國立東華大學

教學計劃表 Syllabus

課程名稱(中文) Course Name in Chinese	應用統計線性模型AA			學年/學期 Academic Year/Semester	115/1
課程名稱(英文) Course Name in English	Applied Statistical Linear Models				
科目代碼 Course Code	AM__5150AA	系級 Department & Year	碩士	開課單位 Course-Offering Department	應用數學系
修別 Type	選修 Elective	學分數/時間 Credit(s)/Hour(s)	3.0/3.0		
授課教師 Instructor	/楊宏基				
先修課程 Prerequisite					

課程描述 Course Description

本課程依《Applied Linear Statistical Models》第 1－14 章編排，介紹線性與廣義線性統計模型的理論、方法及應用。內容從簡單線性迴歸開始，依序涵蓋統計推論、殘差診斷、同時推論、矩陣表示、多元迴歸、額外平方和、量化與類別預測變數、模型選擇與驗證、影響診斷、加權與穩健迴歸、自相關、非線性迴歸、神經網路、Logistic 迴歸、Poisson 迴歸及廣義線性模型。課程搭配 R 軟體、教材例題及實際資料分析，著重模型建立、假設檢查、統計推論、預測及結果解釋，使學生能針對實際問題選擇適當模型，並清楚呈現分析結果。

This course follows Chapters 1－14 of Applied Linear Statistical Models. It covers simple and multiple linear regression, statistical inference, diagnostics, simultaneous inference, matrix formulations, quantitative and qualitative predictors, model selection and validation, remedial measures, autocorrelated errors, nonlinear regression, neural networks, logistic regression, Poisson regression, and generalized linear models. R-based computation and real-data analysis are integrated throughout the course.

課程目標 Course Objectives

Applied linear models for regression, analysis of variance and experimental design are widely used in various application domains. Starting with the simple linear models, we will cover the main topics in linear statistical models such as multiple linear regressions, ANOVA, logistic regression, etc. Students will be exposed to both theoretical and practical aspects of applied linear models. Selected topics such as statistical machine learning, variable selection and PCA will also be briefly addressed if time permits.

	系專業能力 Basic Learning Outcomes	課程目標與系專業能力相關性 Correlation between Course Objectives and Dept.'s Education Objectives
A	具備專業機率、統計知識與應用分析能力。Have well-founded expertise in probability and statistics, and good analytical ability in solving real problems.	●
B	具備程式設計與統計計算能力。Have the computer programming and statistical computing skills.	○
C	具備學習其它學科的能力，以期能邁向跨領域研究。Be able to study other fields of science so as to conduct interdisciplinary research in the future.	○

圖示說明Illustration ：● 高度相關 Highly correlated ○中度相關 Moderately correlated

授 課 進 度 表 Teaching Schedule & Content

週次Week	內容 Subject/Topics	備註Remarks
1	單一預測變數的線性迴歸：模型建立、最小平方法與基本應用／Linear Regression with One Predictor Variable	Chapter 1

2	迴歸與相關分析的統計推論：參數檢定、信賴區間、預測與 ANOVA 方法／Inferences in Regression and Correlation Analysis	Chapter 2
3	模型診斷與補救方法：殘差、離群值、變異數不齊一及變數轉換／Diagnostics and Remedial Measures	Chapter 3
4	同時推論及其他迴歸主題：聯合信賴區間、信賴帶與同時預測／Simultaneous Inferences and Other Topics in Regression Analysis	Chapter 4
5	簡單線性迴歸的矩陣方法：矩陣表示、最小平方法及變異數分析／Matrix Approach to Simple Linear Regression Analysis	Chapter 5
6	多元迴歸 I：一般線性模型、參數估計、推論與預測／Multiple Regression I	Chapter 6
7	多元迴歸 II：額外平方和、部分 (F) 檢定、偏相關與多重共線性／Multiple Regression II	Chapter 7
8	第 1-7 章整合資料分析、R 實作與期中複習／Integrated Data Analysis, R Practice, and Midterm Review	Chapter 1-7
9	期中考試週 Midterm Exam	
10	量化與類別預測變數的迴歸模型：多項式、交互作用與指標變數／Regression Models for Quantitative and Qualitative Predictors	Chapter 8
11	迴歸模型建立 I：變數選擇、模型選擇準則、交叉驗證與模型驗證／Building the Regression Model I: Model Selection and Validation	Chapter 9
12	迴歸模型建立 II：離群值、槓桿值、Cook’s distance、DFFITS 與 DFBETAS／Building the Regression Model II: Diagnostics	Chapter 10
13	迴歸模型建立 III：加權最小平方法、Ridge regression、穩健迴歸、迴歸樹與 Bootstrap／Building the Regression Model III: Remedial Measures	Chapter 11
14	時間序列資料中的自相關：Durbin-Watson 檢定、補救方法與預測／Autocorrelation in Time Series Data	Chapter 12
15	非線性迴歸與神經網路：非線性最小平方法、模型診斷及基本神經網路模型／Introduction to Nonlinear Regression and Neural Networks	Chapter 13
16	Logistic 迴歸、Poisson 迴歸與廣義線性模型；期末綜合複習／Logistic Regression, Poisson Regression, Generalized Linear Models, and Final Review	Chapter 14
17	期末考試週 Final Exam	

彈性教學規劃 Flexible Teaching Plan	請勾選(至少需勾選1 個項目)： Please tick the box(es). (At least one item is required.): ☑ 問題討論 Problem-based Discussion ☐ 翻轉教學 Flipped Classroom ☑ 展演實作 Performance / Practical Presentation ☐ 校外參訪Off-campus Visit ☐ 講座活動 Lecture / Seminar ☐ 線上作業 Online Assignments ☐ 自主學習 Self-directed Learning ☐ 課業輔導Academic Support ☐ 實驗操作 Experiment Operation ☐ 遠距教學(同步) Distance Learning (Synchronous) ☐ 遠距教學(非同步) Distance Learning (Asynchronous) ☐ 其他(請填寫) Others (Please specify.): 備註: 本校學期週數自115 學年度起調整為17 週，為符合1學分18 小時之原則，請教師規劃安排彈性教學。 Note: From the 115th academic year, the semester will be 17 weeks. Please include flexible teaching activities to meet the required 18 hours per credit.

教 學 策 略 Teaching Strategies

☑ 課堂講授 Lecture ☑ 分組討論Group Discussion ☐ 參觀實習 Field Trip

☐ 其他Miscellaneous: Case-based learning and reproducible statistical data analysis using R.

教 學 創 新 自 評 Teaching Self-Evaluation

創新教學(Innovative Teaching)

☑ 問題導向學習(PBL) ☑ 團體合作學習(TBL) ☑ 解決導向學習(SBL)

☐ 翻轉教室 Flipped Classroom ☐ 磨課師 Moocs

社會責任(Social Responsibility)

☑ 在地實踐Community Practice ☐ 產學合作 Industy-Academia Cooperation

跨域合作(Transdisciplinary Projects)

☑ 跨界教學Transdisciplinary Teaching ☐ 跨院系教學Inter-collegiate Teaching

☐ 業師合授 Courses Co-taught with Industry Practitioners

其它 other: Worked examples, statistical computing demonstrations using R, case-based data analysis, and guided problem-solving activities.

學期成績計算及多元評量方式 Grading & Assessments									
配分項目 Items	配分比例 Percentage	多元評量方式 Assessments							
		測驗 會考	實作 觀察	口頭 發表	專題 研究	創作 展演	卷宗 評量	證照 檢定	其他
平時成績(含出缺席) General Performance (Attendance Record)	10%		✓						
期中考成績 Midterm Exam	25%			✓	✓				
期末考成績 Final Exam	25%			✓	✓				
作業成績 Homework and/or Assignments	30%		✓	✓	✓				
其他 Miscellaneous (Course Notebook Grade)	15%		✓						

評量方式補充說明
Grading & Assessments Supplemental instructions

General Performance (10%): Attendance, class participation, engagement in problem discussions, and performance in R-based exercises.
Midterm Examination (25%): Primarily covers Chapters 1–7 and assesses regression modeling, estimation, statistical inference, diagnostics, and matrix formulations.
Final Examination (25%): Primarily covers Chapters 8–14 and integrates important concepts from Chapters 1–7. Students are expected to complete model construction, diagnostics, comparison, interpretation, and reporting.
Homework Assignments (25%): Textbook exercises, theoretical derivations, and R-based data analysis assignments.
Course Notebook Grade (15%): Assessed based on the completeness, organization, accuracy, and clarity of the student’s course notes.
All assignments, computer programs, and reports must comply with academic integrity requirements and appropriate citation practices.

教科書與參考書目（書名、作者、書局、代理商、說明）
Textbook & Other References (Title, Author, Publisher, Agents, Remarks, etc.)

Kutner, M. H., Nachtsheim, C. J., Neter, J., and Li, W. (2005). Applied Linear Statistical Models, Fifth Edition. McGraw-Hill/Irwin. ISBN: 0-07-238688-6.

課程教材網址(含線上教學資訊,教師個人網址請列位於本校內之網址)
Teaching Aids & Teacher’s Website(Including online teaching information. Personal website can be listed here.)

https://elearn4.ndhu.edu.tw/

Course announcements, lecture notes, assignments, data sets, and supplementary R materials will be provided through the NDHU e-Academy course page.

其他補充說明 (Supplemental instructions)

lass time: Tuesdays, 15:10–18:00.

A typical class meeting consists of concept development and lecture, worked examples, and R-based data analysis or discussion. Students are expected to read the assigned textbook sections before class and complete statistical computing exercises using R or RStudio. Detailed assignment deadlines and project requirements will be announced through the NDHU e-Academy.