國 立 成 功 大 學 跨 領 域 模 組 化 課 程

開課學年度/學期：113 學年度第 1 學期　　　　　　**領域：科際整合【社、自】**

最佳決策-數學模式理論與實作
Optimal Decisions – Mathematical models, Theories and Practices

授課教師	任職單位		畢業學校
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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	本課程為同步遠距教學課程

先修課程或先備能力

本課程最好具備基本的線性代數知識、Python 程式語言；因為實作將使用 Python 程式以及最佳化軟體 GuRoBi，而針對決策問題建立數學模型的過程需要對矩陣運算、演算法複雜度等有基本常識。

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 75%，實作 25%

評量方式

問題考試 50%：

> We will have in-class quizzes every day (around 10-15 min at most). More details are as follows: 1. In the first day, we will have a quiz (8%) to check whether a student can use python and GuRoBi to code and run a simple linear programming example. 2. In day 2-5, the lecturer will give at least one in-class quiz using zuvio every day, to test the course taught in previous days and that day. (each quiz is around 8% of the grade. The precise percentage will be announced in class.) 3. In day 6 (Sat), we will hold a 1-hr on-line exam (20%) on moodle.

作業 35%：

> We will have two reports which require coding in python to call GuRoBi functions (about 20% each) which should be submitted to moodle by the 13:00 of the next Tuesday.
>
> (i)one is to solve (model/implement python code) a given problem, upload your codes/report to moodle.
>
> (ii)the other is to design a problem of your own (with python code and report), upload them to moodle.

出席率 15%：

> All the lectures can be conducted by on-line video streaming using Google Meet. Some real-time in-class quizzes will be conducted by zuvio. We will record whether a student can answer the in-class in real-time. We will also check the participation report generated by Google Meet.

學習規範

按時考試、繳交作業

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課程概述

人類無時無刻在做決策，日常生活中有許多決策問題常因其選項或規範限制過多，導致決策者難以做出最佳決策。本課程將以數類可量化的決策問題為例，以數學技巧將決策與限制規範化成數學規劃模式，在早上 3 小時課程中將教授相關的數學與演算法基礎、決策模式設計的原理與其利弊得失；而下午則讓學生用電腦程式與軟體練習實作數學模式，以求解不同應用的最佳決策數學模式。

關鍵字：最佳化、決策模式、數學規劃

課程概述(英文)

People make decisions all the time, yet optimal decisions are often difficult to make, mostly due to numerous choices with consideration on many inter-related factors. In this course, we focus on the decision-making problems whose factors can be quantified. By correctly defining the decision variables, we will learn how to build a mathematical programming model that includes an objective function to achieve and constraints to follow. The purpose of this course is to provide students with the tools and knowledge necessary to model practical optimization problems. In the morning, we will spend 3 hours learning the theories of the mathematical modeling and algorithms for decision making models. In the afternoon, we will spend another 2.5 hours in practicing how to implement the mathematical models by Python and the software GuRoBi.

Keywords：Optimization, Decision model, Mathematical programming

課程進度

日 期	時 間	進 度 說 明
7/1(一)	9:00-12:00	Introduction to some applications of optimal decision making problems, and how to use the software GuRoBi by python to solve them.
	12:00-13:00	Break
	13:00-15:30	Recitation in using Python/GuRobi: installation, how to define problems
7/2(二)	9:00-12:00	Basics of the mathematical properties and theorems behind linear programming (LP) and integer programming (IP).
	12:00-13:00	Break
	13:00-15:30	Recitation in using Python/GuRobi: mapping codes and models, Quiz
7/3(三)	9:00-12:00	Techniques to make LP and IP models
	12:00-13:00	Break
	13:00-15:30	Recitation in using Python/GuRobi: simple LP/IP models, Quiz
7/4(四)	9:00-12:00	IP modeling Practices (I): facility location, logistics network flows
7/5(五)	9:00-12:00	IP modeling Practices (II): scheduling, routing problems
	12:00-13:00	Break
	13:00-15:30	Recitation in using Python/GuRobi: challenging LP/IP models, Quiz.

課程學習目標

1. To understand the basics of the mathematics behind the mathematical models and solution methods for solving an optimization decision making problem.

2. To learn how to model an optimization decision making problem by using mathematical variables and constraints.

3. To learn how to implement a mathematical programming model for an optimization decision making problem by computer language (python) and software (GuRoBi).

課程的重要性、跨域性與時代性

本課程強調以數學方式來分析處理決策的系統化過程，算是橫跨管理、數學、資訊等領域。

其他備註

參考書目：

Model Building in Mathematical Programming, by H. Paul Williams, 5th Edition 2013, Wiley

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本課程若因天災等不可抗力之因素或中央、地方政府公告停課，授課教師需依情況依建議補課方式調整課程進度與補課；若需使用假日、國定假日補課，則需與所有修課學生達成共識方能用例假日補課。

建議補課方式：

1. 線上授課方式補課；

2. 當預期可能會因天災(颱風、超大豪雨…等)宣佈停課時，建議老師先行調整加快課程進度或預先增加可能天氣預警之前幾次課程時數；

3. 停課後隔天起延後下課，補足停課延誤的進度；若停課超過 1 天，則在開始上課後延後下課補課，或當週星期六、日補課；

4. 更改課程授課方式，例如：DEMO 改以考試、報告、作業取代。