City University of Hong Kong
Course Syllabus

offered by Department of Biostatistics
with effect from Semester A 2024/25

Part I   Course Overview

Course Title: Asymptotic Statistics

Course Code: BIOS8003

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 aims to provide students with adequate theoretical background and mathematical tools to access the literature on biostatistics methodologies and applications. Topics covered include: stochastic convergence; delta method; moment estimator; M- and Z- estimators; Bayes procedures; likelihood ratio tests; chi-square tests; Bayesian/MCMC methods; EM algorithm. Selected topics such as empirical likelihood, U-statistics, counting process methods in survival analysis, functional data analysis, nonparametric estimation, shape-constrained inference, and semiparametric inference and efficiency will also be included.

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

No.	CILOs	Weighting	Discovery-enriched curriculum related learning outcomes		
			A1	*A2*	*A3*
1.	Understand the fundamental concepts in asymptotic statistics	20%	✓	✓	
2.	Be familiar with various modes of stochastic convergence	20%	✓	✓	
3.	Acquire the techniques of various statistical estimation and testing procedures	20%	✓	✓	✓
4.	Ability to apply asymptotic analysis techniques in health-related studies	20%	✓	✓	✓
5.	Effectively communicate and present research findings from the literature	20%	✓	✓	✓
		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. Learning and Teaching Activities (LTAs)

LTA	Brief Description	CILO No.					Hours/week (if applicable)
		1	2	3	4	5	
Lectures	Learning through teaching is primarily based on lectures	✓	✓	✓	✓	✓	3 hours/week
Assignments	Learning though take-home assignments helps students understand the key concepts and acquire the techniques	✓	✓	✓	✓	✓	After class

4. Assessment Tasks/Activities (ATs)

Assessment Tasks/Activities	CILO No.					Weighting	Remarks
	1	2	3	4	5		
Continuous Assessment: 50%							
Assignments	✓	✓	✓			30%	Help to train students with basic knowledge, concepts, and analysis techniques
Midterm/quizzes	✓	✓	✓	✓	✓	20%	Test students' capabilities in applying the knowledge to solve relevant problems
Examination: 50% (duration:3 hours)	✓	✓	✓	✓	✓	50%	Examination questions are designed to see how well students have achieved the learning objectives and acquired the requisite techniques for problem-solving
						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	Problem solving skills	Consistently exhibits adept comprehension of asymptotic techniques in statistical theory and applications	Sufficiently applies asymptotic techniques to moderately complex problems	Demonstrates a moderate understanding of asymptotic techniques to intermediate-level problems.	Displays basic grasp of asymptotic techniques to straightforward problems.	Shows limited comprehension of asymptotic techniques and lacks the ability to apply them to problem-solving
2. Midterm/quizzes	Problem solving based on comprehensive understanding	Exhibits a thorough grasp of asymptotic techniques and effectively applies them to intricate problems	Displays sufficient understanding of asymptotic techniques and effectively applies them to moderately complex problems	Exhibits a moderate level of comprehension regarding asymptotic techniques and effectively applies them to intermediate-level problems.	Shows basic comprehension of asymptotic techniques and applies them to straightforward problems	Displays limited grasp of asymptotic techniques and lacks the ability to apply them to problem-solving
3. Examination	Problem solving based on comprehensive understanding	Consistently exhibits a deep understanding of asymptotic techniques concepts and effectively applies them to complex problems	Effectively applies asymptotic techniques to moderately complex problems, demonstrating sufficient understanding	Applies asymptotic techniques to intermediate-level problems with a moderate level of understanding.	Applies asymptotic techniques to simple problems with a basic understanding	Lacks understanding of asymptotic techniques and cannot apply them to problem-solving

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	Problem solving skills	High	Significant	Moderate	Not even reaching marginal levels
2. Midterm/quizzes	Problem solving based on comprehensive understanding	High	Significant	Moderate	Not even reaching marginal levels
3. Examination	Problem solving based on comprehensive understanding	High	Significant	Moderate	Not even reaching marginal levels

Part III   Other Information

1.   Keyword Syllabus

Stochastic convergence; delta method; moment estimator; M- and Z- estimators; Bayes procedures; U-statistics; likelihood ratio tests; chi-square tests; Bayesian/MCMC methods; EM algorithm.

2.   Reading List
2.1   Compulsory Readings

Nil.

2.2   Additional Readings

1.	Asymptotic Statistics (Cambridge University Press Series in Statistical and Probabilistic Mathematics), by A. W. van der Vaart.