Discrete Mathematics 2025 Spring

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https://kejiwei.github.io/

🎓 **Academic Background:**

- **Xi'an Jiaotong University**
  Undergraduate in Automation

- **Dartmouth College**
  Ph.D *Operations Research*
  -Advanced studies in optimization and decision-making processes.

💼 **Professional Experience:**

- **Sabre**
  Research Scientist
  -Leading research in operations research and its applications in the airline industry.

- **Tongji University**
  Tenured Associate Professor, Institute of Operations Research and Intelligent Decision

- ☑ **No Laptop, No cell phones**
- ☑ **English or Chinese is okay**
- ☑ **Attend all classes on time**
- ☑ **Answer questions actively**
- ☑ **Solve everything before final exam**

Course Web Site:

🖥 **https://kejiwei.github.io/teaching/courses/dismath/**

This is a English teaching class…

Discrete mathematic is the part of mathematics devoted to study of discrete objects.

- What is the probability of winning a lottery?
- What is the shortest path between two cites using a transportation system?
- How can a list of integers be sorted so that the integers are in increasing orders?

- **Advanced Mathematics, Linear Algebra, and Discrete Mathematics**

- Main Content of Discrete Mathematics

- Discrete Mathematics and Computer Science

- Discrete Mathematics and Management Science and Engineering

0.1 Discrete Mathematics: Objective and Content
↳ **Advanced Mathematics, Linear Algebra, and Discrete Mathematics**

同济经管
TONGJI SEM

Mathematical Branch	Research Objective	Mathematical Tools	Applied Field
Advanced Mathematics	Continuous Numbers (e.g., real numbers) and methods of handling	Differential and integral calculus, and other mathematical tools	Speed, force, temperature, and physical quantities processing.
Discrete Mathematics	Discrete Elements (e.g., integers) and methods of handling	Set theory, graph theory, combinatorial mathematics, algebra and calculus, and logic tools	Information theory, cryptography, etc., such as data structures, algorithm design, network theory, etc.
Linear Algebra (Branch of Algebra)	Vector space (e.g., projection and matrix)	Linear programming, vector space properties, transformation, and matrix	In complex systems with large data (e.g., graph theory), linear transformation for vector space conversion
Data Structures (Algorithm Theory and Logic Branch)	Basic data structures (e.g., linked lists, arrays, graphs) and complex data structures (e.g., trees, tables)	Set theory, combinatorics, graphs, and operations in computing	Software development and system design for computational systems

Research Subject	Research Content
Set Theory	Operations and properties of sets, such as union, intersection and complement.
Logic and Boolean Algebra	Logical reasoning, propositional logic, predicate logic, and principles and applications of Boolean algebra.
Graph Theory	Graphs and their properties, including paths, cycles, coloring problems, and network flows.
Combinatorial Mathematics	Counting problems such as permutations, combinations, binomial theorem, and counting principles.
Discrete Probability	Probability of events in a discrete sample space.
Number Theory	Integers and their properties, such as divisibility, greatest common divisors, and prime numbers.
Algebraic Structures	Algebraic systems such as groups, rings, and fields.
Algorithm Theory	Algorithm Theory

Management and Engineering-Related Issues	Involvement of Discrete Mathematics Theory and Tools
Operations Research and Optimization	**Graph Theory and Combinatorial Optimization**, used to solve many problems in operations research, such as path optimization, scheduling, and resource allocation.
Decision Analysis	Utilizing **Logic and Set Theory** from discrete mathematics can better construct and analyze decision trees and decision models, aiding corporate management in risk assessment and decision-making.
Project Management	**Network Flow and Path Analysis in Graph Theory** are crucial for optimizing project progress.
Information Systems and Database Design	**Set Theory and Relational Models** play a key role in database design and data structure creation, improving efficiency and effectiveness in data management.
Quality Control and Process Improvement	Discrete mathematics' **statistical methods and models** can optimize quality control and manufacturing processes, helping businesses analyze production data to identify problems and implement improvements.
Risk Management and Analysis	**Discrete Probability Theory and Statistical Methods** are used to evaluate risks and uncertainties, predicting the likelihood of risk events and their potential impact on business.
Market Analysis and Research	**Combinatorial Mathematics and Graph Theory** play a role in market segmentation, customer behavior analysis, and marketing strategy formulation, helping companies understand complex market structures and customer relationship networks.

■ **Course Number：01112201**

■ **Term: 2026 Spring**

■ **Class Times: (Tues, 10:00 am - 11:35 am Thurs: 8:00 am - 9:35 am)**

■ **Venue: Rm 105, North Teaching Bldg, Siping Rd Campus**

■ **Office hour: Friday 2-4 pm, Tongji School of SEM Building A, 1229**

课程名称（中文）	离散数学		
课程名称（英文）	Discrete Mathematics		
课程编号	011122	授课语言	英文
学　分	4	课内学时	64
课程性质	专业基础课	考试/考查	考查
先修课程	高等数学，线性代数，C语言程序设计，面向对象程序设计		

Course Teaching Objectives

■ **Objective 1**: Proficiently grasp the basic concepts and fundamental theories of **set theory** and proof methods, and master the application of these basic tools.

■ **Objective 2:** Understand the basic concepts and fundamental theories of **mathematical logic** (including propositional logic and first-order logic) and learn to apply these basic tools.

■ **Objective 3:** Proficiently grasp the basic concepts and fundamental theories of **relations and functions**, and be able to use relevant research methods to analyze and solve problems.

Course Teaching Objectives

■ **Objective 4:** Proficiently grasp the basic concepts and fundamental theories of **graph theory** (including trees) and use various graph theory models to analyze and solve problems.

■ **Objective 5:** Proficiently grasp the basic concepts and fundamental theories of **abstract algebra** and be able to use relevant research methods to analyze and solve problems.

Knowledge Units (Chapters)	In-Class Hours
Set Theory and Proof Methods	6
Propositional Logic	6
First-Order Logic	5
Relations	6
Functions	6
Graphs	7
Trees and Their Applications	5
Elementary Number Theory	4
Algebraic Systems (Group Theory)	14
Comprehensive Review	2

成绩分布示意图

柱状图

Grading	Percentage	Instruction
Attendance/ Discussion	5%	When I took the course, I tried my best to attend every discussion and ask questions whenever I was confused!
Intermediate exams	35%	There will be 5-10 in-class exams, each with 5 problems. Electronic devices are not allowed for each exam.
Final exam	60%	Students are permitted to bring a single A4 sheet into the exam room to record essential information. Electronic devices are not allowed.

Drop lowest Intermediate exams score
Active participation in class 5% (bonus)
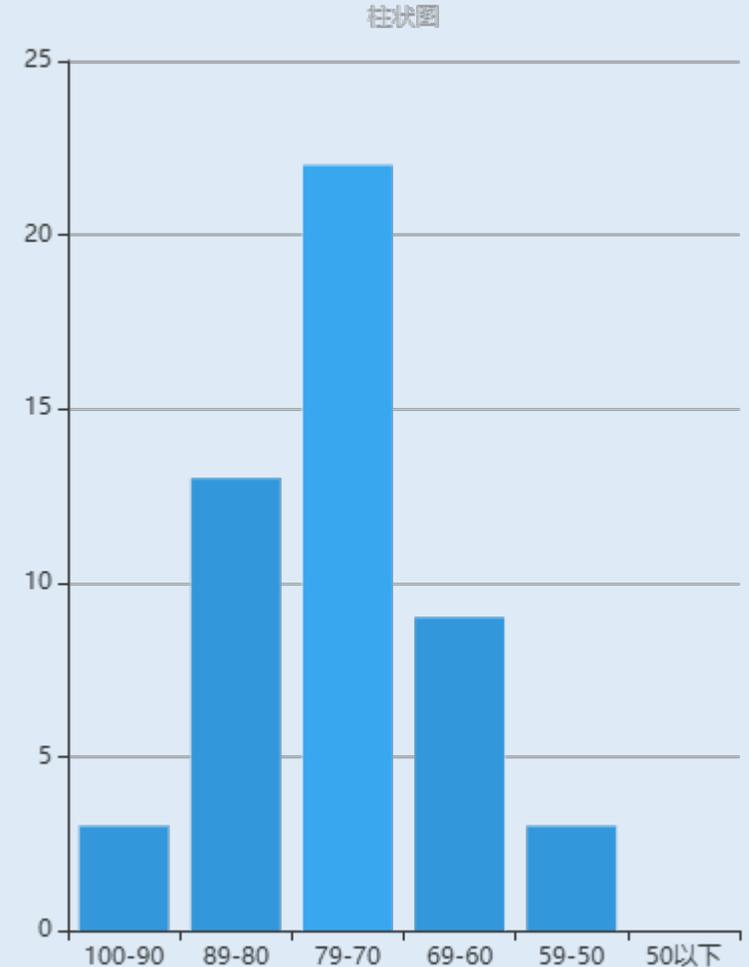
Title	Author(s)	Press	Edition	ISBN	
离散数学	耿素云，曲婉玲，张立昂	清华大学出版社[2021]	第6版	9787302592686	
Discrete Mathematics and Its Applications	Kenneth H. Rosen	Mcgraw-Hill [2019]	Eighth Edition	978125967651	
离散数学及其应用	Kenneth H. Rosen著 徐六通等译	机械工业出版社[2019]	第8版	9787111636878	
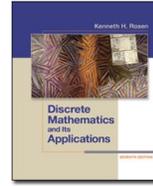
- **Solve additional exercises from text books**

- **Prepare lesson content in advance**

- **Think and finish exams independently**

- **Fully utilize TA/Instructor resources**

- **No tricks (waive, delay...)**

List of Symbols used in the class

? Let me know if you have any questions/suggestions.

Course Web Site:

https://kejiwei.github.io/teaching/courses/dismath/