

# MA6630: INTRODUCTION TO STATISTICAL LEARNING

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## Effective Term

Semester A 2025/26

## Part I Course Overview

### Course Title

Introduction to Statistical Learning

### Subject Code

MA - Mathematics

### Course Number

6630

### Academic Unit

Mathematics (MA)

### College/School

College of Science (SI)

### Course Duration

One Semester

### Credit Units

3

### Level

P5, P6 - Postgraduate Degree

### Medium of Instruction

English

### Medium of Assessment

English

### Prerequisites

MA5617 Statistical Data Analysis;

OR a pass in all of the following courses

PH5102 Introduction to Biostatistics in One Health

BIOS5800 Probability

BIOS5801 Statistical Computing

### Precursors

Nil

### Equivalent Courses

Nil

### Exclusive Courses

Nil

## Part II Course Details

### Abstract

Statistical learning is a new interdisciplinary area, which has connections to a variety of subjects including statistics, applied mathematics and computer sciences. It has been successfully applied in pattern recognition, signal processing, data mining, bioinformatics and financial engineering, etc. This course presents an overview of many cutting-edge techniques and algorithms in statistical learning. The covered topics include linear and nonlinear classification and regression, support vector machine, kernel methods, model averaging, boosting, as well as high-dimensional data. This course will provide the students the fundamental ideas and intuition behind modern statistical learning methods.

### Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Understand basic concepts of statistical learning, and classic algorithms.	25	x	x	
2	Explain the fundamental principles and theories underlying the learning algorithms and generalize to various new applications.	25	x	x	
3	Implement the computer code and programming the statistical learning method and apply to real problems.	25	x	x	
4	Conduct mathematical derivation of the algorithms in the course.	25	x	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	Teaching	Learning through teaching is primarily based on lectures	1, 2, 3, 4	3 hours/week
2	Take-home assignments	Learning through take-home assignments helps students implement advanced theory for better understanding	1, 2, 3, 4	After-class

### Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks ("- " for nil entry)	Allow Use of GenAI?
1	Hand-in assignments	1, 2, 3, 4	20	-	Yes
2	Project	1, 2, 3, 4	20	-	Yes

**Continuous Assessment (%)**

40

**Examination (%)**

60

**Examination Duration (Hours)**

2

**Minimum Examination Passing Requirement (%)**

30

**Additional Information for ATs**

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

**Assessment Rubrics (AR)****Assessment Task**

1. Hand-in assignments (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

**Criterion**

Problem solving based on comprehensive understanding

**Excellent**

(A+, A, A-) Consistently demonstrates a thorough understanding of statistical learning models and algorithms and can always apply them to solve complex real problems

**Good**

(B+, B, B-) Adequately demonstrates an understanding of statistical learning models and algorithms and can usually apply them to solve real problems

**Fair**

(C+, C, C-) Demonstrates some understanding of statistical learning models and algorithms and can sometimes apply them to solve simple problems

**Marginal**

(D) Demonstrates limited understanding of statistical learning models and algorithms and can seldom apply them to solve simple problems

**Failure**

(F) Demonstrates little understanding of statistical learning models and algorithms and can rarely or never apply them to solve simple problems

**Assessment Task**

2. Project

**Criterion**

Real data analytic ability and software usage based on comprehensive understanding

**Excellent**

(A+, A, A-) Demonstrates a comprehensive understanding of statistical learning models and algorithms and has strong ability in applying R to solve complex problems

**Good**

(B+, B, B-) Demonstrates an understanding of statistical learning models and algorithms and has ability in applying R to solve relevant problems

**Fair**

(C+, C, C-) Demonstrates some understanding of statistical learning models and algorithms and has some ability to solve simple problems using R

**Marginal**

(D) Demonstrates limited understanding of statistical learning models and algorithms and has limited ability to solve simple problems using R

**Failure**

(F) Demonstrates little understanding of statistical learning models and algorithms and has little ability to solve simple problems using R

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**Assessment Task**

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

**Criterion**

Creativity and problem solving ability based on comprehensive understanding

**Excellent**

(A+, A, A-) Consistently demonstrates a thorough understanding of statistical learning models and algorithms and can always apply them to solve complex real problems

**Good**

(B+, B, B-) Adequately demonstrates an understanding of statistical learning models and algorithms and can usually apply them to solve real problems

**Fair**

(C+, C, C-) Demonstrates some understanding of statistical learning models and algorithms and can sometimes apply them to solve simple problems

**Marginal**

(D) Demonstrates limited understanding of statistical learning models and algorithms and can seldom apply them to solve simple problems

**Failure**

(F) Demonstrates little understanding of statistical learning models and algorithms and can rarely or never apply them to solve simple problems

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**Assessment Task**

1. Hand-in assignments (for students admitted from Semester A 2022/23 to Summer Term 2024)

**Criterion**

Problem solving based on comprehensive understanding

**Excellent**

(A+, A, A-) Consistently demonstrates a thorough understanding of statistical learning models and algorithms and can always apply them to solve complex real problems

**Good**

(B+, B) Adequately demonstrates an understanding of statistical learning models and algorithms and can usually apply them to solve real problems

**Marginal**

(B-, C+, C) Demonstrates limited understanding of statistical learning models and algorithms and can seldom apply them to solve simple problems

**Failure**

(F) Demonstrates little understanding of statistical learning models and algorithms and can rarely or never apply them to solve simple problems

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**Assessment Task**

2. Project (for students admitted from Semester A 2022/23 to Summer Term 2024)

**Criterion**

Real data analytic ability and software usage based on comprehensive understanding

**Excellent**

(A+, A, A-) Demonstrates a comprehensive understanding of statistical learning models and algorithms and has strong ability in applying R to solve complex problems

**Good**

(B+, B) Demonstrates an understanding of statistical learning models and algorithms and has ability in applying R to solve relevant problems

**Marginal**

(B-, C+, C) Demonstrates limited understanding of statistical learning models and algorithms and has limited ability to solve simple problems using R

**Failure**

(F) Demonstrates little understanding of statistical learning models and algorithms and has little ability to solve simple problems using R

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**Assessment Task**

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

**Criterion**

Creativity and problem solving ability based on comprehensive understanding

**Excellent**

(A+, A, A-) Consistently demonstrates a thorough understanding of statistical learning models and algorithms and can always apply them to solve complex real problems

**Good**

(B+, B) Adequately demonstrates an understanding of statistical learning models and algorithms and can usually apply them to solve real problems

**Marginal**

(B-, C+, C) Demonstrates limited understanding of statistical learning models and algorithms and can seldom apply them to solve simple problems

**Failure**

(F) Demonstrates little understanding of statistical learning models and algorithms and can rarely or never apply them to solve simple problems

**Part III Other Information****Keyword Syllabus**

Concepts of learning; bias-variance trade-off; linear regression, ridge regression, Lasso regression; Logistic regression; Bayes rule; tree methods; boosting; cross-validation; regularisation; model averaging and bagging

**Reading List****Compulsory Readings**

Title	
1	An Introduction to Statistical Learning: with Application in R by James, Springer; 1st ed. 2013, Corr. 7th printing 2017 edition

**Additional Readings**

Title	
1	The Element of Statistical Learning by Hastie, Tibshirani and Friedman, Springer; 2nd edition
2	Pattern Recognition and Machine Learning by Bishop, Springer, 2006