

课程详述

COURSE SPECIFICATION

以下课程信息可能根据实际授课需要或在课程检讨之后产生变动。如对课程有任何疑问，请联系授课教师。

The course information as follows may be subject to change, either during the session because of unforeseen circumstances, or following review of the course at the end of the session. Queries about the course should be directed to the course instructor.

1.	课程名称 Course Title	时间序列分析 Time series analysis
2.	授课院系 Originating Department	数学系 Department of Mathematics
3.	课程编号 Course Code	MA309
4.	课程学分 Credit Value	3
5.	课程类别 Course Type	专业选修课 Major Elective Courses
6.	授课学期 Semester	秋季 Fall
7.	授课语言 Teaching Language	英文 English
8.	授课教师、所属学系、联系方式（如属团队授课，请列明其他授课教师） Instructor(s), Affiliation & Contact (For team teaching, please list all instructors)	蒋学军，数学系，0755-88018687 Xuejun Jiang, Department of Mathematics
9.	实验员/助教、所属学系、联系方式 Tutor/TA(s), Contact	To be announced
10.	选课人数限额(可不填) Maximum Enrolment (Optional)	80

11. 授课方式 Delivery Method	讲授	习题/辅导/讨论	实验/实习	其它(请具体注明)	总学时
	Lectures	Tutorials	Lab/Practical	Other (Please specify)	Total
学时数 Credit Hours	48				48
12. 先修课程、其它学习要求 Pre-requisites or Other Academic Requirements	概率论与数理统计 (MA212) (或数理统计 (MA204)) Probability and Statistics (MA212) (or Mathematical Statistics(MA204))				
13. 后续课程、其它学习规划 Courses for which this course is a pre-requisite	金融风险管理, 高等时间序列分析, 金融统计, 统计机器学习 Financial risk management, Advanced time series, Financial statistics, Statistical machine learning				
14. 其它要求修读本课程的学系 Cross-listing Dept.					

教学大纲及教学日历 SYLLABUS

15. 教学目标 Course Objectives

本课程系统地介绍时间序列分析的重要概念（比如平稳性），一些基本的平稳时间序列模型(滑动平均模型，自回归模型，自回归-滑动平均模型)，趋势及处理非平稳性的一些方法，非平稳时间序列模型(自回归-求和-滑动平均模型，季节模型等)，参数估计及模型诊断，时间序列模型的预测，异方差时间序列模型，及一些选题介绍-协整、协整检验、因果关系等。本课程既注重时间序列分析理论的介绍又注重时间序列分析方法的实际应用及使用 R 语言编程实现。

The aim of this course is to present important concepts of time series analysis such as stationarity, stationary time series models (MA, AR, ARMA models), trends and methods for dealing with non-stationarity, nonstationary time series models (ARIMA models, SEASONAL MODELS etc.), parametric estimation, model diagnostic, forecasting, heteroscedasticity time series models, and other selected topics such as Co-integration and Causality, etc.). The course focuses both on the theory of linear time series and on the practical applications with R.

16. 预达学习成果 Learning Outcomes

学生学习完本课程后，能够理解时间序列分析的基本原理和方法、掌握一些常见的的时间序列数据建模的技术，能对所建立的模型进行估计、诊断和预测，初步具备做实证分析的能力。

After completing this course, students will be able to understand some basic principles and methods of time series analysis, to master some frequent modelling techniques for time series data, to estimate the established model, and to conduct model diagnosis and forecasting. They are expected to have a preliminary capacity to do empirical analysis.

17. 课程内容及教学日历（如授课语言以英文为主，则课程内容介绍可以用英文；如团队教学或模块教学，教学日历须注明主讲人）

Course Contents (in Parts/Chapters/Sections/Weeks. Please notify name of instructor for course section(s), if this is a team teaching or module course.)

CHAPTER 1 FUNDAMENTAL CONCEPTS (4 hours)

1.1 Time Series and Stochastic Processes

1.2 Means, Variances, and Covariances

1.3 Stationarity

1.4 Summary

Exercises

Appendix A: Expectation, Variance, Covariance, and Correlation.

CHAPTER 2 MODELS FOR STATIONARY TIME SERIES (6 hours)

2.1 General Linear Processes

2.2 Moving Average Processes

2.3 Autoregressive Processes

2.4 The Mixed Autoregressive Moving Average Model

2.5 Invertibility

2.6 Summary

Exercises

CHAPTER 3 MODELS FOR NONSTATIONARY TIME SERIES (4 hours)

3.1 Stationarity Through Differencing

3.2 ARIMA Models

3.3 Constant Terms in ARIMA Models

3.4 Other Transformations

3.5 Summary

Exercises

Appendix D: The Backshift Operator

CHAPTER 4 MODEL SPECIFICATION (4 hours)

4.1 Properties of the Sample Autocorrelation Function

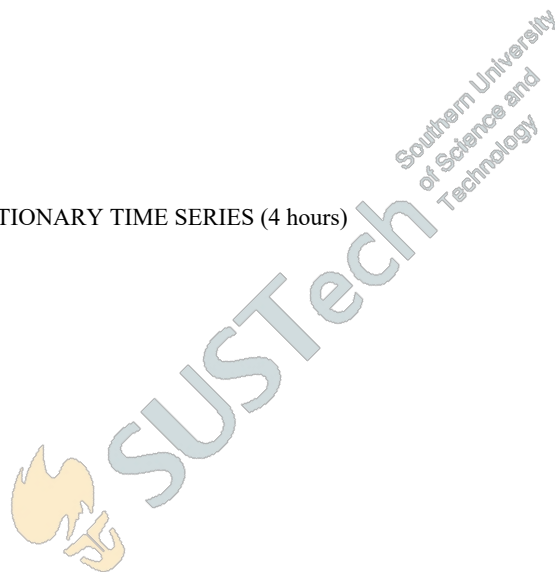
4.2 The Partial and Extended Autocorrelation Functions

4.3 Specification of Some Simulated Time Series

4.4 Nonstationarity

4.5 Other Specification Methods

4.6 Specification of Some Actual Time Series



4.7 Summary

Exercises

CHAPTER 5 PARAMETER ESTIMATION (4 hours)

5.1 The Method of Moments

5.2 Least Squares Estimation

5.3 Maximum Likelihood and Unconditional Least Squares

5.4 Properties of the Estimates

5.5 Illustrations of Parameter Estimation

5.6 Bootstrapping ARIMA Models

5.7 Summary

Exercises

CHAPTER 6 MODEL DIAGNOSTICS (2 hours)

6.1 Residual Analysis

6.2 Overfitting and Parameter Redundancy

6.3 Summary

Exercises

CHAPTER 7 FORECASTING (4 hours)

7.1 Minimum Mean Square Error Forecasting

7.2 Deterministic Trends

7.3 ARIMA Forecasting

7.4 Prediction Limits

7.5 Forecasting Illustrations

Exercises Appendix E: Conditional Expectation.

Appendix F: Minimum Mean Square Error Prediction

Appendix G: The Truncated Linear Process

Appendix H: State Space Models

CHAPTER 8 SEASONAL MODELS (6 hours)

8.1 Seasonal ARIMA Models

8.2 Multiplicative Seasonal ARMA Models

8.3 Nonstationary Seasonal ARIMA Models

8.4 Model Specification, Fitting, and Checking

8.5 Forecasting Seasonal Models

8.6 Summary

Exercises

CHAPTER 9 TIME SERIES MODELS OF HETEROSCEDASTICITY (6 hours)

9.1 Some Common Features of Financial Time Series

9.2 The ARCH(1) Model

9.3 GARCH Models
9.4 Maximum Likelihood Estimation
9.5 Model Diagnostics
9.6 Some Extensions of the GARCH Model
9.7 Another Example: The Daily USD/HKD Exchange Rates
Exercises
Appendix I: Formulas for the Generalized Portmanteau Tests
CHAPTER 10 Selected Topics 1 : Vector autoregressive model and Co-integration; (4 hours)
CHAPTER 11 Selected Topics 2: Causality in time series (4 hours)
Final exam review

18. 教材及其它参考资料 **Textbook and Supplementary Readings**

[1]. Textbook required: Time Series Analysis With Applications in R, Second Edition. Springer. Author by Jonathan D. Cryer Kung-Sik Chan
[2]. Reference 1: Analysis of Financial time series by Ruey S, Tsay. Second Edition. Wiley Series
[3]. Reference 2: Time Series Analysis by Hamilton. Second Edition, Princeton University Press. ISBN: 691042896

课程评估 **ASSESSMENT**

19. 评估形式 Type of Assessment	评估时间 Time	占考试总成绩百分比 % of final score	违纪处罚 Penalty	备注 Notes
出勤 Attendance		5%		One point penalized for absence without leave each time
课堂表现 Class Performance				
小测验 Quiz				
课程项目 Projects		20%		Curriculum small paper
平时作业 Assignments		15%		
期中考试 Mid-Term Test		30%		
期末考试 Final Exam		30		
期末报告 Final Presentation				
其它 (可根据需要 改写以上评估方式) Others (The				

above may be
modified as
necessary)

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20. 记分方式 **GRADING SYSTEM**

- A. 十三级等级制 **Letter Grading**
 B. 二级记分制 (通过/不通过) **Pass/Fail Grading**

课程审批 **REVIEW AND APPROVAL**

21. 本课程设置已经过以下责任人/委员会审议通过

This Course has been approved by the following person or committee of authority

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