



APPROVED

MATH 9901: Introduction to Probability and Statistical Inference

Module Details

Module Code:	MATH 9901
Module Long Title:	Introduction to Probability and Statistical Inference APPROVED
Banner Title:	Intro to Prob & Stat Inference
Version:	1
Indicative NFQ level:	Level 9
Valid From:	Sept 2020 (September 2020)
Language of Instruction:	English
ECTS Credits::	10
ISCED Code:	0542 - Statistics
Current Coordinator::	JOHN BUTLER
Module Coordinators:	JOHN BUTLER (09 January 2020 to ---)
School Responsible:	School of Mathematical Sciences (CC)
Campus:	City Campus
Module Overview	This module will introduce students to the role of probability models and statistical inference in data analysis. Laboratory work will give the student experience in applying probability and statistical models to real data. Peer-to-peer learning and mentoring in an on-line environment will be utilised to support students in developing their background and knowledge in this topic.

Indicative Syllabus	<p>Preparatory background reading.</p> <p>Introduction and orientation, motivation for formal statistical analysis.</p> <p>Data summary, measures of location and dispersion and their meaning, skew.</p> <p>Probability and probability models for data, calculating probabilities,</p> <p>Discrete and continuous distributions, means and standard deviations of probability distributions: Bernoulli, Binomial, Hypergeometric, Poisson, Multinomial and Normal probability distributions. Multivariate Distributions.</p> <p>Hypothesis tests, statistical significance, p-values and their interpretation, confidence intervals.</p> <p>Tests applied to contingency tables and independence tests.</p>
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	Linear and logistic regression models. Predictions and categorisation from regression models.
Learning and Teaching Methods	The module will be delivered primarily through lectures and tutorials which may be supplemented by online material.

Learning Outcomes	
<i>Upon successful completion of this module the learner will be able to</i>	
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MLO1	Describe a data set using descriptive statistics.
MLO2	Demonstrate an understanding of mathematical probability and conditional probability
MLO3	Formulate probability models for discrete data
MLO4	Formulate probability models for continuous data
MLO5	Perform statistical hypothesis testing
MLO6	Perform statistical hypothesis testing on contingency tables and independence tests
MLO7	Formulate, fit and interpret linear regression models

Requisites

Assessment Threshold	Pass mark = 50%
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Module Content & Assessment

Assessment Breakdown	%
Formal Examination	70.00%
Other Assessment(s)	30.00%

Derogations from the General Assessment Regulations
Pass mark = 50%

Assessments

Formal Examination			
Assessment Type	Written Examination	% of Total Mark for Module	70
Indicative Week	Week 15	Learning Outcomes	1,2,3,4,5,6,7
Assessment Threshold:	50	Assessment Role	Individual
Assessment Authenticity	Not Online	Pass/Fail	No
Assessment Description	Final Exam		

Other Assessment(s)			
Assessment Type	Practical Assignment	% of Total Mark for Module	30
Indicative Week	Week 1	Learning Outcomes	1,2,3,4,5,6,7
Assessment Threshold:	None	Assessment Role	Individual
Assessment Authenticity	Not Online	Pass/Fail	No
Assessment Description	An in-class test mid-semester and a homework assignment towards the end of the semester. Quizzes ongoing throughout the semester.		

Module Activity

Full Time hours per semester	
Activity Type	Duration (Hours)
Lecture	39
Self Directed	161
Hours (up to 100 for 5 ECTS credits)	
	200.00

Recommended Reading List

Recommended Book Resources

Roxy Peck, Jay L. Devore. (2012), *Statistics*, Brooks/Cole, p.788, [ISBN: 9780840068590].

Jay L. Devore, Roxy Peck. (1986), *Statistics, the Exploration and Analysis of Data*, West Group, p.699, [ISBN: 0314931724].

David Collett. (2002), *Modelling Binary Data, Second Edition*, CRC Press, p.408, [ISBN: 1584883243].

Supplementary Book Resources

Peter Dalgaard. (2008), *Introductory Statistics with R*, Springer Science & Business Media, p.364, [ISBN: 978-0-387-79054-1].

Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani. (2014), *An Introduction to Statistical Learning*, Springer, p.426, [ISBN: 1461471370].

Module Details

Module Code:	MATH 9902
Module Long Title:	Statistical Programming and Applications APPROVED
Banner Title:	Statistical Programming and Applications
Version:	1
Indicative NFQ level:	Level 9
Valid From:	Sept 2018 (September 2018)
Language of Instruction:	English
ECTS Credits::	5
ISCED Code:	0542 - Statistics
Current Coordinator::	ALBERTO CAIMO
Module Coordinators:	ALBERTO CAIMO (04 January 2022 to ---)
School Responsible:	School of Mathematical Sciences (CC)
Campus:	City Campus
Module Overview	This module introduces students to the computer laboratory and statistical applications and which will support their learning during their programme of study. The module does not assume any experience of programming or statistical software packages and allows learners to become accustomed to the online learning platform of the University, the ICT resources of the School and the software that will be used in their modules (e.g. R). The module is practical and allows students to learn at their own pace.

Indicative Syllabus	<p>Accessing school computers and systems.</p> <p>Assessing data relevance, determine if correct data is available, in an appropriate format and if the data set is representative.</p> <p>Recognising how and when to resolve inconsistencies in a data set using expert knowledge.</p> <p>Using a software package (e.g. R) to:</p> <ul style="list-style-type: none"> • describe a data set using descriptive statistics and standard graphical techniques. • fill in missing values, smooth noisy data, identify or remove outliers. • assess the number of attribute values , recode new variables from existing variables, categorise variables.
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	<ul style="list-style-type: none">• create new variables using binning, clustering or aggregating existing variables.• describe a data set using probability distributions.• design and conduct a statistical analysis on a data set.• build regression models.
Learning and Teaching Methods	<p>Hands on computer lab work using sample data sets and case studies.</p> <p>The module will be delivered through initial laboratory sessions followed by self-directed learning through prepared workbooks and worksheets.</p> <p>Students will be required to support their learning through the use of online tutorials, support and help systems.</p>

Learning Outcomes	
<i>Upon successful completion of this module the learner will be able to</i>	
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MLO1	Access the School computer laboratories and systems.
MLO2	Develop learning and expertise of a statistical software packages.
MLO3	Access online support and help systems.
MLO4	Assess data relevance for a specific task.
MLO5	Recognise variables with outliers or missing values.
MLO6	Validate and clean variable formats.
MLO7	Visualise and summaries data.
MLO8	Parametrically describe data using discrete and continuous distributions.
MLO9	Conduct and interpret statistical analysis.
MLO10	Build regression models.

Requisites

Module Content & Assessment

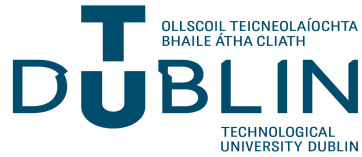
Assessment Breakdown	%
Other Assessment(s)	100.00%

Assessments

Other Assessment(s)			
Assessment Type	Report	% of Total Mark for Module	80
Indicative Week	Week 10	Learning Outcomes	2,3,4,5,6,7,8,9,10
Assessment Threshold:	None	Assessment Role	Individual
Assessment Authenticity	Not Online	Pass/Fail	No
Assessment Description	Case studies x 2		
Assessment Type	Multiple Choice Questionnaires	% of Total Mark for Module	20
Indicative Week	Week 6	Learning Outcomes	1,2,3,4,5,6,7,8,9,10
Assessment Threshold:	None	Assessment Role	Individual
Assessment Authenticity	Not Online	Pass/Fail	No
Assessment Description	Online quizzes		

Module Activity

Full Time hours per semester	
<i>Activity Type</i>	<i>Duration (Hours)</i>
Lecture	39
Self Directed	61
Hours (up to 100 for 5 ECTS credits)	100.00



APPROVED

MATH 9903: Linear & General Regression Models

Module Details

Module Code:	MATH 9903
Module Long Title:	Linear & General Regression Models APPROVED
Banner Title:	MATH 9903 Linear & General Reg
Version:	1
Indicative NFQ level:	Level 9
Valid From:	Jan 2019 (January 2019)
Language of Instruction:	English

ECTS Credits::	10
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ISCED Code:	0542 - Statistics
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Current Coordinator::	JOE CONDON
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Module Coordinators:	JOE CONDON (23 January 2020 to ---)
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School Responsible:	School of Mathematical Sciences (CC)
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Campus:	City Campus
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Module Overview	<p>The aim of this module is to introduce the student to the multiple linear and generalised linear regression models – the most widely used models in data analysis. Model formulation and interpretation will be explored in detail, including inclusion of categorical predictors and interactions.</p> <p>Model building/identification techniques are critically examined. Methods for residual and influence diagnostics are covered. The R software system (or equivalent) will be utilised by the student as a tool for fitting these models</p>
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Indicative Syllabus	<p>Multiple Regression Model</p> <p>Motivation and formulation of the multiple regression model. Variance of parameter estimates and fitted values, confidence intervals and hypothesis testing. General linear hypotheses and ANOVA. Including categorical predictors in regression.</p> <p>Model Building/Identification & model diagnostics.</p> <p>Model building techniques, residuals and model diagnostics and their role in model appraisal.</p> <p>Generalised Linear models: logistic & Poisson Regression</p> <p>Logistic and Poisson regression models. Fitting GLMs with software. Interpretation of model parameters and other model output. General linear hypotheses of parameters. Wald's and likelihood ratio tests. Model building techniques.</p>
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Learning and Teaching Methods	Lectures supported by tutorials and computer laboratory sessions which may be supplemented by online materials.

Learning Outcomes	
Upon successful completion of this module the learner will be able to	
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MLO1	Formulate, fit and interpret the output from multiple regression models.
MLO2	Include categorical predictors in regression models, with and without interactions and formulate classical ANOVA models in the multiple regression framework.
MLO3	Use model building techniques to identify candidate models, including hypothesis testing and information criteria approaches.
MLO4	Perform model critiques using regression and influence diagnostics.
MLO5	Formulate, fit and interpret the output from generalised linear models (GLM: in particular logistic and Poisson regression).
MLO6	Use model building techniques to identify candidate GLM models, including hypothesis testing and information criteria approaches.

Requisites	
Assessment Threshold	CA threshold = 30% End of semester exam threshold = 30%

Module Content & Assessment	
Assessment Breakdown	%
Formal Examination	50.00%
Other Assessment(s)	50.00%

Derogations from the General Assessment Regulations
Pass mark = 50%

Assessments

Formal Examination			
Assessment Type	Written Examination	% of Total Mark for Module	50
Indicative Week	Week 15	Learning Outcomes	1,2,3,4,5,6
Assessment Threshold:	30	Assessment Role	Individual
Assessment Authenticity	Not Online	Pass/Fail	No
Assessment Description	Examination		

Other Assessment(s)			
Assessment Type	Report	% of Total Mark for Module	50
Indicative Week	See Student Handbook	Learning Outcomes	1,2,3,4,5,6
Assessment Threshold:	30	Assessment Role	Individual
Assessment Authenticity	Not Online	Pass/Fail	No
Assessment Description	CA - Report		

Module Activity

Full Time hours per semester	
<i>Activity Type</i>	<i>Duration (Hours)</i>
Lecture	39
Self Directed	161
Hours (up to 100 for 5 ECTS credits)	200.00

Module Details

Module Code:	MATH 9904
Module Long Title:	Topics in Applied Statistics APPROVED
Banner Title:	Topics in Applied Statistics
Version:	1
Indicative NFQ level:	Level 9
Valid From:	Jan 2019 (January 2019)
Language of Instruction:	English
ECTS Credits::	5
ISCED Code:	0542 - Statistics
Current Coordinator::	ALBERTO CAIMO
Module Coordinators:	ALBERTO CAIMO (09 January 2020 to ---)
School Responsible:	School of Mathematical Sciences (CC)
Campus:	City Campus
Module Overview	The aim of this module is to introduce the student to a number of major topics in modern statistical methods. The student will gain experience of applying these methods to real datasets and experience of reporting their findings/conclusions. Statistical software (R or equivalent) will be heavily used.
Indicative Syllabus	<p>A number of discrete topics, typically three, will be covered of which the following are indicative:</p> <p>Classification: Tree based methods. Assessing classification accuracy; confusion matrix, specificity, sensitivity, OC curve & AUC. Compared to logistic regression methods.</p> <p>Clustering: Multidimensional scaling; Hierarchical methods/k-means, distribution and density based clustering.</p> <p>Factor analysis: Covariance and correlation matrices; principle components; factor analysis. Rotation of factor scores; How many factors to include.</p> <p>Survival analysis : Censoring and incomplete data; Survivor and hazard functions; Life-table and KM methods. Log rank and Wilcoxon tests. PH models with regression structure.</p>
Learning and Teaching Methods	Lectures supported by tutorials and computer laboratory sessions which may be supplemented by online materials.

Learning Outcomes	
<i>Upon successful completion of this module the learner will be able to</i>	
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MLO1	Formulate, apply and interpret the output from a number of modern statistical methodologies.
MLO2	Effectively report the findings from statistical data analysis.
MLO3	Use up-to-date software for various statistical analyses (e.g. R).
MLO4	Produce appropriately formatted output (including graphs) for the inclusion in data analysis reporting.

Requisites

Module Content & Assessment

Assessment Breakdown	%
Other Assessment(s)	100.00%

Assessments

Other Assessment(s)			
Assessment Type	Report	% of Total Mark for Module	100
Indicative Week	See Student Handbook	Learning Outcomes	1,2,3,4
Assessment Threshold:	50	Assessment Role	Individual
Assessment Authenticity	Not Online	Pass/Fail	No
Assessment Description			
Continuous Assessment: a series of written data analysis reports (typically 3) and presentation of an analysis which provides an overview of the approach and the results (typically 1).			

Module Activity

Full Time hours per semester	
<i>Activity Type</i>	<i>Duration (Hours)</i>
Lecture	39
Self Directed	61
Hours (up to 100 for 5 ECTS credits)	100.00