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] ID: `892 7838 9253`, Passcode: `appmath`
- **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 geometries. 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 & orthogonal arrays
26th Aug.	Lectures 4–6	Hadamard matrices & BIB designs
27th Aug.	Lectures 7–9	Finite geometries & finite fields
30th Aug.	Lectures 10–12	Error-correcting codes (linear codes, MDS codes, weight enumerator)
31st Aug.	Lectures 13–15	Cyclic codes, cyclic designs, and their applications

3 Prerequisites

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

4 Textbook

None. I will post lecture notes, slides, and handwriting notes during the classes on my website. Here is a reference book on combinatorics which covers most topics in this course.

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

5 Language

I will mainly speak Japanese in this course. Lecture notes containing basic definitions and theorems will be given in Japanese. Slides and handwriting notes during the classes, which cover the contents in the lecture notes, will be given in English.

6 Grading

There is no exam for this course. Grade will be 100% based on your homework assignments. The homework assignments should be written in Japanese or English and should be submitted in PDF format before the scheduled date.

- Please submit your assignments here: https://www.dropbox.com/request/2W1zEuULgSyZPrjvfNyW
- Do not forgot to write down your name and Student No.