中正大學 資訊工程研究所 課程大綱

課程名稱(中文) (Chinese Course type)	隨機演算法	開課單位 (Department)	資訊工程研究所
課程名稱(英文) (English Course name)	Randomized Algorithms	課程代碼 (Course code)	4105313
上課時間	二 G, 四 G	上課地點	工學院 A 館 104
授課教師 (Instructor)	王志航	學分數 (Credits)	3
必/選修 (Required/Selected)	☐ 必修 ☑ 選修	開課年級 (Level)	碩博合開
課程屬性/類別 (Course type)	☐ 人文關懷課程 ☐ 競賽專題課程 ☐ 問題導向課程 ☐ 專題導向課程 ☐ 總整課程 ☐ 實作課程 ☐ 實習 ☑ 其他		
先修科目或先備能力 (Prerequisites)	Probability and discrete mathematics		
課程概述 (Course Descriptions)	Randomization and probabilistic techniques have revolutionized modern computer science, offering powerful tools to tackle a vast array of challenges – from combinatorial optimization and machine learning to network design and secure communication protocols. This course provides a foundational introduction to the probabilistic paradigms and methods that underpin the design and analysis of randomized algorithms.		
學習目標 (Learning Objectives)	Understanding the probabilistic techniques used for designing and analyzing randomized algorithms		
教科書 (Textbooks and Reference)	1. Mitzenmacher, M., Upfal, E. (2017). Probability and Computing: Randomization and Probabilistic Techniques in Algorithms and Data Analysis. 美國: Cambridge University Press. 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.)		

每週課程內容 weekly scheduled contents
第一週：Verifying polynomial identities and axioms of probability
第二週：Verifying matrix multiplication and a randomized min-cut algorithm
第三週：Random variables and expectation
第四週：Bernoulli and binomial random variables and conditional expectation
第五週：Geometric distribution
第六週：Markov’s inequality, variance and moments

第七週：Chebyshev’s inequality
第八週：Mid-term examine
第九週：Moment generating functions
第十週：Chernoff bounds
第十一週：Balls and bins model
第十二週：Poisson distribution and approximation
第十三週：Random graphs
第十四週：Basic counting and expectation arguments
第十五週：Derandomization using conditional expectations
第十六週：Final examine
第十七週：彈性教學週
第十八週：彈性教學週

教育目標

1.具獨立從事學術研究或產品創新研發之人才

2.具團隊合作精神及科技整合能力，並在團隊中扮演領導、規劃、管理之角色

3.具創新研發、自我挑戰與終身學習能力之人才

4.具有學術倫理、工程倫理、國際觀之人才

核心能力

A1.具有資訊工程與科學領域之專業知識(Competence in computer science and computer engineering.)

A2.具有創新思考、問題解決、獨立研究之能力(Be creative and be able to solve problems and to perform independent research.)

A3.具有撰寫中英文專業論文及簡報之能力(Demonstrate good written, oral, and communication skills, in both Chinese and English.)

A4.具策劃及執行專題研究之能力(Be able to plan and execute projects.)

A5.具有溝通、協調、整合及進行跨領域團隊合作之能力(Have communication, coordination, integration skills and teamwork in multi-disciplinary settings.)

A6.具有終身學習與因應資訊科技快速變遷之能力(Recognize the need for, and have the ability to engage in independent and life-long learning.)

A7.認識並遵循學術與工程倫理(Understand and commit to academic and professional ethics.)

A8.具國際觀及科技前瞻視野(Have international view and vision of future technology.)

教學要點概述	
教材編選 (Teaching Materials)	☑自製簡報(ppt) ☐課程講義 ☐自編教科書 ☐教學程式 ☐自製教學影片 ☐其他
教學方法 (Teaching Methods)	☑講述 ☐小組討論 ☐學生口頭報告 ☐問題導向學習 ☐個案研究 ☐其他
評量工具 (Evaluation Tools)	☐上課點名 0% ☑隨堂測驗 0% ☑隨堂作業 40% ☐程式實作 0% ☐實習報告 0% ☐期中報告 0% ☐期末報告 0% ☐專題報告 0% ☑期中考 30% ☑期末考 30% ☐評量尺規 0% ☐課堂參與 0%
教學資源 (Teaching Resources)	☑課程網站 ☑教材電子檔供下載 ☐實習網站
教師 相關訊息 (Instructor's information)	課程進度會依實際教學狀況做調整
教學相關配合事項 (Course relative information)	

課程目標與教育核心能力相關性	
請勾選：☑ A1 ☑ A2 ☐ A3 ☐ A4 ☐ A5 ☐ A6 ☐ A7 ☐ A8	
A1	**具有資訊工程與科學領域之專業知識**(Competence in computer science and computer engineering)
	為何有關：Randomization and probabilistic techniques offer powerful tools to tackle a vast array of challenges in computer science – from combinatorial optimization and machine learning to network design and secure communication protocols. This course provides a foundational introduction to the probabilistic paradigms and methods that underpin the design and analysis of randomized algorithms.
	達成指標：Students will acquire a thorough understanding of randomized algorithm design and analysis.
	評量方法：Assignments and exams. Lv5: this course's grade is above 85; Lv4: this course's grade is above 80; Lv3: this course's grade is

	above 75; Lv2: this course's grade is above 70; Lv1: this course's grade is below 70.
A2	**具有創新思考、問題解決、獨立研究之能力**(Be creative and be able to solve problems and to perform independent research)
	為何有關：This course teaches how to design and analyze randomized algorithms and how to apply them to solve research problems. The techniques have been widely used in research papers.
	達成指標：Students will learn how to design and analyze randomized algorithms and apply them to solve their research problems.
	評量方法：Assignments and exams. Lv5: this course's grade is above 85; Lv4: this course's grade is above 80; Lv3: this course's grade is above 75; Lv2: this course's grade is above 70; Lv1: this course's grade is below 70.
A3	**具有撰寫中英文專業論文及簡報之能力**(Demonstrate good written, oral, and communication skills, in both Chinese and English)
	為何有關:
	達成指標：
	評量方法：
A4	**具策劃及執行專題研究之能力**(Be able to plan and execute projects)
	為何有關：
	達成指標：
	評量方法：
A5	**具有溝通、協調、整合及進行跨領域團隊合作之能力** (Have communication, coordination, integration skills and teamwork in multi-disciplinary settings)
	為何有關：
	達成指標：
	評量方法：
	具有終身學習與因應資訊科技快速變遷之能力(Recognize the need for, and have the ability to engage in independent and life-long learning)
	為何有關：
	達成指標：

A6	評量方法：
A7	**認識並遵循學術與工程倫理**(Understand and commit to academic and professional ethics)
	為何有關：
	達成指標：
	評量方法：
A8	**具國際觀及科技前瞻視野**(Have international view and vision of future technology)
	為何有關：
	達成指標：
	評量方法：