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MATH 4000: Business Case Study Project

Module Details

Module Code:	MATH 4000
Module Long Title:	Business Case Study Project APPROVED
Banner Title:	Business Case Study
Version:	3
Indicative NFQ level:	Level 8
Valid From:	Sept 2025 (September 2025)
Language of Instruction:	English
ECTS Credits::	25
Current Coordinator::	FIONA MURRAY
Module Coordinators:	FIONA MURRAY (23 March 2025 to ---)
School Responsible:	School of Mathematics & Statistics
Campus:	City Campus
Module Overview	Students work on an industry linked case study to solve a particular problem or answer a specific business question through the analysis of an underlying data set. Working as part of a team the students formulate the business problem that they are addressing, perform the data analysis and interpret the results and draw their conclusions. The results of the work are summarised by means of a presentation and formal written reports.
Learning and Teaching Methods	A lecturer mentors the team throughout the project, and meets and works with the team weekly via MS Teams. Teams independently collaborate and work through MS Teams: • consultation, group discussion and peer teaching • teamwork and delegation • problem solving and analytical thinking • collaborating and sharing work via collaboration tools, e.g. OneDrive, MS Teams

Indicative Syllabus

1. Case Study Problem
1.1) Case study problem/question formulation in the context of the available data.

2. Data Analysis Methods
2.1) Research and evaluation of data analysis methods for the industrial/business case study.

3. Data Wrangling
3.1) Identification of data set management requirements – data validation, cleaning, aggregation, transposing.

4. Statistical Methods & Models

4.1) Formulation of underlying methodologies/models for data analysis.

5. Presentation of Results
5.1) Articulation and communication of results of analysis, including tables, figures and graphs.

6. Group Work
6.1) Group work etiquette and practice.

Module MATH 4000 - Business Case Study Project v3   (Year/Cycle:1 / Semester:Semester 1 & 2 / Delivery Type:Mandatory)

Learning Outcomes	
Upon successful completion of this module the learner will be able to	
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MLO1	Design a project plan and manage the time involved to complete the industry linked project and complete the presentations and reports.
MLO2	Formulate and communicate the industry problem or objectives of the data analysis.
MLO3	Identify, justify and use an appropriate methodology to address the task.
MLO4	Critically analyse and interpret the results of an analysis, determine the conclusions that may be drawn and formulate the data narrative.
MLO5	Communicate results in a clear and concise manner by means of a presentation and formal written reports.
MLO6	Demonstrate the ability to work independently and also to recognise the need for, and seek, appropriate academic support.

Requisites

Module Content & Assessment

Assessment Breakdown	%
Other Assessment(s)	100.00%

Derogations from the General Assessment Regulations
There will be no compensation across modules. There is no compensation between the CA components of the Business Case Study Project module and students must achieve a pass mark in each component.

Assessments

Other Assessment(s)			
Assessment Type	Report	**% of Total Mark for Module**	20
Indicative Week	Week 5	**Learning Outcomes**	3,4
Assessment Threshold:	None	**Assessment Role**	Individual
Assessment Authenticity	Online	**Pass/Fail**	No
Assessment Description Data Visualisation Report (Individual): Outline the data cleaning approach and data visualisation techniques and tools used to describe the underlying data set(s). Approx. 500 words not including figures and tables.			
Assessment Type	Presentation	**% of Total Mark for Module**	20
Indicative Week	Week 10	**Learning Outcomes**	1,2,3,4,5
Assessment Threshold:	None	**Assessment Role**	Group
Assessment Authenticity	Online	**Pass/Fail**	No
Assessment Description Presentation (Project Team): Via MS Teams and in PowerPoint or a suitable alternative. Approximately 15 to 20 minutes not including Q&A.			
Assessment Type	Report	**% of Total Mark for Module**	20
Indicative Week	Week 11	**Learning Outcomes**	4,5
Assessment Threshold:	None	**Assessment Role**	Individual
Assessment Authenticity	Online	**Pass/Fail**	No
Assessment Description High-level Summary Report (Individual): Discuss the data narrative for a single model chosen by the student. Approx. 350 words (figures and tables may be included but are not included in the word count)			

Assessment Type	Report	% of Total Mark for Module	30
Indicative Week	Week 14	Learning Outcomes	1,2,3,4,5,6
Assessment Threshold:	None	Assessment Role	Individual
Assessment Authenticity	Online	Pass/Fail	No

Assessment Description
Project Report (Individual).
Description of the problem and data set(s); data cleaning and data analysis; statistical modelling approach and methodology; analysis of results; data narrative; conclusion. Approximately 20 to 30 pages including figures, graphs and tables.

Assessment Type	Group Work	% of Total Mark for Module	10
Indicative Week	See Student Handbook	Learning Outcomes	1,2,3,4,5,6
Assessment Threshold:	None	Assessment Role	Group
Assessment Authenticity	Online	Pass/Fail	No

Assessment Description
Engagement (Individual): Engagement and contribution to project team work, attendance and engagement at weekly mentor/project team meetings.

Module Activity

Full Time hours per semester

Activity Type	Duration (Hours)
Lecture	20
Self Directed	480
Hours (up to 100 for 5 ECTS credits)	500.00

Recommended Reading List

Other Resources

**Website, Torfs, Paul, Brauer, Claudia. (2014), A very short introduction to R, https://cran.r-project.org/,
https://cran.r-project.org/doc/contrib/T orfs+Brauer-Short-R-Intro.pdf**

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MATH 4002: Data Set Management

Module Details

Module Code:	MATH 4002
Module Long Title:	Data Set Management APPROVED
Banner Title:	Data Set Management
Version:	3
Indicative NFQ level:	Level 8
Valid From:	Sept 2025 (September 2025)
Language of Instruction:	English
ECTS Credits::	5
Current Coordinator::	Michael Mcauley
Module Coordinators:	Michael Mcauley (19 June 2025 to ---)
School Responsible:	School of Mathematics & Statistics
Campus:	City Campus
Module Overview	The aim of this module is to introduce the student to techniques and tools for data validation, manipulation and cleaning (sorting, counting, reformatting and aggregating). It also teaches students how to check for and deal with errors, missing values and inconsistencies in a data set. Student will learn how to represent a data set using graphical and visualisation techniques. Case studies will be used so that students can apply these techniques to real data. Students will also gain experience in assessing the relevance and suitability of a data set for a specific data analysis.
Learning and Teaching Methods	A mix of live online classes and pre-recorded video lectures and live online technology and software sessions supported by pre-recorded tutorial walk-throughs, case studies and peer-to-peer learning.

Indicative Syllabus

1. Microsoft Excel
1.1) Work with formulae, copy formulae using absolute, relative and mixed addresses.
1.2) Assess a data set using descriptive statistics: to include, AVERAGE, MEDIAN, MIN, MAX, QUARTILE.INC, VAR, STDEV, CORREL.
1.3) Count number of cases, identify missing data and outliers, clean data: to include, Sort, Filter, Remove Duplicates, Flash Fill, COUNTIF, AVERAGEIF.
1.4) Recode, categorise new and existing variables.
1.5) Date/time functions: to include, DATE, DATEVALUE, DAY, MONTH, YEAR, WEEKDAY, WEEKNUMBER.
1.6) String functions: to include, MID, CONCATENATE, EXACT, FIND, TRIM, REPLACE, SUBSTITUTE, VALUE, MATCH, INDEX, ISBLANK.
1.7) Logic functions: to include, IF, AND, OR, NOT.
1.8) Lookup and Reference: to include, TRANSPOSE, VLOOKUP, HLOOKUP.
1.9) Summarise and aggregate data: to include, Pivot Tables, Subtotals.
1.10) Graphs/Plots: to include, Box and Whisker plots, scatter plots, histograms and other visualisation techniques.

2. R
2.1) Introduction to R, working directories, libraries (packages), scripting, knitting.
2.2) Reading and writing files.
2.3) Data structures, scalers, vectors and matrices.
2.4) Selecting complete cases and dealing with NA data.

2.5) Summary statistics.
2.6) Scatter plots, histograms, box-plots and other visualisation techniques.
2.7) Aggregating data and merging data files.

Module MATH 4002 - Data Set Management v3   (Year/Cycle:1 / Semester:Semester 1 / Delivery Type:Mandatory)

Learning Outcomes	
Upon successful completion of this module the learner will be able to	
#	
MLO1	Develop techniques to assess, validate, clean and manipulate a data set for a specific statistical data analysis.
MLO2	Assess a data set using descriptive statistics, count number of cases and identify variables.
MLO3	Identify missing values and outliers.
MLO4	Validate and clean data.
MLO5	Recode new and existing variables.
MLO6	Summarise or aggregate data.
MLO7	Perform a data analysis and represent data using graphical techniques.
MLO8	Merge different data sets into a single data set.

Requisites

Module Content & Assessment

Assessment Breakdown	%
Other Assessment(s)	100.00%

Assessments

Other Assessment(s)			
Assessment Type	Practical Assignment	**% of Total Mark for Module**	40
Indicative Week	See Student Handbook	**Learning Outcomes**	1,2,3,4,5,6,7,8
Assessment Threshold:	None	**Assessment Role**	Not yet determined
Assessment Authenticity	Not Online	**Pass/Fail**	No
Assessment Description Practical Assignment 1: A data analysis using Microsoft Excel. Submission will be an .xlsx file and a short video presentation of the interpretation of the results of the analysis.			
Assessment Type	Practical Assignment	**% of Total Mark for Module**	60
Indicative Week	See Student Handbook	**Learning Outcomes**	1,2,3,4,5,6,7,8
Assessment Threshold:	None	**Assessment Role**	Not yet determined
Assessment Authenticity	Not Online	**Pass/Fail**	No
Assessment Description Practical Assignment 2: Data analysis using R. Submission will be an .R file and a short video presentation of the interpretation of the results of the analysis.			

Module Activity

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

Recommended Reading List

Recommended Book Resources

Matthew MacDonald. (2013), Excel 2013: the missing manual, O'Reilly & Associates Incorporated, [ISBN: 9781449357276].

Supplementary Book Resources

John Walkenbach. (2015), Excel 2016 Bible, John Wiley & Sons, [ISBN: 9781119067511].

Garrett Grolemund,Hadley Wickham. (2017), R for Data Science, O'Reilly, Beijing, [ISBN: 9781491910399].

Other Resources

**Website, Torfs, Paul, Brauer, Claudia. (2014), A very short introduction to R, https://cran.r-project.org/,
https://cran.r-project.org/doc/contrib/T orfs+Brauer-Short-R-Intro.pdf**

**Website, Microsoft Support. Excel help & learning, Microsoft,
https://support.microsoft.com/en-us/exce l?ui=en-us&rs=en-us&ad=us**

**Website, Microsoft Support. Excel functions (alphabetical), Microsoft,
https://support.microsoft.com/en-us/exce l?ui=en-us&rs=en-us&ad=us**

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MATH 4001: Probability & Statistical Inference

Module Details

Module Code:	MATH 4001
Module Long Title:	Probability & Statistical Inference APPROVED
Banner Title:	Prob & Statistical Inference
Version:	3
Indicative NFQ level:	Level 8
Valid From:	Sept 2025 (September 2025)
Language of Instruction:	English
ECTS Credits::	10
Current Coordinator::	JOHN BUTLER
Module Coordinators:	JOHN BUTLER (26 June 2025 to ---)
School Responsible:	School of Mathematics & Statistics
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.
Learning and Teaching Methods	The module will be delivered primarily through online, lectures, and tutorials. Peer-to-peer learning and mentoring in an on-line environment will be used to support students in developing their background, knowledge and communication in this topic.

Indicative Syllabus
1. Statistical Analysis Overview 1.1) Introduction and orientation, motivation for formal statistical analysis.
2. Data Summary 2.1) Data summary, measures of location and dispersion and their meaning, skew.
3. Discrete & Continuous Probability Models 3.1) Probability and probability models for data, calculating probabilities, discrete and continuous distributions, means and standard deviations of probability distributions: Bernoulli, Binomial, Hypergeometric, Poisson, Multinomial and Normal probability distributions. Multivariate Distributions.
4. Statistical Significance 4.1) Hypothesis tests, statistical significance, p-values and their interpretation, confidence intervals.
5. Contingency Tables 5.1) Tests applied to contingency tables.
6. Regression Models 6.1) Multiple linear and logistic regression models. Predictions from regression models.
7. Classification 7.1) Classification using regression type models.

Module MATH 4001 - Probability & Statistical Inference v3   (Year/Cycle:1 / Semester:Semester 1 / Delivery Type:Mandatory)

Learning Outcomes	
Upon successful completion of this module the learner will be able to	
#	
MLO1	Formulate probability models for discrete and continuous data.
MLO2	Perform statistical hypothesis testing.
MLO3	Perform statistical hypothesis tests on contingency tables.
MLO4	Fit multiple regression and logistic regression models.
MLO5	Interpret the results of the output from multiple regression and logistic regression models.
MLO6	Perform classification using regression type model.
MLO7	Use a statistical analysis software package.

Requisites	

Assessment Threshold	30% threshold on Case Study and 30% threshold on Short Answer Tests

Module Content & Assessment

Assessment Breakdown	%
Other Assessment(s)	100.00%

Assessments

Other Assessment(s)			

Assessment Type	Case Study	% of Total Mark for Module	40
Indicative Week	See Student Handbook	Learning Outcomes	1,2,3,4,5,6,7
Assessment Threshold:	30	Assessment Role	Not yet determined
Assessment Authenticity	Not Online	Pass/Fail	No
Assessment Description Case Study applying the methods to a dataset.			

Assessment Type	Short Answer Test	% of Total Mark for Module	40
Indicative Week	See Student Handbook	Learning Outcomes	1,2,3,4,5,6,7
Assessment Threshold:	30	Assessment Role	Not yet determined
Assessment Authenticity	Online	Pass/Fail	No
Assessment Description Two short answers tests covering the calculations and theory of the module.			

Assessment Type	Online Quiz	% of Total Mark for Module	20
Indicative Week	See Student Handbook	Learning Outcomes	1,2,3,4,5,6,7
Assessment Threshold:	None	Assessment Role	Not yet determined
Assessment Authenticity	Online	Pass/Fail	No
Assessment Description Ongoing online Multiple Choice quizzes			

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, [ISBN: 9780840068590].

David Collett. (2002), Modelling Binary Data, Second Edition, 2nd. CRC Press, [ISBN: 1584883243].

Supplementary Book Resources

James T. McClave,P. George Benson,Terry Sincich. (2018), Statistics for Business and Economics, Global Edition, Pearson, Upper Saddle River, [ISBN: 9781292227085].

Roxy Peck,Chris Olsen,Tom Short. (2018), Introduction to Statistics and Data Analysis, 6th, Cengage Learning, [ISBN: 9781337793612].

Harold J. Larson. (1982), Introduction to Probability Theory and Statistical Inference, John Wiley & Sons, New York, [ISBN: 0471059099].

Geoffrey Grimmett, David Stirzaker. (2001), Probability and Random Processes, Oxford University Press, [ISBN: 0198572220].

Annette J. Dobson,Adrian G. Barnett. (2018), An Introduction to Generalized Linear Models, Chapman & Hall/CRC, Boca Raton, [ISBN: 9781138741515].

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MATH 4003: Quantitative Decision Making

Module Details

Module Code:	MATH 4003
Module Long Title:	Quantitative Decision Making APPROVED
Banner Title:	Quantitative Decision Making
Version:	1
Indicative NFQ level:	Level 8
Valid From:	Jan 2022 (January 2022)
Language of Instruction:	English

ECTS Credits::	5

Current Coordinator::	Mercedes Jordan Sv

Module Coordinators:	• FIONA MURRAY (26 April 2022 to 08 April 2024) • Mercedes Jordan Sv (08 April 2024 to ---)

School Responsible:	School of Mathematics & Statistics

Campus:	City Campus

Module Overview	The aim of the course is to develop in students the ability to apply quantitative techniques to problems in business where outcomes may be uncertain or where the problem is not well defined. The course covers a range of topics and techniques that have a practical relevance to business decision making.

Learning and Teaching Methods	A mix of live online lecture and tutorials and pre-recorded videos.

Indicative Syllabus
1. Single Criteria Decision Making 1.1) Min Max Regret, decision trees, decision rules of thumb, dealing with uncertainty. Bayesian analysis, expected value of perfect and imperfect information.
2. Multicriteria Decision-Making (MCDM) 2.1) The Analytical Hierarchy Process, pairwise comparison, synthetisation, ranking, decision Analysis (MCDA) and MCDM.
3. Forecasting 3.1) Seasonal/non-seasonal forecasting techniques, forecasting error.
4. Software 4.1) Use software, e.g. R, to write code to apply single and multiple criteria decision making techniques through case studies. Build time series forecasting models using software.

Module MATH 4003 - Quantitative Decision Making v1   (Year/Cycle:1 / Semester:Semester 2 / Delivery Type:Mandatory)

Learning Outcomes	
Upon successful completion of this module the learner will be able to	
#	
MLO1	Apply min-max regret to a decision making problem
MLO2	Use decision trees to assess business decisions with probabilities.
MLO3	Apply Multi-Criteria Decision Making techniques to model more complex business decisions.
MLO4	Use forecasting techniques to predict patterns and seasonality.
MLO5	Use software, e.g. R to simulate and model business decisions and predict best case scenarios.

Requisites	
Assessment Threshold	Practical Assignment: Threshold = 30%

Module Content & Assessment

Assessment Breakdown	%
Other Assessment(s)	100.00%

Assessments

Other Assessment(s)			
Assessment Type	Practical Assignment	**% of Total Mark for Module**	50
Indicative Week	See Student Handbook	**Learning Outcomes**	1,2,3,4,5
Assessment Threshold:	30	**Assessment Role**	Not yet determined
Assessment Authenticity	Not Online	**Pass/Fail**	No
Assessment Description			
2 x practical assignments based on case study examples			
Assessment Type	Multiple Choice Questionnaires	**% of Total Mark for Module**	30
Indicative Week	See Student Handbook	**Learning Outcomes**	1,2,3,4,5
Assessment Threshold:	None	**Assessment Role**	Not yet determined
Assessment Authenticity	Online	**Pass/Fail**	No
Assessment Description			
Online quizzes			
Assessment Type	Computer Programming/Coding	**% of Total Mark for Module**	20
Indicative Week	See Student Handbook	**Learning Outcomes**	1,2,3,4,5
Assessment Threshold:	None	**Assessment Role**	Not yet determined
Assessment Authenticity	Not Online	**Pass/Fail**	No
Assessment Description			
Programming exercise in R based on a subset of learning outcomes 1. to 6.			

Module Activity

Full Time hours per semester

Activity Type	Duration (Hours)
Lecture	26
Self Directed	74
Hours (up to 100 for 5 ECTS credits)	100.00

Recommended Reading List

Recommended Book Resources

Bernard W. Taylor. (2019), Introduction to Management Science, Global Edition, 13th. Pearson, Upper Saddle River, Harlow, [ISBN: 1292263040].

David Ray Anderson. (2011), An Introduction to Management Science, 13th. South Western Educational Publishing, [ISBN: 9780538475655].

Hadley Wickham. (2019), Advanced R, 2nd. CRC Press, Boca Raton, [ISBN: 9780815384571].

Supplementary Book Resources

Chris Chatfield. (2016), The Analysis of Time Series, 6th. CRC Press, [ISBN: 9780203491683].