

City University of Hong Kong  
Course Syllabus

offered by School of Data Science  
with effect from Semester A 2021/22

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**Part I Course Overview**

**Course Title:** Data-driven Operations Research

**Course Code:** SDSC8008

**Course Duration:** One Semester

**Credit Units:** 3

**Level:** R8

**Medium of Instruction:** English

**Medium of Assessment:** English

**Prerequisites:**  
(Course Code and Title) Nil

**Precursors:**  
(Course Code and Title) Nil

**Equivalent Courses:**  
(Course Code and Title) Nil

**Exclusive Courses:**  
(Course Code and Title) Nil

## Part II Course Details

### 1. Abstract

This course provides students with PhD research level methodologies and their applications in data-driven decision making, risk management, and operations. Selected topics include predictive and prescriptive analytics, learning of dependencies and structures in data for state estimation and forecast, distributionally robust optimization for decision making under uncertainty, and interpretable approaches to understand machine learning results. Emphasis will be placed on applying these methods to practical problems arises from e-commerce platforms, online market places, and financial markets.

### 2. Course Intended Learning Outcomes (CILOs)

No.	CILOs#	Weighting (if applicable)	Discovery-enriched curriculum related learning outcomes		
			A1	A2	A3
1.	Articulate fundamentals of the data-driven approach to operations research and explain specific methods to approach it.	15%	✓		
2.	Elaborate the key ideas behind each methodology that enable it to be successful for its purpose.	25%	✓	✓	
3.	Assess prevailing practices in business and finance and identify approaches that enhance the existing practices through data-driven approach.	30%	✓	✓	✓
4.	Utilize methods learned to solve given practical problems in decision making, risk management and operations.	30%	✓	✓	✓
		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)

TLA	Brief Description	CILO No.						Hours/week (if applicable)
		1	2	3	4			
In-class Activities	Lectures and interactive discussions on identified latest academic research papers and/or industrial practices of identified topics.	✓	✓	✓	✓			39 hours in total
Assignments & Project	Working out assignments of theoretical nature as well as practicing on real projects aims at allowing students to learn problem-solving in dimensions of both methodologies and applications. The teacher will make assignments and select projects pertaining to the subjects discussed.	✓	✓	✓	✓			After class

### 4. Assessment Tasks/Activities (ATs)

Assessment Tasks/Activities	CILO No.						Weighting*	Remarks
	1	2	3	4				
Continuous Assessment: <u>100</u> %								
<u>In-class discussion</u> Attendance and in-class discussion are strongly emphasized for this course, more important than assignments.  In particular, the in-class discussion component will focus on discussing selected research papers and identified industrial practice through student groups.  Scoring favour those demonstrate well in these activities.	✓	✓	✓	✓			20-50%	
<u>Assignments</u> Students will work independently on assignments made by the teacher from materials in the latest research papers that are relevant to core components of the course.	✓	✓	✓	✓			0-30%	
<u>Presentation &amp; Project report</u> Assessments will be based on individual's presentation, academic difficulties of the project, quality of the implementation, and most importantly, whether there are new discoveries throughout the process of the conducting the project.	✓	✓	✓	✓			50%	
							100%	

## 5. Assessment Rubrics

Assessment Task	Criterion	Excellent (A+, A, A-)	Good (B+, B, B-)	Fair (C+, C, C-)	Marginal (D)	Failure (F)
1. In-class discussion	<p>Percentage of classroom attendance</p> <p>The quality and intensity of participating in-class discussion, answering questions, etc.</p>	High	Significant	Moderate	Basic	Not even reaching marginal level
2. Assignments	<p>Quality of the written Assignments.</p> <p>Ability to learn the basic concepts, apply methods of data-driven operations research to business and finance problems, and other industry applications.</p>	High	Significant	Moderate	Basic	Not even reaching marginal level
3. Projects	<p>Quality of presentation and implementation, whether there are new discoveries throughout the process of the conducting the project.</p> <p>Ability to solve conceptual and real-world problems using methods from data-driven operations research.</p>	High	Significant	Moderate	Basic	Not even reaching marginal level

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

**1. Keyword Syllabus**

Notions of predictive and prescriptive analytics.

Dependence & structure learning of complex data.

Distributionally robust optimization

Decision making under uncertainty and/or partial information

Interpretation of results obtained through machine learning results.

Selection applications in:

--lending in e-commerce platforms,

--matching in online marketplaces,

--investment and risk management in financial markets, etc.

**2. Reading List**

**2.1 Compulsory Readings**

1.	Lecture notes, selected academic papers, and other related material.
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**2.2 Additional Readings**

1.	Relevant online/offline learning material will be provided by the instructor.
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