# ECON 104 Syllabus

Haoqi Tong

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## 1 Course description

Econ 104 is the first course in a two-part econometrics sequence (Econ 104 and Econ 204) designed for economics undergraduate students. The course introduces probability theory and statistical inference, covering topics such as probability, random variables, distributions, moments, estimation, and hypothesis testing, concluding with simple linear regressions. The goal of this course is to equip students with the necessary statistical and econometric knowledge and skills to understand and critically evaluate materials that use these methodologies. This will enable students to become informed and confident readers of statistical and econometric information, as well as lay the foundation for further study in these areas. By the end of the course, students should be able to comprehend and interpret statistical and econometric concepts and techniques and apply them in a variety of economic contexts. The course uses economic examples to illustrate concepts and introduces rigorous statistical concepts that underpin econometrics. It emphasizes conceptual understanding, uses mathematics to illustrate ideas, and has students analyze data to reinforce their understanding.[1]

## 2 Lectures and office hours

- Lectures: SS 124, MTuTh, 2:00PM - 4:05 PM
- Office hours: SS 124, Th, 10:00AM - 12:05 PM[2]

## 3 Assessment

- The class may only be taken for a letter grade and not on a satisfactory/unsatisfactory basis.
- The course grade will be determined based on problem sets (30%), a midterm exam(30%), and a final exam(40%).

[1] I am grateful to professor Jason Brent and professor Pellumb Reshidi for sharing their course contents, all errors are my own.

[2] You can always contact me at haoqi.tong@duke.edu

- Problem sets(30%):
  - There will be (about) 2 problem sets every week.
  - The default due time of problem sets is Friday 11:59 pm each week. The first due date (for problem set 1) will be May 24.
  - You can discuss problem sets with you classmates and me. But each of you should hand in your own copy of problem sets.
- Midterm exam(30%): 90 mins, candidate time: June 4, 2:00PM - 3:30 PM, SS 124.
- Final exam(40%): 3 hours, June 27, 2:00PM - 5:00 PM, SS 124.

# 4 Software

In Econ 104 and 204 you will use the statistical software called STATA for empirical work. Students will use STATA extensively in Econ 204 and will begin to utilize it in Econ 104 towards the mid/end of the course.

The economics department has a site license for STATA, and you can download it to use on your own computer. The license is valid for this calendar year. The information you need is:

- Serial number: 401809321091
- Code: 9xbn x5ee ddc3 vnd$ n5p7 q8ra ir$1 1zup i7ye u
- Authorization: zvrm

This should not be shared with others.

# 5 Textbook

The main textbook for this course is

- John E. Freunds Mathematical Statistics with Applications, 8th Edition - Irwin Miller and Marylees Miller. ISBN-10: 032180709X.

This book will be abbreviated as 'MM'. There are plenty of statistics and econometrics textbooks and you are more than encouraged to explore other options more suitable for you.

# 6 Overview of course contents

- Probability
  - Topics: sample spaces, operations on sets, axioms of probability, permutations and combinations, conditional probability.

  - MM chapter 1-2

- Random variables
  - Topics: discrete and continuous random variables (RVs), probability mass function(PMF), probability distribution function (PDF), and cumulative distribution function (CDF), quantiles.
  - MM chapter 3

- Multivariable random variables
  - Topics: joint, marginal, conditional distributions, independence.
  - MM chapter 3

- Expectation, variance, and other moments
  - Topics: measures of location (mean, median, mode), variance and standard deviation, skewness and kurtosis, covariance, and correlation.
  - MM chapter 4-7

- Introduction to statistical inference
  - Topics: population distribution, sample, sample statistic, large sample inference, and finite sample inference.
  - MM chapter 8, 10

- Hypothesis testing
  - Topics: null and alternative hypotheses, critical regions, test statistics, size, power, types of errors, p-values, and confidence intervals.
  - MM chapter 12-13

- Simple linear regression
  - Topics: ordinary least squares (OLS) regression, R-squared, prediction
  - MM chapter 14