ECONOMICS 205A: ECONOMETRIC METHODS I
FALL 2017

LEC: W 2:10 pm – 3:30 pm, F 1:40 pm – 3:00 pm, SPR 2206 (see page 3 for details)
DIS: F 11:10 am – 12:00 pm, SPR 2206 (see page 3 for details)

Instructor: Professor Tae-Hwy Lee
office: SPR 3103
office hours: by appointment only (good time: W 3:30-5, F 3-4) or open door when available

TA: Ms. Millie Yi Mao
office: SPR 3111
office hours: R 11:00 am – 1:00 pm

Course Description: The course will provide a thorough introduction to statistical methods required for 205BC and for reading articles in econometrics, economic theory, and applied economics, published in core economics journals. The course is primarily theoretical, but covers some applications and many examples. The homework assignments cover analytical problems and computing problems to learn operational aspects of theory.

References:

- George Casella and Roger Berger (CB, 2002), *Statistical Inference*, 2ed., Duxbury, ISBN 0-534-24312-6.
- Joseph Blitzstein and Jessica Hwang (2015), *Introduction to Probability*, Chapman and Hall, ISBN: 1466575573.
- Larry Wasserman (2004), *All of Statistics*, Springer
- Fumio Hayashi (2000), *Econometrics*, Princeton University Press
- Bruce Hansen (2017), *Econometrics*

Grading: Attendanace in all LEC/DIS is required (needless to say). Arrival on time (needless to say). No phone or internet in LEC/DIS (needless to say). No late homework will be accepted. All exams are mandatory and *no* make-up exams will be given. The final exam is comprehensive. The following schedule may be subject to change with a short notice. Students are responsible for any announcement and information provided during LEC/DIS.

- Assignments 25% many, weekly
- Midterm 25% 11/08/2017 Wednesday, 2:10 pm – 3:30 pm, SPR 2206
- Final Exam 50% 12/15/2017 Friday, 1:00 pm – 4:00 pm, SPR 2206

The academic integrity procedures for graduate students: Academic integrity violations involving graduate students are reviewed and processed by the Graduate Division. Examples of academic integrity violations include plagiarism, cheating, unauthorized collaboration, etc. The Student Conduct Office does not administrate these instances for graduate students, only undergraduates. Information, policies and procedures regarding academic integrity for graduate students and the form required to report a violation can be found here. There is also a direct link under the Faculty and Staff section of the Graduate Division website.

Course Outline: We will cover the following topics in Econ 205A. Part I and Part II are based on CB. Many materials in CB will not be covered (e.g., CB6). Other materials (not covered in CB) will be added. The order of covering some topics may be changed, for example, some materials in CB10 will be discussed earlier, and may be combined with the materials in Section CB5.5. Part I was covered in the minimath course and thus Part I will be reviewed rather quickly.

Part I. Introduction to Probability Theory

1. Probability Theory (CB1): set theory, axiomatic foundations, random experiments, sample space, events, probability measure, measurability, probability space, conditional probability, independence, random variables, distribution functions, density and mass functions
2. Transformations and Expectations (CB2, CB3): empirical distributions and histograms, change of variables, functions of a random variable (univariate transformations), expected values, some important inequalities, moment generating function, characteristic function, differentiating under an integral sign
3. Special Distributions (CB3, CB2): discrete distributions, continuous distributions, exponential families, location and scale families
4. Multiple Random Variables (CB4): random vectors and multivariate probability distributions, joint distributions, marginal distributions, conditional distributions, conditional expectations, law of iterated expectations, bivariate transformations, moments, covariance and correlation, some important inequalities, functions of random vectors (multivariate transformations), bivariate normal distribution, marginal normal, conditional normal, regression, multivariate normal, quadratic forms of normal variates

Part II. Introduction to Statistics

5. Properties of a Random Sample (CB5): population and random sample, sampling theory and statistics, sums of random variables from a random sample, sampling from normal distribution, the sampling distribution of the sample mean, the sampling distribution of the sample variance, Student's *t* distribution, Snedecor's *F* distribution
6. Principles of Data Reduction (CB6, CB7): sufficient statistics, Rao-Blackwell
7. Point Estimation (CB7, CB8): least squares, maximum likelihood estimation, method of moments, generalized method of moments, mean square error criterion, best unbiased estimators, information matrix, Cramér-Rao bound, Gauss-Markov theorem, statistical decision theory, loss function optimality, risk, admissible, minimax, testing, Neyman-Pearson lemma
8. Hypothesis Testing (CB8): introduction to hypothesis testing, the Wald test, the Lagrange multiplier test, the likelihood ratio test, error probabilities, the power function, p-values
9. Interval Estimation (CB9): methods of finding interval estimators, inverting a test statistic, pivotal statistics, methods of evaluating interval estimators, coverage probability, testing for correct coverage probability
10. Asymptotic Evaluations (CB10, CB5): limits, orders of magnitude, motivation for convergence concepts, convergence in quadratic mean and L_{p}-convergence, convergence in probability, almost sure convergence, convergence in distribution, the delta method, consistency, efficiency, law of large numbers, central limit theorems, M-estimators (consistency, asymptotic normality), Maximum likelihood, QML, Tests and confidence regions, bootstrap

Part III. Introduction to Econometrics

11. Linear Models (CB11, CB12): classical assumptions, violations of the classical assumptions, estimation, testing linear and nonlinear hypotheses, asymptotic properties, model selection, bootstrap
12. Instrumental Variable Models: IV, 2SLS, control function, GMM