



Hunan University MATH 25: Introductory Discrete Mathematics

Professor: To be announced

Total contact hours: 54 hours

Credit: 4

Course Description

This course is an introduction to discrete mathematics with an emphasis on the understanding of logic, relations, functions, algorithm, basic set theory, countability and counting arguments, proof techniques, mathematical induction, graph theory, combinatorics, discrete probability, recursion, recurrence relations, and number theory. During this course, we will summarize the importance of discrete mathematics related to real-world problems and problem solving with discrete data.

Textbook

Textbook: *Discrete Mathematics*

Editor: S. Axler, F. W. Gehring, K. A. Ribet

Publisher: Springer Science+Business Media

Grading

- Paper 1 15%
- Paper 2 15%
- Presentation 10%
- Midterm Exam 20%
- Final Exam 40%

A+ 96-100	A 90-95	A- 85-89
B+ 82-84	B 78-81	B- 75-77
C+ 71-74	C 66-70	C- 62-65
D 60-61	F < 60	



Course Schedule

The course has 24 class sessions in total. All sessions are 2 hours and 15 minutes in length.

Note: the course outline and required readings are subject to change.

Class 1:

Introduction

1. Let's Count

1.1 A Party

1.2 Sets and the Like

1.3 The Number of Subsets

1.4 The Approximate Number of Subsets

Class 2:

1. Let's Count (Cont.)

1.5 Sequences

1.6 Permutations

1.7 The Number of Ordered Subsets

1.8 The Number of Subsets of a Given Size

Class 3:

2. Combination Tools

2.1 Induction

2.2 Comparing and Estimating Numbers

2.3 Inclusion-Exclusion

2.4 Pigeonholes

2.5 The Twin Paradox and the Good Old Logarithm

Class 4:

3. Binomial Coefficients and Pascal's Triangle

3.1 The Binomial Theorem

3.2 Distributing Presents

3.3 Anagrams

3.4 Distributing Money

Class 5:

3. Binomial Coefficients and Pascal's Triangle (Cont.)

3.5 Pascal's Triangle

3.6 Identities in Pascal's Triangle

3.7 A Bird's-Eye View: Fine Details

3.8 An Eagle's-Eye View; Fine Details

Paper 1



Class 6:

4. Fibonacci Numbers

4.1 Fibonacci's Exercise

4.2 Lots of Identities

4.3 A Formula for the Fibonacci Numbers

Class 7:

5. Combinatorial Probability

5.1 Events and Probabilities

5.2 Independent Repetition of an Experiment

Class 8:

5. Combinatorial Probability (Cont.)

5.3 The Law of Large Numbers

5.4 The Law of Small Numbers and the Law of Very Large Numbers

Class 9:

6. Integers, Divisors and Primes

6.1 Divisibility of Integers

6.2 Primes and Their History

6.3 Factorization into Primes

6.4 On the Set of Primes

6.5 Fermat's "Little" Theorem

Class 10:

6. Integers, Divisors and Primes (Cont.)

6.6 The Euclidean Algorithm

6.7 Congruences

6.8 Strange Numbers

6.9 Number Theory and Combinatorics

6.10 How to Test Whether a Number is a Prime?

Class 11:

7. Graphs

7.1 Even and Odd Degrees

7.2 Paths, Cycles and Connectivity

7.3 Eulerian Walks and Hamiltonian Cycles

Paper 2

Class 12:

8. Trees

8.1 How to Define Trees

8.2 How to Grow Trees



8.3 How to Count Trees

8.4 How to Store Trees

8.5 The Number of Unlabeled Trees

Class 13:

Review and Midterm

Class 14:

9. Finding the Optimum

9.1 Finding the Best Tree

9.2 The Traveling Salesman Problem

Class 15:

10. Matchings in Graphs

10.1 A Dancing Problem

10.2 Another Matching Problem

Class 16:

10. Matchings in Graphs (Cont.)

10.3 The Main Theorem

10.4 How to Find a Perfect Matching

Class 17:

11. Combinatorics in Geometry

11.1 Intersections of Diagonals

11.2 Counting Regions

11.3 Convex Polygons

Class 18:

12. Euler's Formula

12.1 A Planet Under Attack

12.2 Planar Graphs

12.3 Euler's Formula for Polyhedra

Class 19:

13. Coloring Maps and Graphs

13.1 Coloring Regions with Two Colors

13.2 Coloring Graphs with Two Colors

13.3 Coloring Graphs with Many Colors

13.4 Maps Coloring and the Four Color Theorem

Class 20:

14. Finite Geometries, Codes, Latin Squares and Other Pretty Creatures



- 14.1 Small Exotic Worlds
- 14.2 Finite Affine and Projective Planes
- 14.3 Block Designs

Class 21:

- 14. Finite Geometries, Codes, Latin Squares and Other Pretty Creatures (Cont.)
- 14.4 Steiner Systems
- 14.5 Latin Squares
- 14.6 Codes

Class 22:

- 15. A Glimpse of Complexity and Cryptography
- 15.1 A Connecticut Class in King Arthur's Court
- 15.2 Classical Cryptography
- 15.3 How to Save the Last Move in Chess

Class 23:

- 15. A Glimpse of Complexity and Cryptography (Cont.)
- 15.4 How to Verify a Password - Without Learning it
- 15.5 How to Find These Primes
- 15.6 Public Key Cryptography

Class 24:

Final Exam

Attending Policy

Regular and prompt attendance is required. Under ordinary circumstances, you may miss two times without penalty. Each absence over this number will lower your course grade by a third of a letter and missing more than five classes may lead to a failing grade in the course. Arriving late and/or leaving before the end of the class period are equivalent to absences.

Policy on "Late Withdrawals"

In accordance with university policy, appeals for late withdrawal will be approved **ONLY** in case of medical emergency and similar crises.

Academic Honesty

Hunan University expects all students to do their own work. Instructors will fail assignments that show evidence of plagiarism or other forms of cheating, and will also report the student's name to the University administration. A student reported to the University for cheating is placed on disciplinary probation; a student reported twice is suspended or expelled.



General Expectations:

Students are expected to:

- Attend all classes and be responsible for all materials covered in class and otherwise assigned;
- Complete the day's required reading and assignments before class;
- Review the previous day's notes before class and make notes about questions you have about the previous class or the day's reading;
- Participate in class discussions and complete required written work on time;
- Refrain from texting, phoning or engaging in computer activities unrelated to class during the class period;
- While class participation is welcome, even required, you are expected to refrain from private conversations during the class period.

Special Needs or Assistance

Please contact the Administrative Office immediately if you have a learning disability, a medical issue, or any other type of problem that prevents professors from seeing you have learned the course material. Our goal is to help you learn, not to penalize you for issues which mask your learning.