The Hong Kong University of Science and Technology

UG Course Syllabus (Fall 2025-26)

[Course Title]	Honors Discrete Mathematical Tools for Computer Science
[Course Code]	COMP 2711H
[No. of Credits]	4
[Any pre-/co-requisites]	Prerequisites: Level 5* or above in HKDSE Mathematics Extended Module M1/M2; OR grade A- or above in MATH 1014; OR grade B+ or above in MATH 1020 / MATH 1024 Exclusions: COMP2711, MATH 2343

Name: Sunil Arya

Email: arya@cse.ust.hk

Course Description

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, Euclid's 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, Eulerian paths, Hamiltonian paths, planarity, graph coloring. Gentle introduction to many discrete mathematical concepts that will appear later in more advanced computer science courses.

Intended Learning Outcomes (ILOs)

By the end of this course, students should be able to:

1. Describe the formulation of common problems in several areas of discrete mathematics, including combinatorics, number theory and cryptography, logic and proof, recursion and recurrences and probability theory.
2. Define the connection between the discrete mathematical tools learned and some core computer science topics covered later in the curriculum, including computational complexity, information security, recursive functions and data structures.
3. Apply the mathematical techniques learned to solve problems in a range of topics.
4. Demonstrate a level of mathematical maturity by solving problems using an array of different proof techniques.

Assessment and Grading

This course will be assessed using criterion-referencing and grades will not be assigned using a curve. Detailed rubrics for each assignment are provided below, outlining the criteria used for evaluation.

Assessments:

Assessment Task	Contribution to Overall Course grade (%)	Due date
Mid-Term	35%	TBA
Assignment 1	5%	2/10/2024
Assignment 2	5%	16/10/2024
Assignment 3	5%	13/11/2024
Assignment 4	5%	27/11/2024
Final examination	45%	TBA

* Assessment marks for individual assessed tasks will be released within two weeks of the due date.

Mapping of Course ILOs to Assessment Tasks

Assessed Task	Mapped ILOs	Explanation
Assignments, mid-term, final examination	ILO1, ILO2, ILO3, ILO4	ILO1: Problems will span topics like combinatorics, number theory, logic, recursion, and probability. These assessments will provide students with regular, structured practice in identifying, formulating, and interpreting problems in these core areas, thereby deepening their conceptual understanding. ILO2: Selected questions will require students to explain or identify connections between discrete mathematics concepts (such as modular arithmetic and recursion) and topics in computer science they will encounter later, such as computational complexity, information security, and data structures. This helps students appreciate the foundational role of discrete mathematics in the computing curriculum. ILO3: Assignments and exam problems will require students to apply diverse mathematical techniques—including permutations, combinations, recurrence relations, and probability computations—to solve practical and theoretical problems. Many problems will be set in contexts similar to those encountered in computer science, fostering practical application and adaptability. ILO4: Both homework and exams will include problems requiring students to construct and compare proofs using various techniques, such as mathematical induction, direct proof, and proof by contradiction. This approach promotes mathematical rigor, critical thinking, and the ability to choose and justify appropriate proof strategies.

Grading Rubrics

[Detailed rubrics for each assignment will be provided. These rubrics clearly outline the criteria used for evaluation. Students can refer to these rubrics to understand how their work will be assessed.]

Criteria	Excellent (A)	Good (B)	Satisfactory (C)	Marginal/Fail (D/F)
Assignments (20%)	Demonstrates conceptual understanding across all discrete math topics; accurately applies techniques to solve problems; establishes clear connections to computer science applications; uses appropriate and well-structured proof techniques.	Mostly correct with occasional minor errors; shows understanding and application of concepts; links to CS somewhat present; proof techniques are acceptable.	Basic understanding and partial problem-solving; minimal application to CS; limited or formulaic proofs.	Weak or incomplete solutions; many errors; lacks logical structure and connections to CS; missing or poor proofs.
Midterm Exam (35%)	Demonstrates strong grasp of core discrete math concepts; solves problems correctly and efficiently; uses a variety of proof techniques clearly and appropriately.	Mostly accurate problem-solving; shows understanding with minor gaps; acceptable use of proof strategies.	Partial correctness; struggles with some concepts or steps; weak or mechanical proof structure.	Major errors; fails to demonstrate understanding or logic; incorrect or missing proofs.
Final Examination (45%)	Thorough understanding across all topics; solves integrated and complex problems accurately; connects math tools to CS concepts; applies and explains diverse proof strategies with clarity.	Strong grasp of most topics; minor mistakes in problem-solving or connections; uses suitable proof techniques.	Meets basic expectations; partially correct; shows minimal integration or CS linkage; attempts simple proofs.	Inadequate knowledge; mostly incorrect or incomplete answers; weak or no demonstration of proof or application.

Final Grade Descriptors:

Grades	Short Description	Elaboration on subject grading description
A	Excellent Performance	Demonstrates a comprehensive grasp of discrete mathematics concepts, proficiency in problem-solving, and significant creativity in reasoning. Exhibits strong analytical skills and often goes beyond core requirements to achieve learning goals.
B	Good Performance	Shows good knowledge and understanding of key discrete mathematics topics, competence in problem-solving, and the ability to analyze and evaluate mathematical statements and proofs.
C	Satisfactory Performance	Possesses adequate knowledge of fundamental discrete mathematics ideas, competence in solving standard problem types, and some ability to analyze mathematical reasoning and think critically. Shows consistent effort and achieves the basic learning outcomes.
D	Marginal Pass	Shows some effort, has a basic understanding of key discrete mathematics concepts, and the ability to understand simple proofs. Gains benefit from the course and has the potential to improve in further study.
F	Fail	Demonstrates insufficient understanding of discrete mathematics concepts and lacks the problem-solving skills required at this level. Shows limited ability to reason logically or analytically and does not meet the minimum standards needed for progression in this discipline.

Course AI Policy

No use of Generative AI is permitted.

Communication and Feedback

Assessment marks for individual assessed tasks will be communicated via Canvas within two weeks of submission. Students who have further questions about the feedback including marks should consult the teaching assistant or instructor.

Resubmission Policy

Late submission of assignments will not be accepted unless a prior approval has been given by the instructor. No make-ups will be given for the midterm or final exam unless prior approval is granted by the instructor, or you are in an unfavorable medical condition with a physician's documentation for the day of the midterm or final exam.

Required Texts and Materials

- Discrete Mathematics and its Applications, 8th Edition, McGraw-Hill, by K.H. Rosen
- Discrete Mathematics for Computer Scientists, International Edition, Pearson, 2011, by C. Stein, R.L. Drysdale and K. Bogart

Additional Resources

Online course content to be published in HKUST canvas when the semester begins.

Academic Integrity

Students are expected to adhere to the university's academic integrity policy. Students are expected to uphold HKUST's Academic Honor Code and to maintain the highest standards of academic integrity. The University has zero tolerance of academic misconduct. Please refer to Academic Integrity | HKUST – Academic Registry for the University's definition of plagiarism and ways to avoid cheating and plagiarism.