

Module code

SPM-3405

Type of module

Undergraduate: Mathematical Sciences – Elective

Advanced Statistics



Modular credits

4

Total student
engagement

56 hours

Prerequisite

**SPM-2203
(Probability and
Statistics)**

Anti-requisite

None

Aims

To develop students' ability to analyse, evaluate, and apply advanced statistical inference techniques, including estimation, hypothesis testing, and interval estimation, to design and justify rigorous statistical models for real-world applications.

Module learning outcomes (MLO)

On successful completion of this module, a student will be expected to be able to:

MLO 1

Apply probability theory and convergence concepts (LLN, CLT) to justify the use of asymptotic results in statistical inference.

MLO 2

Compute and evaluate parameter estimates using likelihood methods, and assess properties such as sufficiency, efficiency, and consistency.

MLO 3

Formulate and test statistical hypotheses using likelihood ratio, Wald, and score tests, and interpret results with reference to theoretical justifications.

MLO 4

Construct and appraise interval estimates using pivotal quantities and likelihood-based methods.

MLO 5

Synthesise probability and inference theory to design and critically evaluate robust statistical models for real-world contexts.

Module contents

Random variables:
Understanding pdf, cdf, moments, mgf, and transformations

Commonly used discrete and continuous probability models

Sampling from the normal distribution and derived distributions (Chi square, t, F)

Convergence concepts, law of large numbers, central limit theorem

Point estimation: Likelihood function, sufficient statistics, estimators, maximum likelihood estimation (MLE), and Fisher information

Hypothesis testing: Null hypothesis, test statistics, p-values, critical regions, likelihood ratio tests, and Neyman-Pearson lemma

Interval estimation: Confidence intervals, pivots, test inversion, and likelihood-based intervals

Assessment

60% **40%**

Examination

Coursework

Examination
60%

Class tests
40%

■ Examination — 60%

■ Class tests — 40%

Formative assessment

Weekly discussion
and feedback

Summative assessment

COMPONENT		WEIGHTING
Examination		60%
Coursework		40%
Individual		40%
Class tests		40%

Graduate attributes and skills

Programme learning objectives (PLO) addressed

- 1 PLO 1 (Core Mathematical Knowledge)
- 3 PLO 3 (Computational And Digital Tools)

- 2 PLO 2 (Analytical Problem-Solving)
- 4 PLO 4 (Mathematical Communication)

Sustainability concept addressed

- 4 SDG 4 Quality Education

Digital skills/software used (not limited to)

- Statistical computing software (e.g. R)
- Learning management and collaboration platforms (e.g. Canvas)

Micro-credentialling option

No

Stackable towards GenBESTARI Undergraduate Degree Programme or other relevant Lifelong Learning Programmes

No

Document details

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