Maynooth University
National University of Ireland Maynooth

ROINN NA MATAMAITICE AGUS NA STAITISTICE
DEPARTMENT OF MATHEMATICS & STATISTICS

POSTGRADUATE HANDBOOK

2020/2021

Ollscoil na hÉireann, Má Nuad, Co. Chill Dara, Éire.

Contents

ABOUT THE DEPARTMENT OF MATHEMATICS & STATISTICS

Welcome to the Maynooth University Department of Mathematics and Statistics. We are normally located in Logic House at the southern end of the old Campus. We hope you find this handbook of some help to you. If you have any further enquiries, please email mathsstats@mu.ie.
Given the current Government restrictions, the department staff are working remotely.

OFFICE HOURS –

10.00 a.m. - 11.00 a.m.
12.00 p.m. - 1.00 p.m.
2.00 p.m. - 4.00 p.m.

E-mail: mathsstats@mu.ie

Website: https://www.maynoothuniversity.ie/mathematics-and-statistics

The information in this handbook is as accurate as we can make it at the time of going to press, but it may be in error. In the event of difference, the official University rules and procedures take precedence over anything in this handbook, and nothing in this handbook should be understood as official.

TERM DATES: 2020-2021
https://www.maynoothuniversity.ie/registrar/key-term-dates

FIRST SEMESTER

First-Year Registration/Orientation	18th September 2020	25th September 2020
First Semester	28th September 2020	18th December 2020
Study Week	26th October 2020	30th October 2020
Christmas Break	21st December 2020	1st January 2021
Study Period	4th January 2021	7th January 2021

SECOND SEMESTER

Second Semester	1st February 2021	7th May 2021
Study Week	15th March 2021	19th March 2021
Easter Vacation	5th April 2021	9th April 2021
Study Period	10th May 2021	13th May 2021

DEPARTMENT STAFF

Professor Stephen Buckley, Head of Department
https://www.maynoothuniversity.ie/mathematics-and-statistics/our-people/stephen-buckley

****

Dr Stefan Bechtluft-Sachs, Lecturer
https://www.maynoothuniversity.ie/mathematics-and-statistics/our-people/stefan-bechtluft-sachs

Dr Niamh Cahill, Lecturer
https://www.maynoothuniversity.ie/mathematics-and-statistics/our-people/niamh-cahill

Dr Galatia Cleanthous
https://www.maynoothuniversity.ie/mathematics-and-statistics/our-people/galatia-cleanthous

Dr Rafael de Andrade Moral, Lecturer
https://www.maynoothuniversity.ie/mathematics-and-statistics/our-people/rafael-de-andrade-moral

Dr Detta Dickinson, Senior Lecturer
https://www.maynoothuniversity.ie/mathematics-and-statistics/our-people/detta-dickinson

Dr Katarina Domijan, Lecturer
https://www.maynoothuniversity.ie/mathematics-and-statistics/our-people/katarina-domijan

Dr Catherine Hurley, Senior Lecturer
https://www.maynoothuniversity.ie/mathematics-and-statistics/our-people/catherine-hurley

Professor George Huxley
Adjunct Professor
Department of Mathematics & Department of Ancient Classics

Dr Ciarán Mac an Bhaird, Lecturer
Director, Mathematics Support Centre
https://www.maynoothuniversity.ie/mathematics-and-statistics/our-people/ciar-n-mac-bhaird

Professor David Malone
https://www.maynoothuniversity.ie/mathematics-and-statistics/our-people/david-malone

Dr Oliver Mason, Senior Lecturer
https://www.maynoothuniversity.ie/mathematics-and-statistics/our-people/oliver-mason

Dr Pat McCarthy, Lecturer
https://www.maynoothuniversity.ie/mathematics-and-statistics/our-people/pat-mccarthy

Dr Keefe Murphy, Lecturer
https://www.maynoothuniversity.ie/mathematics-and-statistics/our-people/keefe-murphy

Dr John Murray, Senior Lecturer
https://www.maynoothuniversity.ie/mathematics-and-statistics/our-people/john-murray

Dr Fiacre Ó Cairbre, Senior Lecturer
https://www.maynoothuniversity.ie/mathematics-and-statistics/our-people/fiacre-cairbre

Professor Ann O'Shea
https://www.maynoothuniversity.ie/mathematics-and-statistics/our-people/ann-oshea

Professor Andrew Parnell
https://www.maynoothuniversity.ie/mathematics-and-statistics/our-people/andrew-parnell

Dr Anthony Small, Senior Lecturer
https://www.maynoothuniversity.ie/mathematics-and-statistics/our-people/anthony-small

Dr Mark Walsh, Lecturer
https://www.maynoothuniversity.ie/mathematics-and-statistics/our-people/mark-walsh

Professor David Wraith
https://www.maynoothuniversity.ie/mathematics-and-statistics/our-people/david-wraith

SUPPORT STAFF

Ms. Janice Love, Senior Technical Officer
https://www.maynoothuniversity.ie/mathematics-and-statistics/our-people/janice-love

Ms. Gráinne O'Rourke, Administrator
(Tel: 01 – 7083914/3651)
https://www.maynoothuniversity.ie/mathematics-and-statistics/our-people/gr-inne-orourke

Mr. Anthony Waldron, Technical Officer
https://www.maynoothuniversity.ie/mathematics-and-statistics/our-people/anthony-waldron

POSTGRADUATE COORDINATORS

MATHEMATICS 2019/-

Dr Mark Walsh, Lecturer
https://www.maynoothuniversity.ie/mathematics-and-statistics/our-people/mark-walsh

MASTERS IN DATA SCIENCE AND ANALYTICS 2020/-
PhD in STATISTICS 2020/-

Dr Catherine Hurley, Senior Lecturer
https://www.maynoothuniversity.ie/mathematics-and-statistics/our-people/catherine-hurley

HIGHER DIPLOMA IN DATA ANALYTICS 2020/-

Dr Rafael de Andrade Moral, Lecturer
https://www.maynoothuniversity.ie/mathematics-and-statistics/our-people/rafael-de-andrade-moral

RESEARCH INTERESTS OF STAFF

Dr Stefan Bechtluft-Sachs

Stefan Bechtluft-Sachs' research deals with the relation of (algebraic) topology on one side and differential geometry and (global) analysis on the other. Specifically Stefan works on the role variational calculus, in particular natural functionals, plays in homotopy theory. Moreover he is interested in topological obstructions to certain curvature properties of manifolds.

Professor Stephen Buckley

Stephen Buckley's research interests span algebra, geometry, and analysis. In algebra, he is interested in ring theory (particularly combinatorial ring theory and commutativity conditions) and group theory.

He is interested in geometric analysis in the settings of Euclidean space, metric spaces, or metric measure spaces, especially various weak notions of negative or nonpositive curvature such as Gromov hyperbolicity, CAT(0), Busemann convexity, and the Ptolemaic inequality.

He is also interested in quasiconformal mappings, potential theory, metric measure spaces, Gromov hyperbolicity, geometric function theory, and other fields in geometric and harmonic analysis. In particular, he has studied various types of Poincaré and Trudinger inequalities, over Euclidean and non-Euclidean spaces, especially the connection between such analytic inequalities and geometry.

Dr Niamh Cahill

Broadly, Niamh Cahill's research focuses on the development of statistical models for the analysis of time dependent, compositional and/or spatial data. She uses a Bayesian approach to statistical modeling, which is suitable for developing complex hierarchical models, accounting for uncertainties related to model parameters, incorporating prior knowledge and sharing information across data populations. Specifically, her research interests lie in the analysis of reproductive health indicators and climate change.

Dr Rafael de Andrade Moral

Rafael's research interests include the development and application of statistical modelling techniques to Biology and Agriculture, more specifically Ecology and Entomology. He is also interested in the computational implementation of statistical models, especially as packages for the open-source statistical software R. He is currently working on the development of computational and statistical tools to jointly model multivariate responses in ecological studies, in particular those involving the collection of abundance measurements.

Dr Detta Dickinson

Detta works in the area of metric Diophantine approximation. Currently she is interested in the distribution of conjugate algebraic points in regions of space and in simultaneous Diophantine approximation on manifolds.
Classically, Diophantine approximation is the study of how well real numbers can be approximated by rationals. This can be extended to higher dimensions by asking how well real points in n-dimensional Euclidean space can be approximated by rational points or by rational

hyperplanes. Results in this area are very delicate as shown in Khintchine's theorem, where the set of well approximable points has either zero or full measure depending on the convergence or divergence of a certain volume sum. This leads to further questions: those of Hausdorff dimension in the case of measure zero and those of asymptotic number of solutions in the case of full measure.
Both of the above questions become more difficult when the set under investigation is restricted to a manifold embedded in Euclidean space and this is Detta's current area of interest.

Dr Katarina Domijan

Katarina Domijan's research interests lie in applying Bayesian methods of statistical inference to analyze data of complex structure that arise in a variety of applications. In particular, I am interested in classification problems in data with large feature spaces. One of the most important aspects of modelling high-dimensional data is feature selection and I am interested in developing novel methods for this challenging problem.

Dr Catherine Hurley

Catherine Hurley is a Statistician with primary research interests in data visualisation for problems in data science and machine learning. Over the years she has authored and contributed to many such software packages, beginning with Data Viewer (1987) (a predecessor to GGobi), Quail (1987-2000) and more recently the R packages gclus (2004), PairViz (2008), DendSer (2013), condvis (2016) and ERSA (2018), all available on CRAN, and has published many papers on these topics.
She is affiliated with the MU Hamilton Institute and the National Centre for Geocomputation.

Dr. Hurley also coordinates the MSc in Data Science.

Dr Ciarán Mac an Bhaird

Ciarán Mac an Bhaird's current research interests are mostly in mathematics education, particularly on the impact of student engagement with mathematics supports, tutor training and development, online mathematics supports, student accessibility and supports, and mathematics support provision. In the history of mathematics, he is currently focusing on the mathematical archives at the Russell Library in Maynooth and on the benefits, to students, of using the historical materials and examples in mathematics teaching. In Algebraic Number Theory he is interested in Gauss Sums and Cyclotomic Numbers.

Dr Pat McCarthy

Pat McCarthy is interested in Classical Function Spaces and the inequalities which arise in their study. Examples include H^P, L^P and Lipschitz spaces.
He has worked on convergence problems for Fourier series and extremal properties of certain orthogonal polynomials. Currently he is examining generalisations of Carleson Interpolation Sequences.
Another interest is Number Theory, cryptography, and the implementation of cryptographic routines and cipher attacks on microprocessors.

Dr Ollie Mason

Ollie Mason's main research interests are in systems and control, matrix theory, and the mathematics of data privacy. He is particularly interested in matrix stability problems that arise in the study of time-delay systems, ecological applications, and difference/differential inclusions. Other research interests include the properties of matrices over the max-plus algebra, and problems in combinatorial matrix theory related to privacy and anonymity.

Dr Keefe Murphy

Keefe is a statistician with primary research interests in developing methodologies for both supervised and unsupervised classification tasks involving complex, high-dimensional, mixed-type data, often in the presence of outliers. Publications to date include work on Bayesian nonparametric mixtures of factor analysers, covariate-dependent parsimonious model-based clustering, and risk-stratification for multi-omic prostate cancer data. Keefe is currently working on applications of novel distance-based clustering approaches for longitudinal categorical sequences. Keefe takes a keen interest in the computational implementation of statistical models and has authored the R packages IMIFA, MoEClust, and MEDseq, all of which are available on CRAN.

Dr John Murray

John Murray works on the modular representation theory of groups. Representation theory is the study of concrete realisations of the axiomatic systems of abstract algebra. It originated in the study of permutation groups and algebras of matrices. The representation theory of finite groups was developed by G. Frobenius in the last decade of the nineteenth century. Major applications were quickly found by W. Burnside and I. Schur. R. Brauer began his investigations into the modular representations of finite groups in 1939. His work was the genesis of the programme to classify the finite simple groups, which reached fruition in the early 1980's. Other landmarks in the subject include the 1956 paper of J. Green on the general linear group, the work of P. Deligne and G. Lusztig in the 1970's on algebraic groups, and the (still open) conjectures of J. Alperin, G. Robinson and E. Dade from the late 1980's on the p-defects of characters.

Dr. Murray is fascinated by all aspects of this rapidly changing subject. He is particularly interested in the structure of the centres of modular group algebras, the block theory of finite groups, properties of involutions, and generally in the connections between ring theoretic and group theoretic invariants of algebras. He has written a number of papers on these topics. John has developed and implemented algorithms for the computer package GAP to facilitate his investigation into the structure of finite algebras. At the moment he is working on the proof of a result that concerns the involution classes of symmetric groups, using the ring of symmetric functions and the class algebra of I. MacDonald.

Dr Fiacre Ó Cairbre

Fiacre Ó Cairbre's research interests are currently in the two areas of stability theory and mathematics education. He is working on the stability of certain types of switching systems in control theory. He is also working on resource materials for second level mathematics teachers.

Professor Ann O'Shea

Ann O'Shea is interested in Mathematics Education. Current research projects include: task design and evaluation; the role of technology in formative assessment; the professional development of teachers; measuring the effectiveness of mathematics support. She has also worked in the area of Value Distribution Theory in Several Complex Variables.

Professor Andrew Parnell

Andrew Parnell is Hamilton Professor in the Hamilton Institute at Maynooth University. His research is in statistics and machine learning for large structured data sets in a variety of application areas. He has co-authored over 70 peer-reviewed papers in journals such as Science, Nature Communications, and Proceedings of the National Academy of Sciences, and has methodological publications in journals such as Statistics and Computing, The Annals of Applied Statistics, and Journal of the Royal Statistical Society: Series C. He has been awarded over €2 million to date in direct funding. He has been heavily involved in the commercialisation of research through the start-up companies Prolego Scientific (CSO) and Atturos (Scientific Advisor). He is currently a funded investigator in the SFI Insight Centre for Data Analytics and leader of the Advanced Analytics and Engineer Feedback pillar of the The SFI I-Form Advanced Manufacturing Centre.

His main theoretical research interests include:
- Tree-based machine learning methods such as Bayesian Additive Regression Trees (BART) and Random Forests
- Extreme Value Theory
- Spatial statistics
- Bayesian hierarchical modelling using JAGS and Stan
- Compositional data
- Zero-inflation modelling

His current list of application areas includes:
• Climatology, including sea level rise, extremes, and measuring rapid past climate changes
• Manufacturing, including anomaly detection, real-time tool wear analytics, and additive manufacturing
• Bioinformatics, including prostate cancer identification from peptide measurements, machine learning for SNPS, extending G-BLUP and SNP-BLUP models to larger data sets.
• Learning analytics for monitoring student progress and engagement
• Quantitative ecology especially mixing models for estimating animal diets and sediment tracing
• Radiocarbon dating and chronology modelling for archaeological and palynological applications

He enjoys collaborating with other scientists and writing non-specialist software via the open-source statistical language R.

Dr Anthony Small

Anthony Small is working on problems in algebraic/differential geometry, in particular the construction and study of differential geometric objects of variational origin, via 'transforms' that convert the data into more tractable algebro-geometric objects, e.g. minimal surfaces (soap films), constant mean curvature surfaces (soap bubbles), monopoles.

Dr Mark Walsh

Mark Walsh's interests are in Geometry, in particular concerning the relationship between Curvature and Topology. His work so far has focused on Positive Scalar Curvature and especially understanding the topology of the space of Riemannian metrics of positive scalar curvature on a smooth manifold, as well as the corresponding moduli spaces. More recently he has shifted attention to analogous questions for positive Ricci curvature.

Professor David Wraith

David Wraith's research interests encompass Differential Geometry and Algebraic Topology, and focus primarily on the topological implications of positive curvature. Much of his recent work has focused on the topological properties of spaces and moduli spaces of metrics.

INTRODUCTION TO POSTGRADUATE COURSES

The Mathematics & Statistics Department offers postgraduate students the opportunity to study Mathematics or Statistics for the degrees of PhD, MSc, MA, or for a Higher Diploma in Mathematical Studies, Mathematics and Statistics, Data Analytics, or a Masters in Data Science & Analytics.
Please note that all postgraduate Mathematics and Statistics courses can be taken on a part-time basis over two or more years. Students who study on a part-time basis attend the regular daytime classes. The Department does not offer any classes during the evening or at weekends.

Information on Fees can be found on the University website at:
https://www.maynoothuniversity.ie/student-fees-grants

HIGHER DIPLOMA IN MATHEMATICAL STUDIES
https://www.maynoothuniversity.ie/study-maynooth/postgraduate-studies/courses/higher-diploma-mathematical-studies

HIGHER DIPLOMA IN MATHEMATICS
https://www.maynoothuniversity.ie/study-maynooth/postgraduate-studies/courses/higher-diploma-mathematics

HIGHER DIPLOMA IN STATISTICS
https://www.maynoothuniversity.ie/study-maynooth/postgraduate-studies/courses/higher-diploma-statistics

HIGHER DIPLOMA IN DATA ANALYTICS
https://www.maynoothuniversity.ie/mathematics-and-statistics/springboard

MSc in MATHEMATICS OR STATISTICS BY RESEARCH
https://www.maynoothuniversity.ie/study-maynooth/postgraduate-studies/courses/msc-mathematics

MSc in MATHEMATICS BY EXAMINATION

https://www.maynoothuniversity.ie/study-maynooth/postgraduate-studies/courses/msc-mathematics-science

MA IN MATHEMATICS BY EXAMINATION

https://www.maynoothuniversity.ie/study-maynooth/postgraduate-studies/courses/ma-mathematics

MASTER IN DATA SCIENCE AND ANALYTICS

https://www.maynoothuniversity.ie/sites/default/files/assets/document//MSC%20DS%20Student%20Handbook%202020-21.pdf

PhD IN MATHEMATICS

https://www.maynoothuniversity.ie/study-maynooth/postgraduate-studies/courses/phd-mathematics

PhD IN STATISTICS

https://www.maynoothuniversity.ie/study-maynooth/postgraduate-studies/courses/phd-statistics

ERASMUS PROGRAMME

The Department has exchange agreements under the ERASMUS programme with a number of European universities. Students may spend up to half of one year at another university under this program, provided that a suitable programme of studies is arranged. For the Masters degree by examination, certain courses offered at the Universities of Kiel, Tübingen, Ulm (Germany), and the University of La Laguna (Tenerife) have been approved by the NUI as suitable to form part of the Maynooth course. You can find some useful links at

https://www.maynoothuniversity.ie/international

SCHOLASTIC FUNDING

There are opportunities for talented postgraduate students to get funding at Maynooth University, in either taught or research-based courses. Depending on the nature of the award, this can range from funding to cover fees, up to a full scholarship with not only fees, but a living allowance and provision for expenses also.

Competition for both Maynooth University funding and funding from other agencies is very high.

Further information can be found on the Maynooth University website at:

https://www.maynoothuniversity.ie/study-maynooth/postgraduate-studies/fees-funding-scholarships

RESEARCH STUDENT SUPERVISORY POLICIES

For information about the University's research student policies, contact Marie Murphy of the Graduate Studies Office (phone 01-7086016, or e-mail marie.murphy@mu.ie).

Students doing research degrees should also read the Mathematics & Statistics Department Research Student Policy Document:

https://www.maynoothuniversity.ie/sites/default/files/assets/document//policy_res_student_2021.pdf

Structured Research students must take a certain number of taught modules, as explained in the above policy document. Other research students can also avail of these modules. The most relevant modules are the 800 level modules on the following webpage, although 500-level and other modules can also be taken with the permission of the Head of Department:

https://www.maynoothuniversity.ie/mathematics-and-statistics/undergraduates/module-descriptors-202021

HOW TO APPLY FOR A POSTGRADUATE COURSE AT MAYNOOTH UNIVERSITY

TAUGHT POSTGRADUATE COURSES:

Before you submit an application, please discuss your choice of course with the relevant Department Postgraduate Coordinator (currently Dr Mark Walsh, mark.walsh@mu.ie).

Springboard+HDip in Data Analytics:

https://www.maynoothuniversity.ie/mathematics-and-statistics/springboard

RESEARCH DEGREE:

Before submitting any application for a Research degree, please ensure you have the prior agreement of a research supervisor.

If you have satisfied the above criteria, you may proceed and submit your application to the:

POSTGRADUATE APPLICATIONS CENTRE

www.pac.ie/