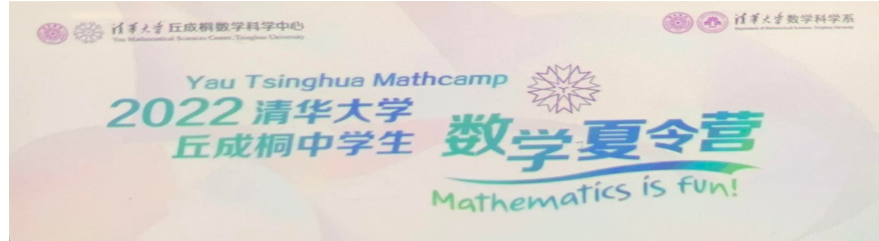


丘成桐数学科学中心
YAU MATHEMATICAL SCIENCES CENTER



ALGEBRAIC COMBINATORICS I, YAU TSINGHUA MATHCAMP, SUMMER 2022

COURSE SYLLABUS

1. GENERAL INFORMATION

Instructor: Cezar Lupu (Postdoc BIMSA)

Teaching Assistants: Tingyu Zhang (student Qiuzhen College), Yigang Zheng (student Qiuzhen College)

Emails: lupucezar@gmail.com (Cezar Lupu), tyzhang21@mails.tsinghua.edu.cn (Tingyu Zhang), zhengyg21@mails.tsinghua.edu.cn (Yigang Zheng)

Lecture & Tutorial session times:

- Monday-Friday (Lecture), 8:30-10:00 AM
- Monday-Friday (Tutorial session), 15:00-17:30 PM

Location: [online via Voov Tencent Meeting](#) (links will be sent via email)

Office hours (1 on 1 meetings with coaches): Make an appointment with the coaches via email

- Tingyu Zhang
- Yigang Zheng

Topics covered: binomials, pigeonhole principle, mathematical induction, generating functions, intersecting sets and partially ordered sets, principle of inclusion-exclusion, graph theory, Ramsey theory, probabilistic method, linear algebra in combinatorics and others

2. COURSE DESCRIPTION

Combinatorics is a fascinatingly large field of mathematics. Typically, it deals with finite structures, but it is also characterized by its methods. In this course we will revisit some of the more "classical" topics in combinatorics such as binomials,

principle of inclusion-exclusion or graph theory, but we will also look at some new topics such as extremal graph theory/Ramsey theory, intersecting sets and partially ordered sets, the probabilistic method or algebra methods in combinatorics. Moreover, we will dwell on applications of combinatorics in algebra, geometry, analysis or topology.

By the end of this course, students should develop fundamental knowledge and skills involving combinatorial objects. This course will serve as an essential ingredient in almost for further studies of other fields such as algebra, topology, linear algebra or probability theory.

Last but not least, students will have the opportunity to present research projects on topics related to the content of this course.

Course Outline

- **Chapter 0.** What is combinatorics?
- **Chapter 1.** Introduction to combinatorics.
- **Chapter 2.** Principle of inclusion and exclusion.
- **Chapter 3.** Generating functions.
- **Chapter 4.** Intersecting sets and partially ordered sets.
- **Chapter 5.** Graph theory.
- **Chapter 6.** Extremal graph theory/ Ramsey theory.
- **Chapter 7.** The probabilistic method in combinatorics.
- **Chapter 8.** Algebraic methods in combinatorics.

3. GRADING POLICY, GRADING SCALE, WEIGHTED VALUE OF ASSIGNMENTS AND TESTS

- Homework assignments: **100%** (6 homework assignments in total; you must solve the assigned problems from each homework to get full credit!). There will be around 35 problems in total.

Letter grades will then be assigned in accordance with the following correspondence:

- Letter **grade A** = a percentile grade of 90% or higher
- Letter **grade B** = a percentile grade of 80% or higher, that is lower than 90%
- Letter **C** = a percentile grade of 70% or higher, that is lower than 80%
- Letter **D** = a percentile grade lower than 60%