

SDSC8008: DATA-DRIVEN OPERATIONS RESEARCH

Effective Term

Semester B 2025/26

Part I Course Overview

Course Title

Data-driven Operations Research

Subject Code

SDSC - Data Science

Course Number

8008

Academic Unit

Data Science (DS)

College/School

College of Computing (CC)

Course Duration

One Semester

Credit Units

3

Level

R8 - Research Degree

Medium of Instruction

English

Medium of Assessment

English

Prerequisites

Nil

Precursors

Nil

Equivalent Courses

Nil

Exclusive Courses

Nil

Part II Course Details

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.

Course Intended Learning Outcomes (CILOs)

CILOs		Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Describe the fundamentals of the data-driven approach to operations research and explain specific methods to approach it.	15	x		
2	Elaborate the key ideas behind each methodology that enable it to be successful for its purpose.	25	x	x	
3	Discuss and assess prevailing practices in business and finance and identify approaches that enhance the existing practices through data-driven approach.	30	x	x	x
4	Utilize methods learned to solve given practical problems in decision making, risk management and operations.	30	x	x	x

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.

Learning and Teaching Activities (LTAs)

LTAs		Brief Description	CILO No.	Hours/week (if applicable)
1	In-class Activities	Students will engage in formal lectures and interactive discussions on identified latest academic research papers and/or industrial practices of identified topics.	1, 2, 3, 4	39 hours in total

2	Assignments & Project	Students will work on 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.	1, 2, 3, 4	After class
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Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks ("- " for nil entry)	Allow Use of GenAI?
1	1) In-class discussion (20%-50%) 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. 2) Assignments (0-30%) 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.	1, 2, 3, 4	50	20-50%	Yes

2	3) Presentation & Project report 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.	1, 2, 3, 4	50	-	Yes
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Continuous Assessment (%)

100

Examination (%)

0

Minimum Continuous Assessment Passing Requirement (%)

0

Minimum Examination Passing Requirement (%)

0

Assessment Rubrics (AR)**Assessment Task**

In-class discussion (Applicable to students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion

Percentage of classroom attendance

The quality and intensity of participating in-class discussion, answering questions, etc.

Excellent

A+, A, A-

Good

B+, B

Marginal

B-, C+, C

Failure

F

Assessment Task

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

Criterion

Quality of the written assignments.

Ability to learn the basic concepts, apply methods of data-driven operations research to business and finance problems, and other industry applications.

Excellent

A+, A, A-

Good

B+, B

Marginal

B-, C+, C

Failure

F

Assessment Task

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

Criterion

Quality of presentation and implementation, whether there are new discoveries throughout the process of the conducting the project.

Ability to solve conceptual and real-world problems using methods from data-driven operations research.

Excellent

A+, A, A-

Good

B+, B

Marginal

B-, C+, C

Failure

F

Assessment Task

In-class discussion (Applicable to students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion

Percentage of classroom attendance

The quality and intensity of participating in-class discussion, answering questions, etc.

Excellent

A+, A, A-

Good

B+, B, B-

Fair

C+, C, C-

Marginal

D

Failure

F

Assessment Task

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

Criterion

Quality of the written assignments.

Ability to learn the basic concepts, apply methods of data-driven operations research to business and finance problems, and other industry applications.

Excellent

A+, A, A-

Good

B+, B, B-

Fair

C+, C, C-

Marginal

D

Failure

F

Assessment Task

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

Criterion

Quality of presentation and implementation, whether there are new discoveries throughout the process of the conducting the project.

Ability to solve conceptual and real-world problems using methods from data-driven operations research.

Excellent

A+, A, A-

Good

B+, B, B-

Fair

C+, C, C-

Marginal

D

Failure

F

Part III Other Information

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.

Reading List

Compulsory Readings

Title	
1	Lecture notes, selected academic papers, and other related material.

Additional Readings

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