

Prof. Xiaodong Liu

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Location: Economics 5

Meeting Times: TTH 2:00-3:15

Office Hours: TTH 12:30-2:00

Course Description:

This is the second course of the sequence Econ 8828-8838. Built on the fundamental concepts and tools covered in Econ 8828, the first half of this course introduces the theory of stochastic processes with the corresponding laws of large numbers and central limit theorems for dependent processes. The second half of this course illustrates the applicability of the theory of stochastic processes by studying some specific stochastic processes commonly used in time series and spatial analysis.

Prerequisite: Econ 8828.

Text:

1. Davidson, J., 1994, Stochastic Limit Theory, Oxford University Press, Oxford.
2. Davidson, J., 2000, Econometric Theory, Blackwell Publishing, Oxford.
3. Brockwell, P. J. and Davis, R. A., 2006, Time Series: Theory and Methods, Springer, New York.

Other Useful References:

4. Grimmett, G.R. and D.R. Stirzaker, 1992, Probability and Random Processes, Oxford University Press, Oxford.
5. van der Vaart, A., 1998, Asymptotic Statistics, Cambridge University Press, Cambridge.
6. Hamilton, J.D., 1994, Time Series Analysis, Princeton University Press, Princeton

Assessment:

There will be a midterm exam, a final exam, and periodic problem sets.

1. Homework assignments (20%)
2. Midterm examination (40%)
3. Final Examination (40%)

Tentative Course Outline:

1. Theory of Stochastic Processes
 - a. Stochastic Processes and Dependence
 - i) Basic concepts and convergence
 - ii) Independence and stationary
 - iii) Ergodicity and mixing
 - iv) Strong and uniform mixing
 - b. Mixing
 - i) Mixing sequences and mixing inequalities
 - ii) Sufficient conditions for strong and uniform mixing
 - c. Martingales
 - i) Sequential conditioning and martingale convergence
 - ii) Martingale inequalities
 - d. Mixingales and Near-Epoch Dependence (NED)
2. Laws of Large Numbers
 - a. Stochastic Convergence
 - b. Weak and Strong LLNs for Stochastic Processes
 - i) Weak LLNs for martingales and mixingales
 - ii) Strong LLNs for martingales and mixingales
 - i) NED and mixing processes
 - c. Uniform Stochastic Convergence
 - i) Stochastic equicontinuity
 - ii) Uniform LLNs
3. Central Limit Theorems
 - a. Martingales
 - b. Mixing and NED
 - c. Bernstein's Blocking Method
4. Dynamic Regression Models
 - a. ARMA Models
 - i) The VAR(1) process
 - ii) Stationary, mixing and ergodicity
 - iii) The lag operator
 - iv) The ARMA process and Wold decomposition

- b. Asymptotics for Dynamic Models
 - i) Limit results for M.D. processes and applications to ARMA processes
 - ii) Limit results for mixing and NED and applications to ARMA processes
- 5. Spatial Dependence
 - a. Spatial Autoregressive (SAR) Models
 - b. Spatial Mixing and NED

University Policies:

University policies regarding classroom behavior are available at <http://www.colorado.edu/policies/classbehavior.html> and at http://www.colorado.edu/studentaffairs/judicialaffairs/code.html#student_code

Information regarding the University Honor Code is available at <http://www.colorado.edu/policies/honor.html> and at <http://www.colorado.edu/academics/honorcode>. The Honor Code Council can be contacted by email at honor@colorado.edu or by telephone at 303-725-2273.

University policies regarding disabilities are available at <http://www.colorado.edu/disabilityservices>. Disability Services can be contacted by telephone at 303-492-8671, or in person at Willard 322.

University policies regarding religious practice are available at http://www.colorado.edu/policies/fac_relig.html.

University policies regarding Sexual Harassment and Amorous Relationships are available at <http://www.colorado.edu/odh/>. The Office of Discrimination and Harassment can be reached by telephone at 303-492-2127. The Office of Judicial Affairs can be reached at 303-492-5550.