中正大學課程大綱(CCU Course Syllabus)

資訊工程學系(Department of Computer Science and Information Engineering)

課程名稱(中文)：	離散數學			開課單位：	資訊工程學系
課程名稱(英文)：	Discrete Mathematics			課程代碼：	
授課教師：	王志航				
學分數：	3	必/選修：	必修	開科年級：	大一
先修科目或先備能力：	None				
課程概述：	Discrete mathematics is the mathematics dealing with objects that can assume only distinct, separated values. It can often be characterized by integers, continuous objects require real numbers. Other fields of mathematics that are considered part of discrete mathematics include graph theory and the theory of computation. Topics in number theory such as congruences and recurrence relations are also considered part of discrete mathematics. Discrete mathematics is the mathematical language of computer science, and as such, its importance has increased dramatically in recent decades. This course is essential for students, particularly for those preparing for future computer science courses and research.				
學習目標：	1. Mathematical reasoning 2. Combinatorial analysis 3. Discrete structures 4. Algorithmic thinking				
教科書：	Textbook: Discrete Mathematics and Its Applications, K. H. Rosen Reference: 1. Elements of discrete mathematics, C.L. Liu, McGraw-Hill. 2. DISCRETE AND COMBINATORIAL MATHEMATICS – AN APPLIED INTRODUCTION 5/E, GRIMALDI.				

課程大綱		分配時數				核心能力	備註
單元主題	內容綱要	講授	示範	習作	其他		
The Foundations: Logic and	Propositional Logic, Applications of Propositional Logic,	3				☑ 1.1 ☑ 1.2 ☑ 1.3	

Proofs	propositional equivalences, predicates and quantifiers , rules of Inference					☐ 2.1 ☐ 2.2 ☐ 2.3 ☑ 3.1 ☐ 3.2 ☑ 3.3 ☐ 4.1 ☐ 4.2	
Basic Structures: Sets, Functions, Sequences, Sums, and Matrices	Basic definitions and operations, induction, truth table	3				☑ 1.1 ☑ 1.2 ☑ 1.3 ☐ 2.1 ☐ 2.2 ☐ 2.3 ☑ 3.1 ☐ 3.2 ☑ 3.3 ☐ 4.1 ☐ 4.2	
Algorithms	Time complexity, tractable and intractable	3				☑ 1.1 ☑ 1.2 ☑ 1.3 ☐ 2.1 ☐ 2.2 ☐ 2.3 ☑ 3.1 ☐ 3.2 ☑ 3.3 ☐ 4.1 ☐ 4.2	
Number Theory and Cryptography	Divisibility and Modular Arithmetic, integer Representations and Algorithms, primes and Greatest Common Divisors, solving congruences	3				☑ 1.1 ☑ 1.2 ☑ 1.3 ☐ 2.1 ☐ 2.2 ☐ 2.3 ☑ 3.1 ☐ 3.2 ☑ 3.3 ☐ 4.1 ☐ 4.2	
Induction and Recursion	How to solve recurrence functions, finding time complexity by solving recurrence functions	6				☑ 1.1 ☑ 1.2 ☑ 1.3 ☐ 2.1 ☐ 2.2 ☐ 2.3 ☑ 3.1 ☐ 3.2 ☑ 3.3 ☐ 4.1 ☐ 4.2	

Counting	The Basics of Counting, the Pigeonhole Principle, permutations and Combinations , binomial Coefficients and Identities, generalized Permutations and combinations	6				☑ 1.1 ☑ 1.2 ☑ 1.3 ☐ 2.1 ☐ 2.2 ☐ 2.3 ☑ 3.1 ☐ 3.2 ☑ 3.3 ☐ 4.1 ☐ 4.2	
Relations	Properties of relations, equivalence relation and partition, pigeonhole principle	6				☑ 1.1 ☑ 1.2 ☑ 1.3 ☐ 2.1 ☐ 2.2 ☐ 2.3 ☑ 3.1 ☐ 3.2 ☑ 3.3 ☐ 4.1 ☐ 4.2	
Graphs	Basic definitions and properties, shortest paths, Euler paths, Hamiltonian paths	6				☑ 1.1 ☑ 1.2 ☑ 1.3 ☐ 2.1 ☐ 2.2 ☐ 2.3 ☑ 3.1 ☐ 3.2 ☑ 3.3 ☐ 4.1 ☐ 4.2	
Trees	Basic definitions and properties, prefix codes, binary search trees, minimum spanning trees	6				☑ 1.1 ☑ 1.2 ☑ 1.3 ☐ 2.1 ☐ 2.2 ☐ 2.3 ☑ 3.1 ☐ 3.2 ☑ 3.3 ☐ 4.1 ☐ 4.2	
Modeling Computation	FSM, FSM as a model, language recognizers	6				☑ 1.1 ☑ 1.2 ☑ 1.3 ☐ 2.1 ☐ 2.2 ☐ 2.3 ☑ 3.1 ☐ 3.2 ☑ 3.3 ☐ 4.1 ☐ 4.2	
教育目標(Education Goals)							
1.專業基礎知識. 使學生擁有扎實的專業基礎知識，成為資訊及相關領域的專業人才							

2.培養創造能力. 使學生具有運用所學到的各種專業知識與理論以科學的方法解決問題與創新

3.自我挑戰能力與終身學習. 讓學生習於自我挑戰、獨立思考，學會思維創新、領導及組織團隊、有效溝通、終身學習之能力

4.社會人文素養與國際視野. 讓學生具備關懷社會的情操與人文素養，並具國際觀，奉獻社會國家及人類

<div align="center">核心能力(Core Capabilities)</div>

1.1. 具有資訊工程相關基礎知識之吸收與了解的能力(Capability to grasp foundational knowledge in computer science.)

1.2. 具有運用資訊工程理論及應用知識，分析與解決相關問題的能力(Capability to use computer science theory and application knowledge to analyze and solve related problems.)

1.3. 在資訊工程的許多領域中，具有至少某一項專業能力，例如：硬體、軟體、多媒體、系統、網路、理論等。(Professional in at least one area, including hardware, software, multimedia, system, networking, and theory.)

2.1. 具有資訊工程實作技術及使用計算機輔助工具的能力。(Capability to perform computer science implementations and use computer-aided tools.)

2.2. 具有設計資訊系統、元件或製程的能力。(Capability to design computer systems, components, or processes.)

2.3. 具有科技寫作與簡報的能力。(Capability to write and present technical materials.)

3.1. 具有除了已有的應用領域之外，亦可以將自己的專業知識應用於新的領域或跨多重領域，進行研發或創新的能力。(Capability to apply one's professional knowledge to a new application domain or across multiple different application domains.)

3.2. 具有領導或參與一個團隊完成一項專案任務的能力並且具有溝通、協調與團隊合作的能力。(Capability to lead or participate in group projects, with effective communication, coordination, and teamwork.)

3.3. 具有因應資訊科技快速變遷之能力，培養自我持續學習之能力。(Capability to adapt to rapidly changing computer science technology and to develop self-learning capabilities.)

4.1. 具有社會責任、人文素養及奉獻精神。(The awareness of social responsibilities, humanity, and contribution.)

4.2. 具有工程倫理、宏觀能力、國際觀及前瞻視野。(The awareness of engineering ethics, broad capabilities, and global and contemporary vision.)

請尊重智慧財產權，不得非法影印教師指定之教科書籍(Please respect to the intellectual property rights, do not photocopy the textbooks which assigned by professors.)

教學要點概述：

1. 教材編選： ☑ 自編教材 ☑ 教科書作者提供

2. 教學方法：☑ 投影片講述 ☑ 板書講述	

3. 評量方法：☐ 上課點名 0%, ☑ 隨堂測驗 0%, ☑ 作業 40%, ☐ 程式實作 0%,

　　　　　☐ 實習報告 0%, ☐ 專案 0%, ☑ 期中考 30%, ☑ 期末考 30%,

　　　　　☐ 期末報告 0%, ☐ 其它 0%

4. 教學資源：☑ 課程網站 ☑ 教材電子檔供下載 ☐ 實習網站

5. 教學相關配合事項：

課程目標與教育核心能力相關性(Relationship between course education goals and core capabilities)

請勾選(Please select)：☑ 1.1 ☑ 1.2 ☑ 1.3 ☑ 2.1 ☐ 2.2 ☐ 2.3 ☑ 3.1 ☐ 3.2 ☑ 3.3 ☐ 4.1 ☐ 4.2

1.1	具有資訊工程相關基礎知識之吸收與了解的能力(Capability to grasp foundational knowledge in computer science.)
	為何有關： Students are expected to learn basic mathematics for computer science, which are fundamental to study advanced courses such as programming languages, data structures, algorithms, theory of computation, and artificial intelligence etc.
	達成指標： 針對本系必修課程、專業選修課程所傳授的知識能夠了解與吸收。Be able to understand and absorb the knowledge taught in the compulsory courses and professional elective courses of the department.
	評量方法： 等級 5：由作業與考試驗證課程之學習程度達到 80%或以上者 等級 4：由作業與考試驗證課程之學習程度達到 70%或以上者 等級 3：由作業與考試驗證課程之學習程度達到 60%或以上者 等級 2：由作業與考試驗證課程之學習程度達到 50%或以上者 等級 1：由作業與考試驗證課程之學習程度為 50%以下者 Level 5: Verified through assignments and examinations, the level of course learning achievement reaches 80% or above. Level 4: Verified through assignments and examinations, the level of course learning achievement reaches 70% or above. Level 3: Verified through assignments and examinations, the level of course learning achievement reaches 60% or above.

	Level 2: Verified through assignments and examinations, the level of course learning achievement reaches 50% or above.
	Level 1: Verified through assignments and examinations, the level of course learning achievement is below 50%.
1.2	具有運用資訊工程理論及應用知識，分析與解決相關問題的能力(Capability to use computer science theory and application knowledge to analyze and solve related problems.)
	為何有關：
	Students are expected to learn mathematical reasoning, combinatorial analysis and algorithmic thinking, to work with discrete structures and apply discrete mathematics to applications.
	達成指標：
	能夠運用課程所學，執行完成至少一項課程具分析與解決問題訓練之作業、試題或專題製作作品。
	Be able to apply the knowledge acquired from the course to complete at least one assignment, exam question, or project work that involves training in analysis and problem-solving.
	評量方法：
	等級 5：由作業與考試驗證課程之學習程度達到 80%或以上者 等級 4：由作業與考試驗證課程之學習程度達到 70%或以上者 等級 3：由作業與考試驗證課程之學習程度達到 60%或以上者 等級 2：由作業與考試驗證課程之學習程度達到 50%或以上者 等級 1：由作業與考試驗證課程之學習程度為 50%以下者
	Level 5: Course learning achievement, as verified through assignments and examinations, reaches 80% or above.
	Level 4: Course learning achievement, as verified through assignments and examinations, reaches 70% or above.
	Level 3: Course learning achievement, as verified through assignments and examinations, reaches 60% or above.
	Level 2: Course learning achievement, as verified through assignments and examinations, reaches 50% or above.
	Level 1: Course learning achievement, as verified through assignments and examinations, is below 50%.
1.3	在資訊工程的許多領域中，具有至少某一項專業能力，例如：硬體、軟體、多媒體、系統、網路、理論等。(Professional in at least one area, including hardware, software, multimedia, system, networking, and theory.)
	為何有關：
	Students are expected to learn mathematics that are basic to learn theory of computational science.
	達成指標：
	能夠修習至少一項資訊工程子領域(如硬體、軟體…等相關專業領域)相關專業課程六門以上。Be able to complete at least six professional courses in one subfield of computer science and

	information engineering (e.g., hardware, software, or other related specialized areas).
	評量方法： 等級 5：由作業與考試驗證課程之學習程度達到 80%或以上者 等級 4：由作業與考試驗證課程之學習程度達到 70%或以上者 等級 3：由作業與考試驗證課程之學習程度達到 60%或以上者 等級 2：由作業與考試驗證課程之學習程度達到 50%或以上者 等級 1：由作業與考試驗證課程之學習程度為 50%以下者 Level 5: Course learning achievement, as verified through assignments and examinations, reaches 80% or above. Level 4: Course learning achievement, as verified through assignments and examinations, reaches 70% or above. Level 3: Course learning achievement, as verified through assignments and examinations, reaches 60% or above. Level 2: Course learning achievement, as verified through assignments and examinations, reaches 50% or above. Level 1: Course learning achievement, as verified through assignments and examinations, is below 50%.
3.1	具有除了已有的應用領域之外，亦可以將自己的專業知識應用於新的領域或跨多重領域，進行研發或創新的能力。(Capability to apply one's professional knowledge to a new application domain or across multiple different application domains.)
	為何有關： Students are expected to learn to apply discrete mathematics to applications
	達成指標： (1)能夠運用課程所學，執行完成新領域或跨多重領域之專題作品;(2)執行完成至少一門新領域或跨多重領域之課程專題作業。 1 .Be able to apply the knowledge acquired from the course to execute and complete a project in a new field or across multiple fields. 2.Execute and complete at least one course project in a new field or across multiple fields.
	評量方法： 等級 5：由作業與考試驗證課程之學習程度達到 80%或以上者 等級 4：由作業與考試驗證課程之學習程度達到 70%或以上者 等級 3：由作業與考試驗證課程之學習程度達到 60%或以上者 等級 2：由作業與考試驗證課程之學習程度達到 50%或以上者 等級 1：由作業與考試驗證課程之學習程度為 50%以下者 Level 5: The level of course learning achievement, as verified through assignments and examinations, reaches 80% or above. Level 4: The level of course learning achievement, as verified through assignments and examinations, reaches 70% or above. Level 3: The level of course learning achievement, as verified through assignments and examinations, reaches 60% or above. Level 2: The level of course learning achievement, as verified through assignments and

	examinations, reaches 50% or above. Level 1: The level of course learning achievement, as verified through assignments and examinations, is below 50%.
3.3	具有因應資訊科技快速變遷之能力，培養自我持續學習之能力。(Capability to adapt to rapidly changing computer science technology and to develop self-learning capabilities.)
	為何有關： Students are expected to learn basic mathematics in computer science, and expected to learn to apply discrete mathematics to applications
	達成指標： 具有自我學習至少一項新的資訊工程相關領域工具或技能。Be able to engage in self-learning of at least one new tool or skill related to the field of computer science and information engineering.
	評量方法： 等級 5：由作業與考試驗證課程之學習程度達到 80%或以上者 等級 4：由作業與考試驗證課程之學習程度達到 70%或以上者 等級 3：由作業與考試驗證課程之學習程度達到 60%或以上者 等級 2：由作業與考試驗證課程之學習程度達到 50%或以上者 等級 1：由作業與考試驗證課程之學習程度為 50%以下者 Level 5: The course learning achievement, as verified through assignments and examinations, reaches 80% or above. Level 4: The course learning achievement, as verified through assignments and examinations, reaches 70% or above. Level 3: The course learning achievement, as verified through assignments and examinations, reaches 60% or above. Level 2: The course learning achievement, as verified through assignments and examinations, reaches 50% or above. Level 1: The course learning achievement, as verified through assignments and examinations, is below 50%.