澳門理工大學
Universidade Politécnica de Macau
Macao Polytechnic University

FACULTY OF APPLIED SCIENCES

BACHELOR OF SCIENCE IN ARTIFICIAL INTELLIGENCE

LEARNING MODULE OUTLINE

Academic Year	2025/2026	Semester	2
Module Code	MATH1113		
Learning Module	Discrete Mathematics		
Pre-requisite(s)	Nil		
Medium of Instruction	English		
Credits	3	Contact Hours	45 hrs
Instructor	Dr. Charles Lam Dr. Duo Wang	Email	cklamsta@mpu.edu.mo duo.wang@mpu.edu.mo
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MODULE DESCRIPTION

This module is designed for students to enhance their training in logical thinking through a variety of mathematical topics. Topics include set theory, logic and proof, combinatorial mathematics, relations and functions, groups, graphs, Boolean algebra and logic gates.

MODULE INTENDED LEARNING OUTCOMES (ILOS)

On completion of this learning module, students will be able to:

M1.	Describe sets using the descriptive property method; (C1)
M2.	Explain a logical proposition; (C2)
M3.	Apply some powerful mathematical tools, viz. Principle of Inclusion and Exclusion, Principle of Mathematical Induction, Multiplication Principle for Counting, and the Pigeonhole Principle in solving some mathematical problems; (C2)
M4.	Explain the abstract concept of relations, especially that of equivalence relations; (C1)
M5.	Explain the abstract concept of algebraic systems, especially that of groups; (C1)
M6.	Discuss Boolean algebra and logic gates. (C2)

These ILOs aims to enable students to attain the following Programme Intended Learning Outcomes (PILOs):

PILOs	**M1**	**M2**	**M3**	**M4**	**M5**	**M6**
P1. Select and apply proven methods, tools and techniques to the effective and efficient implementation of						

	information systems on common platforms, including the Internet platform;						
P2.	Acquire essential knowledge in specific fields of artificial intelligence, including machine learning, computer vision and natural language processing;						
P3.	Apply necessary mathematical techniques to model, analyse and devise solutions to complex problems;	✓	✓	✓	✓	✓	✓
P4.	Work independently to develop an understanding of, and the knowledge and skills associated with the general support and mitigation of security risks of computer systems and networks;						
P5.	Design and implement both relational and non-relational data stores, with an emphasis on how to organise, maintain, retrieve and analyse information;						
P6.	Distinguish the fundamental and operational issues of computer systems and artificial intelligence applications, with considerations of user, business, ethical, societal and environmental needs;						
P7.	Evaluate, prepare and communicate effectively on technical information to both technical and non-technical audience;						
P8.	Work as an effective member of a team in the analysis, design and development of software systems, with recognition of requirement to support equality, diversity and inclusion;						
P9.	Use project planning, risk management and quality management techniques in solutions to complex problems;						
P10.	Build the capacity and desire for lifelong learning and to learn advanced and emerging technologies on one's own.						

MODULE SCHEDULE, COVERAGE AND STUDY LOAD

Week	Content Coverage	Contact Hours
1 – 2	1. Sets	6
	1.1. Basic Concepts of Sets	
	1.2. Operations of Sets	
	1.3. Properties of Set Operations	
	1.4. Principle of Inclusion and Exclusion	
3 – 4	2. Simple Mathematical Logic	6
	2.1. Propositions	
	2.2. Logical Operations	
	2.3. Quantified Propositions	

	2.4. Mathematical Induction	
5 – 7	3. Counting	9
	3.1. Basic Counting Principles	
	3.2. Permutations	
	3.3. Permutations with Repetition	
	3.4. Combinations	
	3.5. Pigeonhole Principle	
8 – 10	4. Relations and Functions	9
	4.1. Cartesian Products and Partitions	
	4.2. Relations	
	4.3. Graphical Representation of Relations	
	4.4. Equivalence Relations	
	4.5. Functions	
	4.6. Injections and Surjections	
11 – 13	5. Groups	9
	5.1. Binary Operations	
	5.2. Closed Algebraic Systems	
	5.3. Monoids and Semigroups	
	5.4. Groups and Subgroups	
14 – 15	6. Boolean Algebra and Logic Gates	6
	6.1. Boolean algebra	
	6.2. Basic theorems	
	6.3. Boolean expressions	
	6.4. Logic gate and circuits	

TEACHING AND LEARNING ACTIVITIES

In this learning module, students will work towards attaining the ILOs through the following teaching and learning activities:

Teaching and Learning Activities	**M1**	**M2**	**M3**	**M4**	**M5**	**M6**

T1. Lectures	✓	✓	✓	✓	✓	✓
T2. In-class tutorials and exercises	✓	✓	✓	✓	✓	✓

ATTENDANCE

Attendance requirements are governed by the Academic Regulations Governing Bachelor's Degree Programmes of the Macao Polytechnic University. Students who do not meet the attendance requirements for the learning module shall be awarded an 'F' grade.

ASSESSMENT

In this learning module, students are required to complete the following assessment activities:

Assessment Activities	Weighting (%)	AHEP4 LOs	ILOs to be Assessed
A1. Assignments/Classwork	25%	C1, C2	M1, M2, M3, M4, M5, M6
A2. Test	25%	C1, C2	M1, M2, M3, M4, M5, M6
A3. Examination	50%	C1, C2	M1, M2, M3, M4, M5, M6

The assessment will be conducted following the University's Assessment Strategy (see www.mpu.edu.mo/teaching_learning/en/assessment_strategy.php). Passing this learning module indicates that students will have attained the ILOs of this learning module and thus acquired its credits.

Students with an overall score of less than 35 in the coursework must take the re-sit examination even if the overall score for the module is 50 or above.

Students with a score of less than 35 in the final examination must take the re-sit examination even if the overall score for the module is 50 or above.

Students with an overall final grade of less than 35 are NOT allowed to take the re-sit examination.

REQUIRED READINGS

1. Kolman, B., Busby, R. C., and Ross, S. C. (2008). *Discrete Mathematical Structures* (6th ed.). New York: Prentice Hall.

REFERENCES

1. Rosen, K. H. (1998). *Discrete Mathematics and Its Applications*. Singapore: McGraw-Hill.

STUDENT FEEDBACK

At the end of every semester, students are invited to provide feedback on the learning module and the teaching arrangement through questionnaires. Your feedback is valuable for instructors to enhance the module and its delivery for future students. The instructor and programme coordinators will consider all feedback and respond with actions formally in the annual programme review.

ACADEMIC INTEGRITY

The Macao Polytechnic University requires students to have full commitment to academic integrity when engaging in research and academic activities. Violations of academic integrity, which include but are not limited to plagiarism, collusion, fabrication or falsification, repeated use of assignments and cheating in examinations, are considered as serious academic offenses and may lead to disciplinary actions. Students should read the relevant regulations and guidelines in the Student Handbook which is distributed upon the admission into the University, a copy of which can also be found at www.mpu.edu.mo/student_handbook/.