SENIOR STATISTICS COURSES
STAT3011/3911 Stochastic Processes and Time Series, Semester 1, 2013

Director of Statistics Program: A/Prof Shelton Peiris (819)
2nd- and 3rd-year Coordinator: Dr. Ray Kawai (816)

Section 1 - Stochastic Processes: Weeks 1-7

1. Lectures
   (a) STAT3011 Stochastic Processes
       Lecturer: Dr Ray Kawai (816)
       Lectures: Mon 13pm (350), Tue 13pm (375) and Wed 13pm (350)
       Tutorial: Fri 12pm (451) Prof. Eugene Seneta
   (b) STAT3911 Advanced Stochastic Processes
       Lecturer: Dr Ray Kawai (816)
       Normal STAT3011 Lectures, PLUS
       Additional Advanced Lecture: Tue 16pm (351)
       Tutorial: Fri 12pm (452) Dr. Ray Kawai

2. Tutorial Classes: Tutorials for STAT3011/3911 start in Week 2

3. Assignment and Quiz
   There will be 1 assignment, to be submitted in the labeled (white) cabinet next to Carslaw 817 by 9am on 24 April. There will be one quiz in tutorial slot of Week 7 (26 April). NO makeup will be available.

4. Assessment
<table>
<thead>
<tr>
<th>Course</th>
<th>Assignment</th>
<th>Quiz</th>
<th>Final Exam</th>
</tr>
</thead>
<tbody>
<tr>
<td>STAT3011</td>
<td>3%</td>
<td>12%</td>
<td>35%</td>
</tr>
<tr>
<td>STAT3911</td>
<td>3%</td>
<td>12%</td>
<td>35%</td>
</tr>
</tbody>
</table>

5. Course Outline
   Objectives and Outcomes: This course will study basic topics of stochastic processes. After successful completion of this part, the students will be able to handle basic problems around modern stochastic processes by this course. Various probabilistic techniques are developed throughout the course so that the students can extend these methods in advanced topics.

   Lectures in Common
   (a) Review of probability theory.
   (b) Elements of stochastic processes.
   (c) Markov chains.
   (d) The Poisson process.
   (e) A tiny bit about Brownian motion.

   Extra Material for STAT3911
   (a) A little more about Markov chain
   (b) A little more about Brownian motion
Section 2 - Time Series Analysis: Weeks 8-13

Lecturer: Associate Professor Shelton Peiris, Carslaw 819 - Ext 15764

General Information for Time Series Analysis - Section 2

In 2013 the lectures on Time Series Analysis section (Section 2 of STAT3013/3913) will begin in Week 8. Therefore, the first lecture will be given on Monday April 29. The weekly tutorials and practicals will begin on the Friday May 10 in Week9. Classes end on Friday 7 June. All classes are in common for both STAT3011 and STAT 3911. No additional material or lectures will be available for STAT3911 section 2 (Time Series) of the course. All electronic material will posted on the STAT3011 homepage only.

Objectives: Establish some methods of modelling and analysing (ie. identification, estimation, decision making, and prediction) of time series data (ie. data containing some serially dependence structure). Some real world applications will be discussed. The package R will be used to analyse time series data.

Outcomes: Successful completion of this unit, students will be able to:

1. Identify a time series and its various components,
2. Apply various transformations to smooth a time series,
3. Identify stationary and homogeneous non-stationary time series,
4. Autocorrelation and partial autocorrelation functions,
5. Identify suitable ARMA and ARIMA models for given time series data,
6. Parameter estimation,
7. Diagnostic checking procedures and forecasting,
8. Apply the statistical package R to model and forecast time series data.

Course Outline for the Time Series Component

<table>
<thead>
<tr>
<th>Week</th>
<th>Topics</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>Time series data, components of a time series, Filtering to remove trends and seasonal components.</td>
</tr>
<tr>
<td>9</td>
<td>Stationary time series, Sample autocorrelations and partial autocorrelations, Probability models for stationary time series, Moving Average (MA) models and properties.</td>
</tr>
<tr>
<td>10</td>
<td>Invertibility of MA models, Autoregressive (AR) models and their properties, Stationarity of AR models, Mixed Autoregressive Moving Average (ARMA) models and their properties.</td>
</tr>
<tr>
<td>12</td>
<td>Estimation and fitting ARIMA models via MM and MLE methods, Hypothesis testing, diagnostic checking and goodness-of-fit tests, AIC for ARIMA models, Forecasting methods for ARIMA models.</td>
</tr>
<tr>
<td>13</td>
<td>Minimum mean square error (mmse) forecasting and its properties, Derivation of l-step ahead mmse forecast function, Forecast updates, Forecast errors, related results and applications.</td>
</tr>
</tbody>
</table>

Assessment

Section 2 - Time Series Analysis - 50% as given below:

1 Assignment (due Friday 17 May) 3%
1 tutorial quiz (Friday 31 May) 7%
5 Computer practicals (weeks 8/9-12/13) 5%
Final examination in June 35%

References