Math 3343 – Combinatorial Analysis
Course outline – Fall 2023-2024

Instr/Tutor	Office	Lecture/Tutorial Hour	Venue
Instructor Chen, Beifang email: mabfchen	Rm 3438	MW, 9:00 pm-10:20 pm Office hours: Wed, 16-18	Rm 4504 Rm 3438
Tutor Cao, Ying email: ycaobf	Rm 3214	Rm 3214 Tue, 1800-18:50	Rm 4502

Course description

Credit point: 4 credits

Prerequisite(s): MATH 2721; or MATH 2121/MATH 2111/MATH 2350/MATH 2131; or MATH 2343/COMP 2711

Combinatorics has its roots in mathematical recreations and games; it dates back to ancient Chinese He Luo Tu. Many problems that were studied in the past, either for amusement or for aesthetic appeal, are of great importance today in pure and applied science. Now combinatorics is an important branch of mathematics, and its influence continues to expand. Part of the reason for the tremendous growth of com- binatorics since the sixties has been the major impact that computers have had and continue to have in our society. Another reason for the recent growth of combinatorics is its applicability to disciplines that had previously had little serious contact with mathematics. It is often found that the ideas and techniques of combinatorics are being used not only in the traditional areas of mathematical application, namely, the physical sciences, but also in the social sciences, the biological sciences, information theory, and so on.

Combinatorics is concerned with arrangements of the objects of a finite set into pat- terns satisfying certain specified rules.

This course is intended for undergraduates who have taken Math2343 or elementary course of linear algebra. For students who did not take the above courses or similar ones, they are assumed to have reached certain level of mathematical maturity.

Intended Learning Outcomes

Upon successful completion of this course, students should be able to:

No.	ILOs
1	Develop concrete knowledge to understand the core combinatorial ideas and to taste the style of discrete part of mathematics. Master the fundamental principles, counting formulas, algorithms, patterns, and analytic techniques of combinatorial analysis.
2	Recognize the power of abstraction and generalization, and to carry out investigative mathematical work with independent judgment
3	Apply the fundamental principles, counting formulas, algorithms, and other techniques to formulate mathematical problems and to solve them with skills.
4	Improve the use of correct mathematical terminology and writing of correct mathematical proofs.

Assessment Scheme

Assessment	Assessing Course ILOs
10% Attendance	1, 2, 3, 4
15% Homework	1, 2, 3, 4
35% Midterm	1, 2, 3, 4
40% Final	1, 2, 3, 4

There are 4 problems sets, 2 midterm exams, and one final exam.

Textbook: Introductory Combinatorics (5th edition)
Author: Richard A. Brualdi
Press: Prentice Hall

References: R. Merris, *Combinatorics*, PWS Publishing Company, 1996.
J. Riordan, *An introduction to combinatorial analysis*, John Wiley & Sons, 1958.
J. H. van Lint & R. M. Wilson, *A course in combinatorics*, Cambridge University Press, 1992.

Advanced books
R. Stanley, *Enumerative combinatorics*, Cambridge University Press, 1991.
Jr. M. Hall, *Combinatorial theory*, John Wiley & Sons, 1986. M. Aigner, *Combinatorial theory*, Springer, 1979.

Topics: Pigeonhole principle, Ramsey theory; permutations and combinations; inclusion-exclusion principle; linear recurrence relations; generating functions; partially ordered sets; Möbius inversions; combinatorial design; Pólya counting; network flows; difference operator; marriage problem, etc.