City University of Hong Kong
Course Syllabus

offered by Department of Biostatistics
with effect from Semester A 2023/24

Part I Course Overview

Course Title:	Advanced Statistical Theory
Course Code:	BIOS8004
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 some theoretical background and mathematical tools in theoretical statistics to access the literature on biostatistics methodologies and applications. Topics covered include: efficiency of estimators; efficiency of tests; empirical processes; functional delta method; quantile and order statistics; L-statistics; bootstrap; high-dimensional models, gradient descent optimization. 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* (if applicable)	Discovery-enriched curriculum related learning outcomes (please tick where appropriate)		
			A1	*A2*	*A3*
1.	Understand the fundamental concepts in statistical estimation and inference	20%	✓	✓	
2.	Be familiar with empirical process and resampling techniques	20%	✓	✓	
3.	Acquire the techniques of evaluating the efficiency for various estimation and testing procedures	20%	✓	✓	✓
4.	Ability to apply the skills and techniques to solve real problems in health-related studies	20%	✓	✓	✓
5.	Effectively summarize and present research results 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. Teaching and Learning Activities (TLAs)

TLA	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: 60%							
Assignments	✓	✓	✓			30%	Help to train students with basic knowledge, concepts, and analysis techniques
Midterm/quizzes/presentation	✓	✓	✓	✓	✓	30%	Test students' understanding of basic knowledge and their capabilities in applying the knowledge to solve relevant problems
Examination: 40% (3 hours in-class exam/take-home exam)	✓	✓	✓	✓	✓	40%	Examination questions are designed to see how well students have achieved the learning objectives and acquired the requisite techniques for problem-solving
** The weightings should add up to 100%.*						100%	

5. Assessment Rubrics

Applicable to students admitted in Semester A 2022/23 and thereafter

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/presentation	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

Efficiency of estimators; efficiency of tests; empirical processes; functional delta method; quantile and order statistics; L-statistics; bootstrap; high-dimensional models, gradient descent optimization.

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.
2.	Mathematical Statistics (Springer), by Jun Shao.