

**City University of Hong Kong
Course Syllabus**

**offered by School of Data Science
with effect from Semester A 2019/20**

Part I Course Overview

Course Title: Advanced Statistics

Course Code: SDSC3007

Course Duration: One Semester

Credit Units: 3

Level: B3

- Arts and Humanities
 Study of Societies, Social and Business Organisations
 Science and Technology

Proposed Area:
(for GE courses only)

Medium of Instruction: English

Medium of Assessment: English

Prerequisites:
(Course Code and Title) MS2602 Statistical Inference **OR**
SDSC2102 Statistical Methods and Data Analysis

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

(A 150-word description about the course)

In this course, students will learn statistical theories and methods for drawing inference from data. Fundamental statistical concepts and theories in point estimation, hypothesis testing and asymptotic inference are taught. Students will learn properties that good parameter estimates and hypothesis tests should possess, and use them as criteria in the development and justification of parameter estimators and test procedures. Some fundamental aspects of the linear model theories are also covered.

2. Course Intended Learning Outcomes (CILOs)

(CILOs state what the student is expected to be able to do at the end of the course according to a given standard of performance.)

No.	CILOs [#]	Weighting* (if applicable)	Discovery-enriched curriculum related learning outcomes (please tick where appropriate)		
			A1	A2	A3
1.	Derive sufficient statistics, maximum likelihood estimators, and likelihood ratio tests	25%		√	
2.	Establish limiting distribution of sample estimators and asymptotic inference results	35%	√	√	
3.	Justify point estimators and hypothesis test procedures with statistical decision theory.	20%	√		
4.	Elaborate the theory of linear models.	20%	√	√	√
		100%			

* If weighting is assigned to CILOs, they should add up to 100%.

Please specify the alignment of CILOs to the Gateway Education Programme Intended Learning outcomes (PILOs) in Section A of Annex.

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)

(TLAs designed to facilitate students' achievement of the CILOs.)

TLA	Brief Description	CILO No.				Hours/week (if applicable)
		1	2	3	4	
Lecture	Learning through teaching is primarily based on lectures. In-class exercises will be used to facilitate conceptual understanding and applications of various statistical inference methods.	√	√	√	√	26 hours/ semester
Tutorial Exercises	The exercises provide students with the opportunities to familiarize and apply the statistical inference methods and theories learnt during the lectures.	√	√	√		13 hours/ semester

4. Assessment Tasks/Activities (ATs)

(ATs are designed to assess how well the students achieve the CILOs.)

Assessment Tasks/Activities	CILO No.				Weighting*	Remarks
	1	2	3	4		
Continuous Assessment: <u>50%</u>						
Test	√	√			25%	
Assignments	√	√	√	√	25%	
Examination: <u>50%</u> (duration: 2 hours)						
Examination	√	√	√	√	50%	
					100%	

* The weightings should add up to 100%.

For a student to pass the course, at least 30% of the maximum mark for the examination should be obtained.

5. Assessment Rubrics

(Grading of student achievements is based on student performance in assessment tasks/activities with the following rubrics.)

Assessment Task	Criterion	Excellent (A+, A, A-)	Good (B+, B, B-)	Fair (C+, C, C-)	Marginal (D)	Failure (F)
1. Test	2-hour test to assess students' conceptual understanding of statistical inference theory and method.	High	Significant	Moderate	Basic	Not even reaching marginal levels
2. Assignments	Students' ability to employ correct statistical inference methods and to justify the methods using appropriate theory. Explanation and presentation of results are also assessed.	High	Significant	Moderate	Basic	Not even reaching marginal levels
3. Examination	Examination questions are designed to assess student's level of achievement of the intended learning outcomes, with emphasis placed on conceptual understanding and correct application, mostly through mathematical exposition, clear explanation, and numerical calculation, of the various statistical inference techniques.	High	Significant	Moderate	Basic	Not even reaching marginal levels

The test and assignments will be numerically-marked, while examination will be numerically-marked and grades-awarded accordingly.

Part III Other Information (more details can be provided separately in the teaching plan)

1. Keyword Syllabus

(An indication of the key topics of the course.)

- Review of probability and distribution; exponential class of distributions
- Review of elementary statistical inferences
- Consistency and limiting distributions, law of large numbers, central limit theorem, Slutsky theorem, Delta methods
- Likelihood inference, sufficiency, completeness, Cramer-Rao inequality, Fisher information, sampling theory, asymptotic efficiency
- Optimal tests of hypothesis, likelihood ratio test, Bayesian procedures
- Linear model theory, best linear unbiased estimator, Gauss-Markov theorem, sampling theory

2. Reading List

2.1. Compulsory Readings

(Compulsory readings can include books, book chapters, or journal/magazine articles. There are also collections of e-books, e-journals available from the CityU Library.)

1.	Introduction to Mathematical Statistics – Hogg, McKean & Craig (7/e, Pearson, 2012)
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2.2. Additional Readings

(Additional references for students to learn to expand their knowledge about the subject.)