

# Statistical Methods in R

## Module Information

2022.01, Approved

### Summary Information

Module Code	7011DATSCI
Formal Module Title	Statistical Methods in R
Owning School	Astrophysics Research Institute
Career	Postgraduate Taught
Credits	20
Academic level	FHEQ Level 7
Grading Schema	50

### Teaching Responsibility

LJMU Schools involved in Delivery
Astrophysics Research Institute

### Learning Methods

Learning Method Type	Hours
Lecture	20
Practical	40

### Module Offering(s)

Display Name	Location	Start Month	Duration Number Duration Unit
SEP-CTY	CTY	September	12 Weeks

### Aims and Outcomes

Aims	The module aims to provide an introduction to students from differing academic disciplines to key concepts in statistics and statistical computing using the R programming language, with an emphasis on the informed interpretation of the results of statistical testing.
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**After completing the module the student should be able to:**

**Learning Outcomes**

Code	Number	Description
MLO1	1	Critically apply a variety of statistical techniques to problems in data science, using the R computer language.
MLO2	2	Critically evaluate the appropriateness of various techniques for a particular problem.
MLO3	3	Critically analyse the outcomes of hypothesis testing in an informed fashion
MLO4	4	Synthesize a combination of statistical methods to test a complex problem.

**Module Content**

Outline Syllabus	1. Statistical fundamentals (significance, inference and hypotheses, replication, models, confidence intervals) 2. Introduction to the R language (dataframes, functions, loops, I/O, plotting, packages) 3. Descriptive statistics (measures of central tendency and variability) 4. Probability density, central limit theorem, normal distribution 5. Single sample tests (Z-test, t-test, testing for normality, nonparametric tests, jackknife/bootstrap) 6. Two sample testing (F-test, ECDF-based tests, Fisher's exact test, Chi-squared test, correlation and covariance) 7. Regression (maximum likelihood, least-squares, linear and nonlinear regression, nonparametric curve-fitting) 8. Analysis of variance (ANOVA inference, post-hoc tests, multifactor analysis, structured error, goodness of fit / model comparison) 9. Multiple regression (ANCOVA, stepwise regression, cross-validation) 10. Count data (Binomial/Poisson errors, logistic regression, generalized linear models) 11. Survival analysis (Hazard, censorship, distribution fitting) 12. Bayesean inference (Likelihood, priors and posteriors, credibility intervals)
Module Overview	This module provides an introduction to key concepts in statistics and statistical computing using the R programming language, with an emphasis on the informed interpretation of the results of statistical testing.
Additional Information	

**Assessments**

Assignment Category	Assessment Name	Weight	Exam/Test Length (hours)	Module Learning Outcome Mapping
Report	Computer Assignments	70	0	MLO1, MLO2, MLO3, MLO4
Exam	In Class Test	30	0	MLO1, MLO2, MLO3, MLO4

**Module Contacts**

**Module Leader**

Contact Name	Applies to all offerings	Offerings
Daniel Perley	Yes	N/A

**Partner Module Team**

Contact Name	Applies to all offerings	Offerings
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