MS8956: ADVANCED REGRESSION TECHNIQUES

Effective Term
Semester A 2025/26

Part I Course Overview

Course Title
Advanced Regression Techniques

Subject Code
MS - Decision Analytics and Operations
Course Number
8956

Academic Unit
Decision Analytics and Operations (DAOS)

College/School
College of Business (CB)

Course Duration
One Semester

Credit Units
3

Level
R8 - Research Degree

Medium of Instruction
English

Medium of Assessment
English

Prerequisites
MS8952 Introduction to Mathematical Statistics

Precursors
Nil

Equivalent Courses
Nil

Exclusive Courses
Nil

Part II Course Details

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.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Demonstrate a comprehensive understanding of advanced regression theories and their underlying principles.		x		
2	Analyze and prove crucial theorems in regression, showcasing proficiency in statistical reasoning.		x		
3	Apply regression theory to practical applications, solving real-world problems using appropriate methodologies.			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	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	1, 2, 3	3 hours per week

2	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.	1, 2, 3	3 hours per week

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks ("-" for nil entry)	Allow Use of GenAI?
1	Assignments 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.	1, 2, 3	40	-	Yes

Continuous Assessment (%)

40

Examination (%)

60

Examination Duration (Hours)

3

Minimum Continuous Assessment Passing Requirement (%)

0

Minimum Examination Passing Requirement (%)

0

Additional Information for ATs

Examination

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.

Allow use of GenAI: No

Assessment Rubrics (AR)

Assessment Task

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

Criterion

Able to apply the methodology andknowledgetosolve problems.

Excellent

(A+, A, A-) High

Good

(B+, B, B-) Significant

Fair

(C+, C, C-) Moderate

Marginal

(D) Fair

Failure

(F) Fail to understand the core concepts

Assessment Task

Examination (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion

Evidence of knowledge of subject matter and capability to formulate, and analyse the fundamentaltheoretical problems in regression models.

Excellent
(A+, A, A-) High

Good
(B+, B, B-) Significant

Fair
(C+, C, C-) Moderate

Marginal
(D) Fair

Failure
(F) Fail to understand the core concepts

Assessment Task
Assignments (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion
Able to apply the methodology andknowledgetosolve problems.

Excellent
(A+, A, A-) High

Good
(B+, B) Significant

Marginal
(B-, C+, C) Moderate

Failure
(F) Fail to understand the core concepts

Assessment Task
Examination (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion
Evidence of knowledge of subject matter and capability to formulate, and analyse the fundamentaltheoretical problems in regression models.

Excellent
(A+, A, A-) High

Good
(B+, B) Significant

Marginal
(B-, C+, C) Moderate

Failure

(F) Fail to understand the core concepts

Part III Other Information

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.

Reading List

Compulsory Readings

	Title
1	Nil

Additional Readings

	Title
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.