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:	Advanced Regression Techniques
Course Code:	MS8956
Course Duration:	One Semester
	3
Credit Units:	R8
Level:	
Medium of Instruction:	English
Medium of Assessment:	English
Prerequisites : (Course Code and Title)	MS8952 Introduction to Mathematical Statistics
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 advanced Ph.D. level course delves into the essential principles and methodologies of regression models, catering to students pursuing a doctorate in the field. The curriculum encompasses a comprehensive examination of several core topics, with a focus on fostering a deep understanding of statistical techniques and their practical applications. The course begins with an in-depth exploration of OLS (Ordinary Least Squares) regression, covering finite sample properties, the Gauss-Markov theorem, hypothesis testing, generalized least squares, and large sample theory. Subsequently, students will gain expertise in panel data models, instrumental variable techniques, and the General Method of Moments (GMM) estimation. The curriculum also encompasses Bayesian Inference, facilitating a nuanced understanding of probabilistic modeling and decision-making. As a tentative component, the course may include the study of linear or nonlinear time series models and other selected topics, depending on the interests of the students and the instructor. Overall, this rigorous course aims to equip future scholars with the essential statistical tools needed to excel in the field of Business Analytics.

2. Course Intended Learning Outcomes (CILOs)

No.	CILOs	Weighting	Discov	ery-en	riched
		(if	curricu	ılum rel	ated
		applicable)	learnin	g outco	mes
			(please	tick	where
			approp	riate)	
			A1	A2	A3
1.	Demonstrate a comprehensive understanding of advanced				
	regression theories and their underlying principles.		•		
2.	Analyze and prove crucial theorems in regression,				
	showcasing proficiency in statistical reasoning.		v		
3.	Apply regression theory to practical applications, solving				./
	real-world problems using appropriate methodologies.			v	*
		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		O No.		Hours/week		
		1	2	3	4		(if applicable)
Lectures	Student will engage in in-depth discussions on course topics, understand the motivation behind each concept, and explore various models and their applications. Gain insights into important theorems, such as the Gauss-Markov theorem, and	~	~	✓			3 hours per week

	learn how to prove them from a student's perspective.					
Assignments	Student will work on assignments designed to enhance comprehension of course concepts and facilitate the application of theories to real- world situations. These assignments will challenge students to explore special cases, generalizations, and practical applications of the models introduced during lectures.	~	~	~		3 hours per week

4. Assessment Tasks/Activities (ATs)

Assessment Tasks/Activities	CILO No.			Weighting	Remarks	
	1	2	3	4		
Continuous Assessment:40	%					
Assignments	\checkmark	\checkmark	\checkmark		40%	
Demonstrate the ability to						
apply theoretical knowledge to						
real-world problems through						
the completion of four course						
assignments. Tasks may						
include using regression						
models to analyze data and						
solving practical problems						
that showcase the effective						
implementation of course						
concepts.						
-						
Exhibit problem-solving and						
critical thinking skills by						
addressing complex issues						
within each assignment. This						
requires the appropriate use of						
course knowledge to analyze,						
evaluate, and devise solutions						
to the given problems.						
Showcase a deepening						
understanding of course						
concepts and theories through						
the successful completion of						
progressively challenging						
assignments. Each assignment						
aligns with the course						
progress, gradually increasing						
in difficulty to promote						
continuous learning and						
development.						
Examination:60% (duration	n: 3 h	ours)		 	
Examination	\checkmark	✓	\checkmark		60%	
Evaluate the student's						
understanding of essential						
course concepts and theories,						

	 		 		-
such as regression analysis,					
Gauss-Markov theorem, and					
Bayesian inference, through					
examination questions that					
require a comprehensive grasp					
of the subject matter.					
Assess the student's skills in					
analyzing and proving					
regression theorems during the					
examination. This includes					
demonstrating an in-depth					
understanding of concepts and					
the ability to logically present					
proof processes.					
Determine the student's					
overall mastery and					
application of the entire					
course content through a					
summative examination. This					
final assessment will measure					
the student's performance and					
achievement of all CILOs to					
ensure a thorough					
understanding of the subject.					
				100%	

5. Assessment Rubrics

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

Assessment Task	Criterion	Excellent	Good	Fair	Marginal	Failure
		(A+, A, A-)	(B+, B, B-)	(C+, C, C-)	(D)	(F)
1.Assignments	Able to apply the methodology	High	Significant	Moderate	Fair	Fail to understand
	and knowledge to solve					the core concepts
	problems.					_
2.Examination	Evidence of knowledge of	High	Significant	Moderate	Fair	Fail to understand
	subject matter and capability to					the core concepts
	formulate, and analyse the					
	fundamental theoretical					
	problems in regression models.					

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

Assessment Task	Criterion	Excellent	Good	Marginal	Failure
		(A+, A, A-)	(B+, B)	(B-, C+, C)	(F)
1.Assignments	Able to apply the methodology	High	Significant	Moderate	Fail to understand the
	and knowledge to solve				core concepts
	problems.				_
2.Examination	Evidence of knowledge of	High	Significant	Moderate	Fail to understand the
	subject matter and capability to				core concepts
	formulate, and analyse the				
	fundamental theoretical				
	problems in regression models.				

Part III Other Information

1. Keyword Syllabus

- 1. OLS regression: finite sample properties, Gauss Markov theorem, hypothesis testing, generalized least squares, large sample theory.
- 2. Panel data models.
- 3. Instrumental Variable and General Method of Moments (GMM).
- 4. Bayesian Inference.
- 5. Tentative: linear or nonlinear time series models, other selected topics.

2. Reading List

2.1 Compulsory Readings

Nil

2.2 Additional Readings

1.	Hayashi, Fumio. Econometrics. Princeton University Press, 2011.
2.	Freedman, David. Statistical Models: Theory and Practice. Cambridge University Press, 2009.
3.	Hastie, Trevor, Robert Tibshirani, and Martin Wainwright. Statistical Learning with Sparsity:
	The Lasso and Generalizations. CRC, 2015.
4.	Hoff, Peter D. A first course in Bayesian statistical methods. Springer, 2009.