students have to provide feedback is through Student Experience of Learning Support (SELS) surveys. The feedback given in these surveys is anonymous and provides the Colleges, University Education Committee and Academic Board with opportunities to recognise excellent teaching, and opportunities for improvement.

For more information on student surveys at ANU and reports on the feedback provided on ANU courses, go to http://unistats.anu.edu.au/surveys/selt/students/ and http://unistats.anu.edu.au/surveys/selt/results/learning/

Policies

ANU has educational policies, procedures and guidelines, which are designed to ensure that staff and students are aware of the University’s academic standards, and implement them. You can find the University’s education policies and an explanatory glossary at: http://policies.anu.edu.au/

Students are expected to have read the Academic Misconduct Rule before the commencement of their course.

Other key policies include:

• Student Assessment (Coursework)
• Student Surveys and Evaluations

Additional course costs

The only other additional course costs are a calculator, textbook (if purchased) and printing materials.

Examination material or equipment

• Calculator (non-programmable).
• Unannotated paper-based dictionary (no approval required).
• Two A4 pages with notes on both sides.
**Recommended Resources**

**Recommended Text**

**Supplementary Reading (Not Compulsory)**
Tsay, R. S. *Multivariate Time Series Analysis*, Wiley.

**COURSE SCHEDULE**

<table>
<thead>
<tr>
<th>Week</th>
<th>Summary of Activities</th>
<th>Assessment</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Overview of STAT4102/8002 and general information</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Time Series Characteristic and R language</td>
<td></td>
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<tr>
<td>3</td>
<td>Time Series Smoothing, Regression and Exploratory Data Analysis</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Time Series Smoothing, Regression and Exploratory Data Analysis</td>
<td>Release of Quiz on Wattle</td>
</tr>
<tr>
<td>5</td>
<td>Box-Jenkin approach and its multivariate variant</td>
<td>Submission of Quiz</td>
</tr>
<tr>
<td>6</td>
<td>Box-Jenkin approach and its multivariate variant</td>
<td>Feedback of Quiz</td>
</tr>
<tr>
<td>7</td>
<td>Difference equations</td>
<td>Release of Assignment 1 on Wattle</td>
</tr>
<tr>
<td>8</td>
<td>Autocorrelation and partial autocorrelation functions</td>
<td>Submission of Assignment 1</td>
</tr>
<tr>
<td>9</td>
<td>Time Series Estimation and Forecasting</td>
<td>Feedback of Assignment 1</td>
</tr>
<tr>
<td>10</td>
<td>Nonstationary time series/Multiplicative Seasonal ARIMA models</td>
<td>Release of Assignment 2 on Wattle</td>
</tr>
<tr>
<td>11</td>
<td>ARCH/GARCH models</td>
<td>Submission of Assignment 2</td>
</tr>
<tr>
<td>12</td>
<td>Various topics of interest/Review</td>
<td>Feedback of Assignment 2</td>
</tr>
<tr>
<td></td>
<td>Examination period</td>
<td>Final examination</td>
</tr>
</tbody>
</table>
ASSESSMENT REQUIREMENTS

The ANU is using Turnitin to enhance student citation and referencing techniques, and to assess assignment submissions as a component of the University's approach to managing Academic Integrity. For additional information regarding Turnitin please visit the ANU Online website.

This course does not require students to use Turnitin for assignment submission.

As a further academic integrity control, students may be selected for a 15 minute individual oral examination of their written assessment submissions.

Any student identified, either during the current semester or in retrospect, as having used ghost writing services will be investigated under the University's Academic Misconduct Rule.

Assessment Tasks

Assessment Task 1: Quiz (online)

Details of task: The students will get 180 minutes to complete this quiz individually. This quiz is designed to cover materials from Week 1 to 3. Besides, this quiz is compulsory but redeemable, and is to be attempted online on Wattle. Under no circumstances will the students be able to attempt the quiz outside of the allocated time period. Announcements will be made during lectures and on Wattle site regarding the availability of the quiz. This quiz may require the use of R to analyse real data and there will be a mix of multiple choice questions and numerical evaluation questions.

Assessment Rubrics

Value: 10%.
Estimated return date: The week after submission.

Assessment Task 2: Assignment 1

Details of task: The students are expected to complete this assignment individually. This assignment is designed to cover materials form Week 4 to 6. Assignments will require the use of R to analyse real data and then to summarise and report on the findings of the analysis. More details will be provided during the lectures and on Wattle.

Assessment Rubrics

Assignments are expected to be printed and contain relevant computer code and graphics.
Value: 15%.
Estimated return date: The week after submission.

Assessment Task 2: Assignment 2

Details of task: The students are expected to complete this assignment individually. This assignment is designed to cover materials form Week 7 to 9. Assignments will require the use of R to analyse real data and then to summarise and report on the findings of the analysis. More details will be provided during the lectures and on Wattle.

Assessment Rubrics
Assignments are expected to be printed and contain relevant computer code and graphics. **Value:** 15%. **Estimated return date:** The week after submission.

**Examination**

The final examination will be based on all the work covered throughout the duration of the semester. The final examination is worth 60% of the final raw score. The exam will include a mixture of theoretical and numerical questions. Students will be provided with further details regarding the exam as it approaches.

**Assignment submission**

**Hard Copy Submission:** Assignments are submitted via the physical assignment box at the front of the admin office on Level 4, CBE Building (26C). The cover sheet must use the assignment cover sheet template. Assignments must include the cover sheet available on Wattle site. Please keep a copy of tasks completed for your records. Email and fax submissions are not acceptable.

**Extensions and penalties**

Extensions and late submission of assessment pieces are covered by the Student Assessment (Coursework) Policy and Procedure. The Course Convener may grant extensions for assessment pieces that are not examinations or take-home examinations. If you need an extension, you must request it in writing on or before the due date. If you have documented and appropriate medical evidence that demonstrates you were not able to request an extension on or before the due date, you may be able to request it after the due date.

No submission of assessment tasks without an extension after the due date will be permitted. If an assessment task is not submitted by the due date, a mark of 0 will be awarded.

**Returning assignments**

The marked hard copy assignments will be mainly returned to students via the admin office on Level 4, CBE Building (26C). Students will be provided with further details on Wattle site regarding the other returning information as it approaches. You should retain a copy of your submission for your own records. If you do not collect your assignments, they will be destroyed after the end of the semester.

**Resubmission of assignments**

Resubmission of assignments will not be accepted.

**Referencing requirements**

The University offers a number of support services for students. Information on these is available online from [http://students.anu.edu.au/studentlife/](http://students.anu.edu.au/studentlife/).

**Scaling**

Your final mark for the course will be based on the raw marks allocated for each of your assessment items. However, your final mark may not be the same number as produced by
that formula, as marks may be **scaled**. Any scaling applied will preserve the rank order of raw marks (i.e. if your raw mark exceeds that of another student, then your scaled mark will exceed the scaled mark of that student), and may be either up or down.

**Privacy Notice**

The ANU has made a number of third party, online, databases available for students to use. Use of each online database is conditional on student end users first agreeing to the database licensor’s terms of service and/or privacy policy. Students should read these carefully.

In some cases student end users will be required to register an account with the database licensor and submit personal information, including their: first name; last name; ANU email address; and other information.

In cases where student end users are asked to submit ‘content’ to a database, such as an assignment or short answers, the database licensor may only use the student’s ‘content’ in accordance with the terms of service – including any (copyright) licence the student grants to the database licensor.

Any personal information or content a student submits may be stored by the licensor, potentially offshore, and will be used to process the database service in accordance with the licensors terms of service and/or privacy policy.

If any student chooses not to agree to the database licensor’s terms of service or privacy policy, the student will not be able to access and use the database. In these circumstances students should contact their lecturer to enquire about alternative arrangements that are available.

**Tutorial Seminar Registration**

Tutorial signup for this course will be done via the Wattle website. Detailed information about signup times will be provided on Wattle or during your first lecture. When tutorials are available for enrolment, follow these steps:

1. Log on to Wattle, and go to the course site
2. Click on the link “Tutorial enrolment”
3. On the right of the screen, click on the tab “Become Member of…..” for the tutorial class you wish to enter
4. Confirm your choice

If you need to change your enrolment, you will be able to do so by clicking on the tab “Leave group…..” and then re-enrol in another group. You will not be able to enrol in groups that have reached their maximum number. Please note that enrolment in ISIS must be finalised for you to have access to Wattle.

**SUPPORT FOR STUDENTS**

The University offers a number of support services for students. Information on these is available online from [http://students.anu.edu.au/studentlife/](http://students.anu.edu.au/studentlife/)