Spring 2021

Math 2343 – Discrete Structure

Brief Outline: This is an introductory course on Discrete Mathematics for `Year One` students. We will cover set theory, elementary logic, binary relations, combinatorics, graph theory, and Boolean algebra, etc. If time permits, we may add some more details to each topic. There is no specific prerequisite for taking this course, though the A Level Math is required.

Instr/Tutor	Office	Lecture/Tutorial Hour	Venue
Beifang Chen email: mabfchen	Rm 3438	L: Tue,Thu 10:30am-11:50am Office Hour: Wed, 4pm-6pm	Rm xxxx Lift 25-26
Chan, Wa Fai email: mawfchan@ust.hk	Rm 3213	T: Fri, 10:30am-11:50am Office Hour: Mon 4-6pm	Rm xxxx Lift 25-26

Textbook: **Discrete Mathematics** (5th edition)
by Kenneth A. Ross & Charles B. Wright
Prentice Hall International Editions 2003

Homework: Problem sets will be distributed from time to time. All of them will be collected by tutors in tutoring sessions before the due dates. Tutors will keep the records of all grades. Since we have no graders, the problems will be checked on the 0-1 base, that is, full mark for handed in problems and zero mark for not.

Test: There are midterm and final exams. Everyone must write the two exams without exception.

Grading: Final letter grades will be given at the end, based on the results of homework, midterm and final exams. Attendance, homework, midterm, and final count 10%, 15%, 30%, and 45% respectively.

Question: For mathematical questions, whether they are about lectures or problem sets or exams, you may ask either the tutors or the instructor. But for solutions to problem sets and grading records of homework and exams, ask the tutor.

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Tentative Schedule (further topics will be added in if time permits)

Week 1-2	Sets, Sequences, and Functions
1.1–1.7	Divisibility, Sets and Subsets, Operations on Sets
	Sets and Subsets, Operations on Sets
1.5, 1.6	Functions, Sequences
1.7	Properties of Functions
Week 3-4	Elementary Logic
2.1, 2.2	Propositional Calculus
2.3, 2.4	Methods of Proof
2.5, 2.6	Logic in Proofs, Analysis of Arguments
Week 4-5	Relations
3.1, 3.2, 3.3	Relations, Digraphs and Graphs, Matrices
3.4	Equivalence Relations and Partitions
3.5	Integers Mod p (Elementary number theory)
Week 5-6	Induction and Recursion
4.1, 4.2	Loop Invariants, Mathematical Induction
4.3, 4.4	Big-Oh Notation, Recursive Definition
4.5, 4.6	Recurrence Relations, More Induction
4.7	Euclidean Algorithm, Linear Diophantine Equation
	Modular Linear Equation
Midterm Exam	March 20, 2021; Sat, 0:00-23:59; venue TBA or online open
Week 7-8	Counting
5.1	Basic Counting Techniques, Permutation, Combination
5.3	Inclusion-Exclusion Principle
5.4	Counting and Partitions
5.5	Pigeon-Hole Principle
Week 9-10	Basic Graph Theory
6.1, 6.2	Graphs, Euler Paths and Circuits
6.3 6.4	Trees and Rooted Trees
6.5*	Hamilton Path and Circuits, Planar Graphs
6.6	Minimal Spanning Trees
Week 11-12	Recursion, Trees, Algorithms, Probability
7.1–7.5	Depth-First Search, Breadth-First Search
	Polish Notation, Minimal Spanning Trees
8.1–8.3	Digraphs
9.1– 9.4	Discrete Probability
Week 13	Boolean Algebra
10.1–10.5	Boolean Expressions

Discrete mathematics needed for the study of computer science: sets, functions; propositional logic, predicate logic, rules of inference, proof techniques; pigeonhole principle, basic and generalized permutations and combinations, binomial coefficients, inclusion-exclusion principle; probability theory, Bayes theorem, expectation, variance, random variables, hashing; cryptography and modular arithmetic, Euclids division theorem, multiplicative inverse, divisibility, RSA cryptosystem, Chinese remainder theorem; mathematical induction, strong induction and well-ordering property, recursion, recurrence relations; graph representation, isomorphism, connectivity, Euler paths, Hamilton paths, planarity, graph coloring. Gentle introduction to many discrete mathematical concepts that will appear later in more advanced computer science courses.