

**City University of Hong Kong
Course Syllabus**

**offered by Department of Management Sciences
with effect from Semester A 2024/25**

Part I Course Overview

Course Title:	Decision Analytics
Course Code:	MS5216
Course Duration:	One semester
Credit Units:	3
Level:	P5
Medium of Instruction:	English
Medium of Assessment:	English
Prerequisites: <i>(Course Code and Title)</i>	Nil
Precursors: <i>(Course Code and Title)</i>	Nil
Equivalent Courses: <i>(Course Code and Title)</i>	Nil
Exclusive Courses: <i>(Course Code and Title)</i>	Nil

Part II Course Details

1. Abstract

This course provides a comprehensive introduction to decision analytics, focusing on optimization models and methods critical for business decision-making. Utilizing the textbook "Spreadsheet Modeling & Decision Analysis: A Practical Introduction to Business Analytics," students will explore the foundational principles and practical applications of optimization. Key topics include the formulation and solution of optimization problems using Excel spreadsheets, with an emphasis on linear and integer programming. The course also covers advanced techniques in convex and nonlinear optimization, ensuring a robust understanding of various optimization scenarios. Furthermore, students will engage with data-driven applications, learning to harness data for improved decision-making processes. Through a combination of theoretical instruction and hands-on exercises, this course equips students with the analytical skills necessary to address complex business challenges and make informed decisions grounded in quantitative analysis.

2. Course Intended Learning Outcomes (CILOs)

(CILOs state what the student is expected to be able to do at the end of the course according to a given standard of performance.)

No.	CILOs	Weighting (if applicable)	Discovery-enriched curriculum related learning outcomes (please tick where appropriate)		
			A1	A2	A3
1.	Understand and apply key quantitative concepts essential for effective management.			√	
2.	Formulate and build models for decision problems by using quantitative skills. Apply appropriate methodologies to find solutions and interpret the results.			√	√
3.	Utilize computer software packages to effectively solve the models developed in the course.			√	√
4.	Evaluate and discuss academic literature and other information sources related to quantitative methods.		√	√	
5.	Prepare and present comprehensive reports that integrate textual and numerical material and communicate findings effectively using both traditional and electronic media.			√	√
		100%			

A1: Attitude

Develop an attitude of discovery/innovation/creativity, as demonstrated by students possessing a strong sense of curiosity, asking questions actively, challenging assumptions or engaging in inquiry together with teachers.

A2: Ability

Develop the ability/skill needed to discover/innovate/create, as demonstrated by students possessing critical thinking skills to assess ideas, acquiring research skills, synthesizing knowledge across disciplines

or applying academic knowledge to real-life problems.

A3: *Accomplishments*

Demonstrate accomplishment of discovery/innovation/creativity through producing /constructing creative works/new artefacts, effective solutions to real-life problems or new processes.

3. Learning and Teaching Activities (LTAs)

(LTAs designed to facilitate students' achievement of the CILOs.)

LTA	Brief Description	CILO No.						Hours/week (if applicable)
		1	2	3	4	5		
Lecture and Discussion Engagement	Students will attend lectures to comprehend key quantitative concepts essential for effective management and participate in discussions to apply these concepts to real-life decision-making scenarios.	✓	✓					
Case Study Analysis	Students will analyze and discuss case studies to formulate and model decision problems using quantitative skills, apply appropriate methodologies to find solutions, and interpret the results.		✓		✓			
Group Project	Students will collaborate in group projects to utilize computer software packages for solving quantitative models, prepare comprehensive reports integrating textual and numerical material, and communicate findings effectively using both traditional and electronic media.			✓		✓		
Practical Exercises and Workshops	Students will participate in hands-on exercises and workshops to apply appropriate quantitative methodologies to various decision problems, interpret the results, and develop a critical understanding of quantitative methods through practical application.		✓	✓	✓			

4. Assessment Tasks/Activities (ATs)

(ATs are designed to assess how well the students achieve the CILOs.)

Assessment Tasks/Activities	CILO No.					Weighting	Remarks
	1	2	3	4	5		
Continuous Assessment: <u>40</u> %							
Assignment/Test	✓	✓		✓		40%	
Examination: <u>60</u> % (duration: 2 hours)							
Examination	✓	✓	✓		✓	60%	
						100%	

5. Assessment Rubrics

(Grading of student achievements is based on student performance in assessment tasks/activities with the following rubrics.)

Applicable to students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter

Assessment Task	Criterion	Excellent (A+, A, A-)	Good (B+, B, B-)	Fair (C+, C, C-)	Marginal (D)	Failure (F)
1. Assignment/Test	The accuracy and depth in problem formulations and application of methodologies, reflecting a thorough understanding of quantitative concepts and their practical implementations.	Strong evidence of understanding the key concepts and definitions of the learned subject; capacity to analyse and synthesize; superior grasp of subject matter; evidence of extensive knowledge base	Evidence of grasp of subject, some evidence of critical capacity and analytic ability; reasonable understanding of issues; evidence of familiarity with literature	Student who is profiting from the university experience; understanding of the subject; ability to show some evidence of familiarity with literature	Sufficient familiarity with the subject matter to enable the student to progress further	Little evidence of familiarity with the subject matter; limited or irrelevant use of literature
2. Examination	The comprehensiveness and accuracy in demonstrating understanding and application of course concepts, showcasing the ability to integrate and critically evaluate information across various topics.	Strong evidence of original thinking; good organization, capacity to analyse and synthesize; superior grasp of subject matter; evidence of extensive knowledge base	Evidence of grasp of subject, some evidence of critical capacity and analytic ability; reasonable understanding of issues; evidence of familiarity with literature	Student who is profiting from the university experience; understanding of the subject; ability to show some evidence of familiarity with literature	Sufficient familiarity with the subject matter to enable the student to progress without repeating the course	Little evidence of familiarity with the subject matter; weakness in critical and analytic skills; limited or irrelevant use of literature

Applicable to students admitted from Semester A 2022/23 to Summer Term 2024

Assessment Task	Criterion	Excellent (A+, A, A-)	Good (B+, B)	Marginal (B-, C+, C)	Failure (F)
1. Assignment/Test	The accuracy and depth in problem formulations and application of methodologies, reflecting a thorough understanding of quantitative concepts and their practical implementations.	Strong evidence of understanding the key concepts and definitions of the learned subject; capacity to analyse and synthesize; superior grasp of subject matter; evidence of extensive knowledge base	Evidence of grasp of subject, some evidence of critical capacity and analytic ability; reasonable understanding of issues; evidence of familiarity with literature	Ability to show some evidence of familiarity with literature to enable the student to progress further	Little evidence of familiarity with the subject matter; limited or irrelevant use of literature
2. Examination	The comprehensiveness and accuracy in demonstrating understanding and application of course concepts, showcasing the ability to integrate and critically evaluate information across various topics.	Strong evidence of original thinking; good organization, capacity to analyse and synthesize; superior grasp of subject matter; evidence of extensive knowledge base	Evidence of grasp of subject, some evidence of critical capacity and analytic ability; reasonable understanding of issues; evidence of familiarity with literature	Sufficient familiarity with the subject matter to enable the student to progress without repeating the course	Little evidence of familiarity with the subject matter; weakness in critical and analytic skills; limited or irrelevant use of literature

Part III Other Information (more details can be provided separately in the teaching plan)

1. Keyword Syllabus

(An indication of the key topics of the course.)

1. Introduction
Introduction to optimization models and methods, and its application in business decision making. Review of elementary calculus and probability. Random variables, data modeling, and decision making under uncertainty.
2. Optimization Software and Tools
Optimization in Excel spreadsheet and Python.
3. Linear and Integer Programming
Modeling techniques, applications, theory and solution methods, LP relaxation for integer programming.
4. Convex Optimization and Nonlinear Optimization.
Convexity and properties. Duality. Methods for convex optimization. Methods for nonlinear optimization.
5. Data-driven Applications
Optimization in statistics: linear regression, maximum likelihood estimation, and methods of moments. Optimization in statistical/machine learning: supervised learning, gradient descent methods. Applications in finance: portfolio optimization.

2. Reading List

2.1 Compulsory Readings

(Compulsory readings can include books, book chapters, or journal/magazine articles. There are also collections of e-books, e-journals available from the CityU Library.)

1.	Ragsdale, C. T. Spreadsheet Modeling & Decision Analysis: A Practical Introduction to Business Analytics, Cengage Learning. 2015.
2.	Griva, I., Nash, S. G., and Sofer, A. Linear and Nonlinear Optimization. SIAM. 2009.

2.2 Additional Readings

(Additional references for students to learn to expand their knowledge about the subject.)

1.	Bradley, S. P., Hax, A. C., and Magnanti, T. L. Applied Mathematical Programming, Addison-Wesley, 1977.
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