

## Advanced Probability Theory

**Credits:** 7.5 ECTS

### Course organizer and lecturer

Department of Mathematics and Mathematical Statistics

Jun Yu, e-mail: [jun.yu@umu.se](mailto:jun.yu@umu.se)

**Course period:** May 2020 – August 2020

### Prerequisites

Courses in probability theory and inference theory at second cycle level, corresponding to 5MS073 and 5MS058. Students are assumed to have a good knowledge of advanced calculus. A course in real analysis or measure theory prior to this course is also recommended but not strictly necessary.

### Objective

The goal of the course is in a mathematically rigorous fashion to provide essential materials in probability theory that a first or second year graduate student typically needs to learn as preparation for work on a Ph.D. degree in mathematical statistics.

There will be one three-hour lecture per week, and one three-hour exercise presentation and discussion per week.

### Content

This course provides important concepts, results and proofs in measure-theoretic probability theory with emphasis in statistical applications. It covers probability spaces and random elements, integration and differentiation, distributions and their characteristics, conditional expectations, asymptotic theory, together with a large number of exercises which includes many additional results.

### Examination

The examination consists of an oral exam and a written exam at the end of the course.

### Literature

The main course literature is Jun Shao's book (recommended buying). The other books are complementary reading. They are excellent reference literature.

Shao, J. *Mathematical Statistics*, 2<sup>nd</sup> Edition. Springer, 2003.

Shao, J. *Mathematical Statistics: Exercises and Solutions*. Springer, 2005.

Billingsley, P. *Probability and Measure*, Anniversary Edition. Wiley, 2012.