

## Advanced Mathematical Statistics

I. **Course Code: 1700116**

Class Hour: 48 Credit: 3 Semester: Spring  
(Classroom Hour: 48 ; Practice Hour: 0 )

II. **Suitable specialty: Statistics**

III. **Prerequisites: Mathematical analysis, linear algebra, probability theory, mathematical statistics**

IV. **Course Description and course target**

This is a core course in statistical theory for beginning graduate students in statistics, probability, and application fields where a sound understanding of statistical principles is essential. We will approximately cover most materials in Chapters 1–5 of Bickel and Doksum.

V. **Teaching method:**

Classroom lecture and in-class discussion

VI. **Course content**

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| 1. Statistical Models and goals                        | 12 Class Hour |
| 1.1 Statistical Models                                 |               |
| 1.2 Decision theory and prediction                     |               |
| 1.3 Sufficiency and data reduction                     |               |
| 1.4 Exponential families                               |               |
| 2. Estimation Methods                                  | 12 Class Hour |
| 2.1 Basic heuristics of estimation                     |               |
| 2.2 Method of moments                                  |               |
| 2.3 MLE  |               |
| 2.4 Computational issues                               |               |
| 3. Measures of performance                             | 12 Class Hour |
| 3.1 Bayes procedures and Minimax procedures            |               |
| 3.2 Unbiased estimation and UMVUE                      |               |
| 3.3 Asymptotic theory and consistency                  |               |
| 3.4 Asymptotic efficiency of MLEs and other criteria   |               |
| 4. Testing and confidence regions                      | 8 Class Hour  |
| 4.1 Hypothesis testing: the NP lemma and UMPT          |               |
| 4.2 Likelihood ratio tests and Bayes tests             |               |
| 4.3 Confidence set and Bayesian credible sets          |               |
| 5. Discussion part: Statistical modeling in modern era | 4 Class Hour  |

VII. **Evaluation and exams**

English problems. The final score is made up of homework(40%), presentation (30%), and final exam (30%).

## **VIII. References**

Peter J. Bickel and Kjell A. Doksum (2015) Mathematical Statistics: Basic Ideas and Selected Topics. Vol 1. Second Edition, Springer

Jun Shao (2003) . Mathematical statistics, Second Edition, Springer.

Kotz,S.,and Johnson,N.L.(1997). Breakthroughs in statistics, Volume I, Springer

Lehmann, E.L., and Casella, G. (2003). Theory of Point Estimation, Second Edition, Springer

## **IX. Syllabus written by:**

Jun Yu, assistant professor in the school of mathematics and statistics, served as a visiting scholar at the department of statistics of the University of Georgia during 2019.12—2020.12.