Advanced Applied Math II

Intensive Course Syllabus

Instructor: Xiao-Nan LU (University of Yamanshi)
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0 Basic Information

- **Course** Advanced Applied Math II
- **Time** 9:00–12:10, 13:20–14:50, Aug. 25th, 26th, 27th, 30th, 31st, 2021.
- **Venue** Zoom [URL]
- **Instructor** Xiao-Nan LU (Department of Computer Science and Engineering, Univ. Yamanshi)
- **E-mail** xnlu@yamanashi.ac.jp
- **Webpage** https://xnlu-math.github.io/kobe2021/

1 The aim of this course

Discrete mathematics is the mathematical foundation of information sciences. Combinatorial design theory is a branch of discrete mathematics that has been actively investigated from the early 20th century due to its application to statistical design of experiments. The study on combinatorial designs has been developed from various aspects, such as their combinatorial constructions, algebraic and geometric properties, as well as their applications to information sciences. In this course, I will propose the basics of combinatorial design theory and its applications to statistics and information sciences. I also manage to introduce some recent topics and applications on combinatorial designs (if possible).

2 The contents of this course

Starting with examples and definitions, I will focus on the basic properties, existence problems and constructions of combinatorial designs, in particular, their close relation to finite geometry. In addition, I will introduce some topics on the applications to statistics and information sciences, such as optimal statistical designs and error-correcting codes. The current schedule is as follows.

25th Aug.	Lectures 1–3	Latin squares; Finite fields (1)
26th Aug.	Lectures 4–6	Finite fields (2); Finite affine geometry
27th Aug.	Lectures 7–9	Statistical design of experiments and combinatorial designs
30th Aug.	Lectures 10–12	Finite projective geometry
31st Aug.	Lectures 13–15	Error-correcting codes and combinatorial designs

3 Prerequisites

There are no particular prerequisites for this course. Basic knowledge on linear algebra and statistics (e.g. mean value, variance, linear regression) will ease the learning.

4 Textbook

None. I will post lecture notes on my website. Here are some reference books.

[1] J. H. van Lint, R. M. Wilson, A Course in Combinatorics, 2nd ed., Cambridge University Press, 2001. ISBN: 978-0521006019

[2] J. Justesen, T. Høholdt, A Course in Error-Correcting Codes, 2nd ed., European Mathematical Society, 2017. ISBN: 978-3037191798

5 Language

I will mainly speak Japanese in this course. Slides and handouts will be partially given in English.

6 Grading

There is no exam for this course. Grade will be 100% based on you homework assignments.