City University of Hong Kong
Course Syllabus

offered by Department of Management Sciences
with effect from Semester A 2024/2025

Part I Course Overview

Course Title:	Introduction to Mathematical Statistics
Course Code:	MS8952
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

The course emphasizes likelihood-based inference and offers a comprehensive exploration of key topics, including sufficiency and exponential family of distributions, moments and moment-generating functions, minimum variance unbiased estimation, and methods of transformation. Furthermore, students will gain in-depth knowledge on the likelihood principle and maximum likelihood estimation, maximum likelihood asymptotic theory, and likelihood-based hypothesis testing. The course also addresses loss and risk functions, model selection, and pre-testing, equipping learners with the necessary tools to make informed decisions in various management contexts. By the end of this course, students will possess a understanding of the core theoretical principles that underpin statistical estimation and testing techniques in the realm of business and economics.

2. Course Intended Learning Outcomes (CILOs)

No.	CILOs	Weighting (if applicable)	Discovery-enriched curriculum related learning outcomes (please tick where appropriate)		
			A1	*A2*	*A3*
1.	Strengthen their grasp of core econometric theory principles.		✓		✓
2.	Gain proficiency in implementing the maximum likelihood estimation technique and develop an understanding of the associated asymptotic distribution theory.			✓	✓
3.	Enhance the concept and application of likelihood-based hypothesis testing.			✓	✓
4.	Understand and address statistical issues related to model selection in econometrics.		✓		✓
		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)

LTA	Brief Description	CILO No.						Hours/week (if applicable)
		1	2	3	4			
Participating in Interactive seminars	Students will actively engage in seminar-style lectures, absorbing and discussing course material, which will aid our understanding and consolidation of core econometric theory principles.	✓	✓	✓	✓			

Delivering Student presentations	Students will supplement our learning by preparing and presenting on special topics related to the course during seminars. This activity will not only deepen our comprehension of specific areas but also foster critical thinking and effective communication skills.	✓	✓	✓	✓			

4. Assessment Tasks/Activities (ATs)

Assessment Tasks/Activities	CILO No.						Weighting	Remarks
	1	2	3	4				
Continuous Assessment: 100%								
Assignments/ In-Class Quizzes: Throughout the course, students will complete assignments/quizzes designed to assess their understanding and application of core econometric theory principles (CILO 1), maximum likelihood estimation techniques (CILO 2), and likelihood-based hypothesis testing (CILO 3). Grading will be based on the accuracy and completeness of students' responses, reflecting their comprehension of the material.	✓	✓	✓	✓			100%	
Research Project: Students will conduct an individual research project focused on addressing a real-world econometric problem, showcasing their ability to apply maximum likelihood estimation (CILO 2) and address statistical issues related to model selection (CILO 4). The project will be graded on the quality of research, the application of techniques, and the effectiveness of the proposed solution.		✓		✓				
Student Presentations: As part of the course, students will prepare and deliver presentations on special topics related to the course material, demonstrating their understanding of the core principles of econometric theory (CILO 1) and likelihood-based hypothesis testing (CILO 3). Presentations will be assessed on content, clarity, and the student's ability to communicate complex concepts effectively.	✓		✓					
Examination: 0% (duration: , if applicable)								
							100%	

5. Assessment 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. Assignments/Projects/Student Presentations/Quizzes	Students work on assignments based on the concepts of each topic. Students are also assessed on the knowledge of the course materials.	High	Significant	Moderate	Basic	Not even reaching marginal levels

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. Assignments/Projects/Student Presentations/Quizzes	Students work on assignments based on the concepts of each topic. Students are also assessed on the knowledge of the course materials.	High	Significant	Moderate	Not even reaching marginal levels

Part III Other Information

1. Keyword Syllabus

- Sufficiency and exponential family of distributions
- Moments and moment-generating functions
- Minimum variance unbiased estimation
- Methods of transformation
- Likelihood principle and maximum likelihood estimation
- Maximum likelihood asymptotic theory
- Likelihood-based hypothesis test
- Loss and risk functions, model selection and pre-testing

2. Reading List

2.1 Compulsory Readings

Nil

2.2 Additional Readings

1.	Greene, W.H. (2008), Econometric Analysis, 6th edition, Prentice Hall, New York. ISBN-13: 978-0-13-513245-6 ISBN-10: 0-13-513245-2
2.	Zaman, A. (1996), Statistical Foundations for Econometric Techniques, Academic Press, New York ISBN 0-12-775415-6