UFUG2106 (L02) - Discrete Mathematics

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[Course Title] Discrete Mathematics

[Course Code] UFUG 2106

[No. of Credits] 3

[Any pre-/co-requisites] UFUG 1601 Introduction to Computer Science

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Office Hours:

Zishuo DING: Fri: 15:00-17:00, W4-410

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Zhengquan Li: Mon 9:30-11:30 E1-5F-179

Xin Wang: Fri 9:30-11:30 E1-5F-182

Course Description

This course examines applied and theoretical mathematical implications of discrete mathematical concepts. These include elementary logic and set theory, elementary number theory, direct proof techniques, contradiction and contraposition, mathematical induction and recursion, functions and relations, elementary combinatorics, basic graph theory, minimal spanning trees, and so on. It also expands and explores symbolic, numerical, and graphical representations of mathematical concepts. Emphasis will be put on solving problems symbolically, numerically, and graphically and understanding the connections among these methods in interpreting and analyzing results.

Intended Learning Outcomes (ILOs)

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

1. Understand the formulation of common problems in several areas of discrete mathematics, including logic and proof, combinatorics, recursion and recurrences, and graph theory
2. Understand and analyze the key algorithms in the above areas of discrete mathematics

3. Plan and select appropriate concepts and algorithms in the above areas to solve real-world problems

Weekly schedule & Weekly ILOs

Week	Topics	Weekly ILOs
1	Speaking mathematically	ILO1
2	The logic of compound statements	ILO1, ILO2, ILO3
3	The logic of quantified statements	ILO1, ILO2, ILO3
4	Number theory and methods of proof	ILO1, ILO2, ILO3
5	Sequences, mathematical induction, and recursion	ILO1, ILO2, ILO3
6	Set theory	ILO1, ILO2, ILO3
7	Mid-term test; Properties of functions	ILO1, ILO2, ILO3
8	Properties of relations	ILO1, ILO2, ILO3
9	Counting and probability	ILO1, ILO2, ILO3
10	Theory of graphs and trees	ILO1, ILO2, ILO3
11	Analysis of algorithm efficiency	ILO1, ILO2, ILO3
12	Regular expressions and finite-state automata	ILO1, ILO2, ILO3
13	Finite-state automata; course review	ILO1, ILO2, ILO3

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 (%)**
Written assignments	10%
Course participation and quizzes	5%
Project	15%
Mid-term test	25%
Final examination	45%

Mapping of Course ILOs to Assessment Tasks

Assessed Task	**Mapped ILOs**	**Explanation**
Written assignments	ILO1, ILO2	Develop problem-solving skills, reinforce understanding of key concepts (e.g., logic, sets, proof techniques, functions, relations, combinatorics, graph theory), and improve written communication of mathematical reasoning.
Course participation and quizzes	ILO1, ILO2, ILO3	Encourage active engagement with the material, provide immediate feedback on understanding, and foster critical thinking. Quizzes assess comprehension of foundational topics, while participation ensures students are consistently involved in

		discussions and collaborative learning.
Projects	ILO3	Promote deeper exploration of discrete mathematics topics, enhance research and analytical skills, and encourage creativity in applying concepts to real-world or theoretical problems.
Mid-term test	ILO1, ILO2, ILO3	Evaluate students' mastery of core concepts covered in the first half of the course (e.g., logic, number theory, proof techniques). The test assesses their ability to recall, apply, and synthesize knowledge under timed conditions.
Final examination	ILO1, ILO2, ILO3	Assess comprehensive understanding of the entire course material, including advanced topics. The exam tests students' ability to integrate and apply knowledge across different areas of discrete mathematics to solve complex problems.

Grading Rubrics

Grade adjustment will not be considered when more than 60% of students achieve a B- or higher.

1. Written Assignments Rubric

Criteria	**A (Excellent)**	**B (Good)**	**C (Satisfactory)**	**D (Marginal Pass)**	**F (Fail)**
Understanding of Concepts	Thorough and deep understanding, no errors.	Good understanding with minor errors.	Basic understanding with some errors.	Limited understanding with significant errors.	Lacks understanding.

Criteria	A (Excellent)	B (Good)	C (Satisfactory)	D (Marginal Pass)	F (Fail)
Problem Solving and Analysis	Correct, well-reasoned solutions, demonstrates creativity.	Mostly correct, lacks depth or creativity.	Partially correct with several errors.	Mostly incorrect with major errors.	Incorrect or missing solutions.
Clarity and Organization	Clear, logical, well-organized presentation.	Mostly clear, minor organizational issues.	Somewhat clear, lacks logical flow.	Disorganized, difficult to follow.	Lacks clarity and organization.
Mathematical Language and Notation	Correct and precise use of language and notation.	Minor errors in language or notation.	Some errors in language and notation.	Frequent errors in language and notation.	Incorrect use of language/notation.

2. Programming Assignments Rubric

Criteria	A (Excellent)	B (Good)	C (Satisfactory)	D (Marginal Pass)	F (Fail)
Code Correctness	Program runs flawlessly, meets all requirements, and handles edge cases.	Program runs correctly for standard cases; minor edge case issues.	Program runs partially but has functional gaps in non-edge cases.	Program runs but produces incorrect outputs for most cases.	Program does not run or crashes entirely; no valid output.
Code Quality	Clean, modular, and efficient code.	Mostly readable, well-structured, but minor inefficiencies or redundancies.	Basic structure but lacks modularity; some duplicated code.	Messy structure, poor naming, minimal organization.	Unreadable code; no effort to follow conventions.

Criteria	A (Excellent)	B (Good)	C (Satisfactory)	D (Marginal Pass)	F (Fail)
Comments	Comprehensive in-line comments; clear descriptions of logic and flow.	Adequate comments; some lack of detail.	Minimal in-line comments; explanations are vague.	Sparse or misleading comments	No comments

3. Course Participation and Quizzes Rubric

Criteria	A (Excellent)	B (Good)	C (Satisfactory)	D (Marginal Pass)	F (Fail)
Engagement and Contribution	Actively participates, contributes meaningful insights.	Regular participation, relevant contributions.	Occasional participation, limited contributions.	Rarely participates or contributes.	Does not participate.
Accuracy	Answers accurate, demonstrate full comprehension.	Mostly accurate, few errors.	Some correct answers, significant errors.	Few correct answers.	Mostly incorrect or missing.
Completion	All questions attempted, thorough effort.	Most questions attempted, reasonable effort.	Some questions attempted.	Few questions attempted.	Little to no attempt.

3. Projects Rubric

Criteria	A (Excellent)	B (Good)	C (Satisfactory)	D (Marginal Pass)	F (Fail)
Research and Understanding (30%)	Comprehensive research, deep understanding.	Good research, clear understanding.	Basic research, some understanding.	Limited research and understanding.	Insufficient research/understandir
Application of Concepts (30%)	Excellent application,	Good application, some insight.	Basic application, limited insight.	Poor application of concepts.	Incorrect or no application.

Criteria	A (Excellent)	B (Good)	C (Satisfactory)	D (Marginal Pass)	F (Fail)
	demonstrates innovation.				
Presentation and Organization (20%)	Clear, well-organized, engaging presentation.	Clear and organized presentation.	Somewhat organized, lacks clarity.	Disorganized and unclear.	Poor presentation.
Teamwork (20%)	Excellent collaboration, balanced contributions.	Good collaboration, mostly balanced.	Some collaboration, uneven contributions.	Poor collaboration.	Little to no collaboration.

4. Midterm and Final Examinations Rubric

Criteria	A (Excellent)	B (Good)	C (Satisfactory)	D (Marginal Pass)	F (Fail)
Understanding and Application	Excellent understanding and application of concepts.	Good understanding, minor errors.	Satisfactory understanding, some errors.	Limited understanding, major errors.	Insufficient understanding.
Problem Solving	Correct, thorough solutions, demonstrates insight.	Mostly correct solutions, minor gaps.	Partially correct solutions, significant gaps.	Mostly incorrect solutions.	Incorrect or missing solutions.
Clarity and Organization	Clear and well-organized responses.	Mostly clear and organized.	Somewhat clear, disorganized.	Poorly organized and unclear.	Disorganized and unclear.
Mathematical Language and Notation	Precise, correct use of language and notation.	Minor errors in language or notation.	Several errors in language and notation.	Frequent errors.	Incorrect use of language/notation.

Final Grade Descriptors:

Grades	Short Description	Elaboration on subject grading description
A	Excellent Performance	Demonstrates a comprehensive grasp of discrete mathematics, expertise in problem-solving, and significant creativity in mathematical reasoning and proofs. Exhibits a high capacity for scholarship and collaboration, going beyond core requirements to achieve learning goals. As a reference, the overall course score in A category (A-, A, A+) is no less than 85.00 (out of 100).
B	Good Performance	Shows good knowledge and understanding of the main subject matter of discrete mathematics, competence in problem-solving, and the ability of mathematical reasoning and proofs. Displays high motivation to learn and the ability to work effectively with others. As a reference, the overall course score in B category (B-, B, B+) is between 70.00 and 84.99 (out of 100).
C	Satisfactory Performance	Possesses adequate knowledge of core subject matter of discrete mathematics, competence in dealing with familiar problems, and some capacity for mathematical reasoning and proofs. Shows persistence and effort to achieve broadly defined learning goals. As a reference, the overall course score in C category (C-, C, C+) is between 55.00 and 69.99 (out of 100).
D	Marginal Pass	Has threshold knowledge of core subject matter of discrete mathematics, potential to achieve key professional skills, and the ability to make basic mathematical reasoning and proof. Benefits from the course and has the potential to develop in the discipline. As a reference, the overall course score in D category is between 50.00 and 54.99 (out of 100).
F	Fail	Demonstrates insufficient understanding of the subject matter of discrete mathematics and lacks the necessary problem-solving skills. Shows limited ability to mathematical reasoning and proofs, and exhibits minimal effort towards achieving learning goals. Does

		not meet the threshold requirements for professional practice or development in the discipline. As a reference, the overall course score in F category is below 50.00 (out of 100).

Course AI Policy

Students are encouraged to use generative artificial intelligence (GAI) tools for self-studying and exploring the topics of discrete mathematics. However, students are **not allowed** to use GAI tools to complete assessment tasks in this course unless explicitly specified.

Communication and Feedback

Assessment marks for individual assessed tasks will be communicated via Canvas within two weeks of submission. Feedback on assignments will include wrong answers, sample solutions, and average performance of the class. Students who have further questions about the feedback including marks should consult the instructor within five working days after the feedback is received. Students are also encouraged to discuss with the instructor face-to-face during the office hours.

Late Submission Policy

1-3 Days Late: 10% of the total possible points will be deducted from the score.

4-7 Days Late: 20% of the total possible points will be deducted.

More than 7 Days Late: The assignment will not be accepted and will receive a score of zero.

Extensions:

Extensions will only be granted in exceptional circumstances, such as documented medical emergencies or other serious situations. Students must contact the instructor as soon as possible to request an extension.

If there are technical difficulties with the submission platform, students must email the instructor immediately with evidence of the issue (such as screenshots) and submit the assignment as soon as the issue is resolved.

Required Textbook

“Discrete Mathematics with Applications”, 5th Edition, Susanna S. Epp.

Academic Integrity

Students are expected to adhere to the university’s academic integrity policy. Students are expected to uphold HKUST(GZ)’s Academic Honor Code and to maintain the highest standards of academic integrity. The University has zero tolerance of academic misconduct. Please refer to **Regulations for Academic Integrity and Student Conduct (https://vptlo.hkust-gz.edu.cn/ugeducation/#/ugstudenthandbook)** for the University’s definition of plagiarism and ways to avoid cheating and plagiarism.

How to avoid plagiarism and copying?

Please refer to https://www.hkust-gz.edu.cn/academics/academic-quality-manual/roles-and-responsibilities-students/how-to-avoid-plagiarism-and-copying (https://www.hkust-gz.edu.cn/academics/academic-quality-manual/roles-and-responsibilities-students/how-to-avoid-plagiarism-and-copying)

Example case of plagiarism in assignments:

- Student A borrowed the completed assignment from Student B for whatever reason. Student A then partially copied B's solutions and submitted his assignment.
- The plagiarism detector software Turnitin detected that the submitted assignments from A and B have significant similarities. Course instructors investigated the case.
- Upon confirmed, both A and B will receive zero marks on this assignment. The case will be reported to Thrust for further action.

Additional Resources

Reference book:

"Discrete Mathematics and Its Applications", 8th Edition, Kenneth H. Rosen

Website:

The Discrete Math Resources and Help Page: **http://www.discrete-math-hub.com/resources-and-help.html (http://www.discrete-math-hub.com/resources-and-help.html)**

Course Summary:

Date	Details	Due
Tue Feb 10, 2026	**Written Assignment 1 (https://hkust-gz.instructure.com/courses/2954/assignments/21208)**	due by 11:59am
Thu Mar 5, 2026	**Written Assignment 2 (https://hkust-gz.instructure.com/courses/2954/assignments/21558)**	due by 11:59pm
Thu Mar 26, 2026	**Written/Programming Assignment 3 (https://hkust-gz.instructure.com/courses/2954/assignments/22298)**	due by 11:59pm
Wed Apr 15, 2026	**Written Assignment 4 (https://hkust-gz.instructure.com/courses/2954/assignments/22797)**	due by 11:59pm

Date	Details	Due
Sun Apr 26, 2026	**Project 1 Description and Submission Details (https://hkust-gz.instructure.com/courses/2954/assignments/22651)**	due by 11:59pm
	Class Attendance 1 (https://hkust-gz.instructure.com/courses/2954/assignments/21749)	
	Class Attendance 2 (https://hkust-gz.instructure.com/courses/2954/assignments/22005)	
	Midterm Exam (https://hkust-gz.instructure.com/courses/2954/assignments/22416)	
	Quiz (https://hkust-gz.instructure.com/courses/2954/assignments/22620)	