

**City University of Hong Kong  
Course Syllabus**

**offered by Department of Management Sciences  
with effect from Semester A in 2019/20**

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**Part I Course Overview**

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

## Part II Course Details

### 1. Abstract

This course aims to train students' skills in modelling and optimization that are essential in turning real-world business decision-making problems into mathematical models and developing solution methods using computer packages such as spreadsheets, R/Python. It serves as a foundation course for business analytics, and covers commonly used optimization methods in business applications, including linear programming, and nonlinear optimization. It also introduces application of the optimization methods to a wide range of problems, including statistical estimation, machine learning, and business decision making under uncertainty.

### 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 quantitative concepts that are important for practicing managers		√		√
2.	Define decision problems, formulate and model the problems using quantitative skills studied; apply appropriate methodologies to find solutions and interpret the solutions found			√	√
3.	Handle computer software packages to solve the models built			√	√
4.	Critically discuss academic literature and other information sources related to quantitative methods		√	√	√
5.	Prepare reports integrating textual and numerical material and make effective oral communication using a range of traditional and electronic media; undertake a set of tasks associated with improving their career prospects		√		√
		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 self-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. Teaching and Learning Activities (TLAs)

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

TLA	Brief Description	CILO No.					Hours/week
		1	2	3	4	5	
1. Lecture	Concepts and general knowledge of quantitative decision methods are explained. The relevant techniques are developed and applied in the context of real business situations. Examples are used to emphasize the crucial skills of describing and defining the problem before conducting any analysis. Whenever available, computer software packages are introduced as a tool for solving the model, so that students can actually bring what they learnt to their place of work.	√	√	√	√	√	
2. Class discussion	Discussions on major issues related to decision models.	√	√	√	√		
3. Assignment	Case assignment is used to provide training in analysing complex problem situations and solving business problems. Students are required to work in groups, observe existing practices and/or conduct research on related applications. They are expected to apply methodologies learned or design their solution to solve problems. Findings are presented in a report or through presentation, including a reflection upon their learning experiences and challenges.	√	√	√	√	√	

### 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, if applicable)							
Examination	√	√	√		√	60%	
						100%	

## 5. Assessment Rubrics

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

Assessment Task	Criterion	Excellent (A+, A, A-)	Good (B+, B, B-)	Fair (C+, C, C-)	Marginal (D)	Failure (F)
1. Assignment	Core concepts and ideas; use of appropriate quantitative methods	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	Core concepts and ideas; use of appropriate quantitative methods	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.

## Part III Other Information

### 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

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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