

國立成功大學

112 學年度第一學期跨域模組化課程

機率論與隨機模式入門簡介

Introduction to Probability Theory and Stochastic Modelling

授課教師

任職單位

畢業學校

許瑞麟

國立成功大學數學系

北卡羅來納州立大學

課程類別

學分數

選必修

開課人數

其他注意事項

Lecture

+

Recitation

1.5

選修

30

先修課程或先備能力

無

課程難易度

難 中偏難 中偏易 易

建議修課學生背景

全校各院

教學方法

講授 70%，演習與考試 30%

補充說明：

每天下午 14:00 – 14:50 助教先帶領作題目。14:50 – 15:30 考試，考試內容以上課內容與演習課練習題為主。但是因為最後一天課程較趕，會延遲 20 分鐘下課。

評量方式

問題考試 50%，報告 40%，出席率 10%

補充說明：

每次小考佔 10%，五次共 50%。期末報告主要是撰寫課程(至少)1000 字心得報告，內容必須包含「課程總結」、「自我整合筆記」、以及「學習心得」三部分，於課程結束後隔周五，於 moodle 線上繳交。

學習規範

無

課程概述

機率是一種描述不確定性的模式語言。這個模組化課程主要目的是替初學者介紹機率論裏的基礎元素，然後延伸到馬可夫鏈以及其長時間的極限行為。我們採取的是機率公理化的描述方法，因此必須理解樣本空間， σ -algebra 以及機率測度的數學結構與意義。特別是，我們將使用二項式資產定價模式作為所有基礎觀念的例子，並用其來說明條件期望隨機變數。之後，我們將介紹兩個最基本的隨機過程，柏努力過程以及馬可夫鏈，作為許多應用的模式並分析其極限行為。

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課程概述(英文)

Probability is a modeling language to describe uncertainty. This course is meant to cover fundamental elements in probability for beginners and extends to Markov chains for their long term behavior analysis. We take an axiomatic approach to build the probability theory on the sample space, σ -algebra and the probability measure. In particular, we will use the binomial asset pricing model as an example of all the fundamental concepts, including the conditional expectations. Then, we introduce two stochastic processes: Bernoulli processes and the Markov chains for modeling many applications and investigate their long term behavior properties.

課程進度

日期	時間	進度說明
8/14(一)	9:00 – 12:10	The binomial asset pricing model Sample spaces for various stochastic processes and their foreground configuration spaces.
	13:10 – 14:00	Independence
	14:00 – 15:30	Recitation and quiz.
8/15(二)	9:00 – 12:10	Conditional Expectations
	13:10 – 14:00	Bernoulli Processes (infinite coin tossing processes) – the process of number of successes
	14:00 – 15:30	Recitation and quiz.
8/16(三)	9:00 – 12:10	Bernoulli Processes (infinite coin tossing processes) – sum of <i>i.i.d</i> random variables. The process of times of successes.
	13:10 – 14:00	Markov chains – terminologies and notations.
	14:00 – 15:30	Recitation and quiz.
8/17(四)	9:00 – 12:10	Markov chains – examples
	13:10 – 14:00	First Step Analysis
	14:00 – 15:30	Recitation and quiz.
8/18(五)	9:00 – 12:10	Some special Markov Chains – two states Markov chains and one-dimensional random walks.
	13:10 – 14:30	State classification and Limiting behaviors of Markov chains
	14:30 – 15:50	Recitation and quiz.

課程學習目標

1. Learning axiomatic approach to build the probability theory.
2. Learning Binomial Asset Pricing Model and the Bernoulli Processes.
3. Learning fundamental knowledge on Markov chains and its long term behavior.

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課程的重要性、跨域性與時代性

Stochastic processes are useful in many areas, including finances, physics and biology because they can describe phenomena that are both dynamic and random. They can be also used for predictions and simulations. Although the applications of stochastic processes are often modern, yet their modeling language – the probability theory – is, however, quite classical and often adopts an abstract approach. Understanding the fundamentals and notions of abstract probability theory and stochastic processes will prove to be indispensable for students who consider to extend their knowledge to some advanced cross-disciplinary areas.

其他備註

參考書目：

An introduction to stochastic modeling, by Taylor and Karlin