



Shanghai Jiao Tong University

MA967 Statistics of Stochastic Processes (Online)

| | | | |
|-----------------------------------|--|----------------|---------|
| Instructor Information | Wanchunzi Yu Home Institution: Bridgewater State University Email: wyu@bridgew.edu | | |
| Term | December 17, 2020 - January 8, 2021 | Credits | 4 units |
| Course Delivery | The course will be delivered in the format online. Other than recorded lecture videos, the instructor will arrange 3 hours' real-time interaction with students per week (via zoom meeting, discussion forum, and WeChat). The workload students are expected to complete to properly pass this course is about 12-16 hours per week. Exams are proctored under zoom-meeting camera. | | |
| Required Texts (with ISBN) | Unit information, summary lecture notes, assignments, exercises, marks, all handouts and all announcements are made available during class. Mathematical Statistics and Stochastic Processes, Denis Bosq, Wiley. | | |
| Prerequisite | Students need to finish one of the three courses below: Mathematics of Uncertainty Mathematical Statistics Probability and statistical inference for economics and business | | |



Course Overview

Standard statistical methods always assume that the sampling data are independent and identically distributed. However, in practice, it is quite common that the observed data are correlated, for example in chemistry, economics, biology and so on. Stochastic Processes are ways of modelling this relationship. This course aims to familiarize students with such statistical processes.

The following topics will be covered in this course: Review of probability and mathematical statistics; convergence of random variables and measures; Decision theory: loss function, Bayesian statistics; Classical theory of estimation: bias, consistency, sufficiency, completeness, efficiency, maximum-likelihood estimation, Bayesian estimator, likelihood ratio test; Stochastic processes: Stationary processes, Markov processes, Poisson processes, Square-integrable processes, Diffusion processes, ARMA; Prediction.

Learning Outcomes

On completion of this subject students should be able to

1. Familiar with the maximum likelihood estimation, likelihood ratio test;
2. Clear the principle of Bayesian analysis and use it for parameter estimation and model selection;
3. Understand the basic concepts of common random processes;
4. Estimate the unknown parameter(s) and derive the corresponding properties of the estimator(s) for a given model;
5. Perform model selection (and verification) for stationary, ARMA and diffusion processes;
6. Construct statistical predictor for ARMA.

Course Structure

1. Asynchronous Hours: Sunday through Thursday, total 25 hours Pre-recorded videos will be posted on SJTU SCE online learning platform.
2. Synchronous Hours: Beijing Time: Tuesday: 8 – 9:30 am, Wednesday: 8:30 – 10:00 pm



Grading Policy

| | |
|--------------------|-----|
| Three Assignments | 30% |
| Quizzes/Attendance | 20% |
| Midterm Exam | 25% |
| Final exam | 25% |

Grading Scale is as follows

| Number grade | Letter grade | GPA |
|--------------|--------------|-----|
| 90-100 | A | 4.0 |
| 85-89 | A- | 3.7 |
| 80-84 | B+ | 3.3 |
| 75-79 | B | 3.0 |
| 70-74 | B- | 2.7 |
| 67-69 | C+ | 2.3 |
| 65-66 | C | 2.0 |
| 62-64 | C- | 1.7 |
| 60-61 | D | 1.0 |
| ≤59 | F (Failure) | 0 |



Class Schedule

| Date | Lecture | Arrangement | Chapter |
|--------|---|---|---------|
| Day 1 | Chapter 1. Introduction to Mathematical Statistics | 2.25 hours pre-recorded video | 1 |
| Day 2 | Chapter 2. Principles of Decision Theory | 2.25 hours pre-recorded video | 2 |
| Day 3 | Chapter 3. Conditional Expectation | 2.25 hours pre-recorded video | 3 |
| Day 4 | Chapter 4. Statistics and Sufficiency | 2.25 hours pre-recorded video | 4 |
| Day 5 | Chapter 5. Point Estimation | 1.5 hours Zoom meeting 0.75 hours pre-recorded video | 5 |
| Day 6 | Chapter 6. Hypothesis Testing and Confidence Regions | 1.5 hour Zoom meeting 0.75 hour pre-recorded video | 6 |
| Day 7 | Chapter 7. Asymptotic Statistics | 2.25 hours pre-recorded video | 7 |
| Day 8 | Chapter 8. Non-Parametric Methods and Robustness | 2.25 hours pre-recorded video | 8 |
| Day 9 | Midterm Exam Review | 2.25 hours pre-recorded video | 1-8 |
| Day 10 | Midterm Exam | 2.25 hours online exam proctored under zoom-meeting camera. | 1-8 |
| Day 11 | Chapter 9. Introduction to Statistics for Stochastic Processes | 1.5 hours Zoom meeting 0.75 hours pre-recorded video | 9 |
| Day 12 | Chapter 10. Weakly Stationary Discrete – Time Processes. | 2.25 hours pre-recorded video | 10 |
| Day 13 | Chapter 11. Poisson Processes – A Probabilistic and Statistical Study | 2.25 hours pre-recorded video | 11 |
| Day 14 | Chapter 12. Square-Integrable Continuous – Time Processes | 2.25 hours pre-recorded video | 12 |
| Day 15 | Chapter 13. Stochastic Integration and Diffusion Processes | 1.5 hours Zoom meeting 0.75 hours pre-recorded video | 13 |
| Day 16 | Chapter 14. ARMA Processes | 1.5 hours Zoom meeting 0.75 hours pre-recorded video | 14 |
| Day 17 | Final Exam Review | 2.25 hours pre-recorded video | 9-14 |
| Day 18 | Final Exam | 2.25 hours pre-recorded video | 9-14 |