| 科目ナンバリング | U-LAS70 10002 SE50 | | | | | | |
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| 授業科目名 <英訳> | ILAS Seminar-E2 :Introduction to Probability（確率入門）<br>ILAS Seminar-E2 :Introduction to Probability | | | 担当者所属 職名・氏名 | 数理解析研究所 准教授 Croydon, David Alexander | | |
| 群 | 少人数群 | 単位数 | 2単位 | 週コマ数 | 1コマ | 授業形態 | ゼミナール（対面授業科目） |
| 開講年度・開講期 | 2026・前期 | 受講定員 (1回生定員) | 25 (15) 人 | 配当学年 | 主として1回生 | 対象学生 | 全学向 |
| 曜時限 | 木2 | 教室 | 4共22 | | | 使用言語 | 英語 |
| キーワード | mathematical analysis / applied mathematics and statistics / probability / stochastic process / Markov chain | | | | | | |

**[授業の概要・目的]**

This seminar-style course will give students a chance to learn about some important models in applied probability. The focus will be on Markov chains, which are central to the understanding of random processes, and have applications in simulation, economics, optimal control, genetics, queues and many other areas. As well as introducing mathematical techniques, it will be a goal to show how these can be applied to understand certain random phenomena, such as the long-time behaviour of random walks, survival/extinction of branching processes, convergence of algorithms, and reinforcement.

**[到達目標]**

- To understand basic models of applied probability, particularly Markov chains
- To apply mathematical techniques to understand random phenomena in applications
- To gain experience in reading and presenting mathematics in English

**[授業計画と内容]**

In the first lecture, the lecturer will introduce the topic, and basic aims of the course. For most subsequent weeks, the classes will consist of two parts:
- a part where students present their attempts to solve problems set by the lecturer in the previous class;
- a part where the lecturer introduces some new topics upon which the following week's student problems will be based.

The following indicates possible topics, though this may vary depending on the students’ proficiency level and background.

(1) Introduction to applied probability and Markov chains [1 week]
Review of basic probability, definition of a Markov chain, outline of course
(2) Basic properties of discrete-time Markov chains [7 weeks]
Class structure, hitting times/probabilities, computations using probability generating functions
(3) Long-time behavior of discrete-time Markov chains [3 weeks]
recurrence/transience, invariant distributions, convergence to equilibrium, time reversal, ergodic theorem
(4) Applications [3 weeks]
Random walks, branching processes, urn models, queuing models

Total: 14 classes and 1 week for feedback

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**[履修要件]**

特になし

**[成績評価の方法・観点]**

Students will be expected to participate in class, both by presenting material prepared in advance, and by discussing problems. Their performance in these aspects will contribute 70% of the final mark. There will also be a final exam, in which students will be asked to apply the techniques covered in the course, which will also contribute 30% of the final mark.

**[教科書]**

Norris 『Markov Chains』（University Press, 1997）
Grimmett and Stirzaker 『Probability and random processes』（Oxford University Press, 2001）
All the material needed for this course will be provided in the classes, and so there is no need to purchase the listed textbooks. However, they are both good sources for additional reading. Particularly, the course will follow quite closely Chapter 1 of the Norris book.

**[授業外学修（予習・復習）等]**

As noted in the course schedule, from the second week, students will be asked to prepare and present problem solutions. (Their efforts on such assignments form part of the assessment.) Details will depend on the number of students enrolled on the course, and will be discussed in the first class. Typically the lecturer would expect students to spend 1-2 hours per week on study outside the class.

**[その他（オフィスアワー等）]**

**[主要授業科目（学部・学科名）]**