SENIOR STATISTICS COURSES
STAT3011/3911 Stochastic Processes and Time Series, Semester 1, 2018

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1. **Timetable:** Note the following adjustments to the standard weekly timetable
   - Week 04: Fri, 30/03/2018 no tutorial and no computer lab because of Good Friday
   - Fri 30/03/2018 - Fri 06/04/2018 (inclusive) Easter recess
   - Week 06: Wed, 18/04/2018 STAT3011/3911 (common) quiz at lecture time 13.00 in Chemistry LT2 (CLT2)
   - Week 07: Tue 24/04/2018 Advanced quiz at lecture time 16.00 in 350
   - Week 07: Wed, 25/04/2018 no lecture because of Anzac Day
   - Week 07: Fri, 27/04/2018 STAT3011/3911 (common) the computer exam
   - Week 13: Wed, 06/06/2018 STAT3011/3911 (common) quiz at lecture time 13.00 in CLT2 and 452.
2. **Lectures**
   (a) **STAT3011 Stochastic Processes and Time Series**
   Lecturer from Week 01 to 06: A/Prof Shelton Peiris (819)
   Lecturer from Week 07 to 13: Dr Ray Kawai (816)
   Lectures: Mon 13.00 (273), Tue 13.00 (175) and Wed 13.00 (Chemistry LT2)
   (b) **STAT3911 Advanced Stochastic Processes and Time Series**
   Lecturer: A/Prof Qiying Wang (825)
   Mainstream STAT3011 lectures, PLUS
   Extra advanced lectures on Stochastic Processes: Tue 16.00 (350) from Week 01 to Week 07
3. **Tutorial Classes and Computer Labs**
   Tutorial slots start in week 2 and four computer labs take place in weeks 2, 3, 5 and 6. You should attend the slots given on your personal timetable.
4. **Quizzes**
   You must attend your designated location based on your official timetable. All quizzes are NOT of multiple-choice type. NO marks will be award for answers without justification. NO makeup is available. Non-participants will get zero marks. The schedule and the content are as follows.
   (a) **STAT3011 Stochastic Processes and Time Series**
      1. Week 06: Wed 18/04/2018 STAT3011/3911 (common) quiz at lecture time 13.00 in CLT2.
         This quiz is about the "Time Series" component.
         You are allowed to bring one two-sided A4 sheet of handwritten notes as well as a University approved non-programmable calculator.
      2. Week 13: Wed 06/06/2018 STAT3011/3911 (common) quiz at lecture time 13.00 in CLT2.
         This quiz is about the "Stochastic Processes" component.
         You are allowed to bring one two-sided A4 sheet of handwritten notes as well as a University approved non-programmable calculator.

(b) **STAT3911 Advanced Stochastic Processes and Time Series**

1. Week 06: Wed 18/04/2018 STAT3011/3911 (common) quiz at lecture time 13.00 in CLT2.
   This quiz is about the "Time Series" component.
   You are allowed to bring one two-sided A4 sheet of handwritten notes as well as a University approved non-programmable calculator.
2. Week 07: Tue 24/04/2018 Advanced quiz at lecture time 16.00 in 350.
   This quiz is about the *advanced* "Stochastic Processes" component.
   You are allowed to bring one two-sided A4 sheet of handwritten notes as well as a University approved non-programmable calculator.
3. Week 13: Wed 06/06/2018 STAT3011/3911 (common) quiz at lecture time 13.00 in Carslaw 452.
   This quiz is about the *common* "Stochastic Processes" component.
   You are allowed to bring one two-sided A4 sheet of handwritten notes as well as a University approved non-programmable calculator.

5. **Computer Exam**
   The Computer Exam will be conducted (both streams in common) in week 7 and **must be done using School computers**, not on your laptops. **NO EXCEPTIONS.** It is your responsibility to familiarize yourself with the School network as well as RStudio Sweave before the Computer Exam. **This is an open-book (as well as open-computer) exam.**
6. **Assessment**
   Your final raw mark for this unit will be calculated as follows:

	Time Series			Stochastic Processes		
	Q1	Comp*	Final Exam	Q2	Adv Q	Final Exam
STAT3011	10%	10%	30%	20%	na	30%
STAT3911	10%	10%	30%	5%	20%	25%

*Note that the "Comp 10%" component consists of the following three subcomponents:

- active computer lab participation of 4 labs 4%,
- submission of work/report (of all 4) no later than 23.59 on sane Friday 1%,
- computer exam 5% (in week 7).

Final grades are returned within one of the following bands: **High Distinction (HD), 85–100:** representing complete or close to complete mastery of the material; **Distinction (D), 75–84:** representing excellence, but substantially less than complete mastery; **Credit (CR), 65–74:** representing a creditable performance that goes beyond routine knowledge and understanding, but less than excellence; **Pass (P), 50–64:** representing at least routine knowledge and understanding over a spectrum of topics and important ideas and concepts in the course.

Last updated: March 28, 2018.

STAT3011/3911 Common Component

Prerequisite: STAT2011 or STAT2911, and MATH1003 or MATH1903 or MATH1907. It is *essential* that students have a very good command of those contents.

Outline: Learn some basic theory and methodologies of stochastic processes and time series, such as identification, estimation, decision making, and prediction. Some real world applications will be discussed. The package R will be used to analyze time series data.

Week	Topics
1	Time series data, components of a time series.
	Filtering to remove trends and seasonal components.
2	Stationarity time series.
	Sample autocorrelations and partial autocorrelations.
	Probability models for stationary time series.
	Moving Average (MA) models and properties.
3	Invertibility of MA models.
	Autoregressive (AR) models and their properties.
	Stationarity of AR models.
	Mixed Autoregressive Moving Average (ARMA) models and their properties.
4	Homogeneous nonstationary time series (HNTS). Simple models for HNTS.
	Autoregressive Integrated Moving Average (ARIMA) models and related results.
	Review of theoretical patterns of ACF and PACF for AR, MA and ARMA processes.
	Identification of possible AR, MA, ARMA and ARIMA models for a set of time series data.
5	Estimation and fitting ARIMA models via MM and MLE methods.
	Hypothesis testing, diagnostic checking and goodness-of-fit tests. AIC for ARIMA models.
	Forecating methods for ARIMA models.
6	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.
7	Review of probability theory.
	Elements of stochastic processes and time series.
8	Markov chains.
9	Markov chains.
10	Markov chains.
11	The Poisson process.
12	The Poisson process.
13	The Poisson process.

Outcomes: Successful completion of the common component, students will

(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, Diagnostic checking procedures and forecasting;
(7) Apply the statistical package R to model and forecast time series data;
(8) Have basic background on stochastic processes;
(9) Have an appreciation for the power of stochastic processes, as well as its range of applications;
(10) Understand basic properties of Markov chains and the Poisson process.

STAT3911 Add-on Component

Prerequisite: STAT2911, and MATH1003 or MATH1903 or MATH1907. It is *essential* that students have an excellent command of those contents.

Beneficial: Although not prerequisites, the basic knowledge of real analysis (MATH2962) and metric spaces (MATH3961) will be highly beneficial.

Outline: The advanced add-on lectures will explore further essential topics in stochastic processes, such as

- Filterations,
- Martingales,
- Stopping times,
- Wald equation,
- Branching processes, and
- Brownian motion.

The advanced students are expected to go through all relevant proofs on their own, which have to be omitted in lectures but are provided in the lecture notes.

Outcomes: After successful completion of the add-on component, students will

- be more familiar with the basics of stochastic processes to continue a further study,
- have a decent idea on martingales and stopping time,
- know the definition and basic properties of branching processes and Brownian motion,
- be able to find and write simple proofs, and apply the theory in a number of applications.