

105413001: Probability and Mathematical Statistics

Course Syllabus

Instructors: Chao Song

Lecture hours: Monday 10:30AM–12:10PM, Thursday 8:30–10:10AM

Location: Qinling Hall B408

Office hour: By appointment

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Course description: This course is an entry level probability and statistics course for undergraduate student majored in ecology and related fields. This course focuses on the basic concepts in probability and statistics. We will also cover simple statistical methods commonly used in ecological data analyses. We aim at providing you a solid theoretical understanding of probability and statistics and building a foundation to pursue more advanced topics in data analyses in the future.

Course materials: This course does not require any textbooks. I will provide lecture slides for your references. Lecture slides will be posted on the online teaching platform and my lab website (chaosonglab.github.io/teaching).

Statistical software: We will use R in this course to perform simulations and statistical analysis. R is a language and environment for statistical computing and graphics. It is the most popular statistical software for ecology and many other fields. R is freely available. Go to the [Comprehensive R Archive Network](#) to get the software. Refer to the [R user manual](#) to learn the basics of the software. This course also has an accompanied lab section. You will have more opportunities to learn how to use R for data analysis in the lab sessions.

Evaluation: The course grade will be determined by homework assignments (50%) and the final exam (50%). Homework will be posted on the online teaching platform. You should submit your homework on time. No late homework submission will be accepted.

Attendance: Attending the lecture regularly is essential for success in this class. I thus expect students to come to class regularly without me formally requiring it or taking attendance. If you have to miss class for one reason or another, you need not inform me, but you are still responsible for the materials you missed in class.

Schedule: The course schedule is tentative. I will strive to follow the schedule but it may be adjusted depending on the course progress.

| Week | Date | Topic |
|------|-------|--|
| 1 | 9/1 | Concepts of probability |
| 1 | 9/4 | Conditional probability and Bayes' theorem |
| 2 | 9/8 | Discrete random variables |
| 2 | 9/11 | Common discrete distributions |
| 3 | 9/15 | Continuous random variables |
| 3 | 9/18 | Common continuous distributions |
| 4 | 9/22 | Multivariate distributions |
| 4 | 9/25 | Multivariate distributions |
| 5 | 9/29 | Transformation of random variables |
| 6 | 10/9 | Central limit theorem |
| 7 | 10/13 | Exploratory data analysis |
| 7 | 10/16 | Point estimation |
| 8 | 10/20 | Point estimation |
| 8 | 10/23 | Interval estimation |
| 9 | 10/27 | Interval estimation |
| 9 | 10/30 | Hypothesis and hypothesis testing |
| 10 | 11/3 | Likelihood ratio tests |
| 10 | 11/6 | Tests about means and proportions |
| 11 | 11/10 | Chi-square goodness of fit tests |
| 11 | 11/13 | Linear regression |
| 12 | 11/17 | Linear regression |
| 12 | 11/20 | Analysis of variance |
| 13 | 11/24 | Analysis of variance |
| 13 | 11/27 | Implementing linear models in R |
| 14 | 12/1 | Experimental design |