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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:	MATH 4000 Business Case Study
Version:	1
Indicative NFQ level:	Level 8
Valid From:	Sept 2019 (September 2019)
Language of Instruction:	English
ECTS Credits::	25
ISCED Code:	0541 - Mathematics
Current Coordinator::	FIONA MURRAY
Module Coordinators:	FIONA MURRAY (10 December 2019 to ---)
School Responsible:	School of Mathematical Sciences (CC)
Campus:	City Campus
Module Overview	Students work on an industry linked case study to solve a particular problem or attempt to 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 formal written report. It is recommended that each student keep a reflective blog for the duration of the case study project.
Learning and Teaching Methods	Working in groups, consultation and group discussion. Peer teaching, teamwork and delegation. Problem solving and analytical thinking. Report writing.

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 v1   (Year/Cycle:1 / Semester:Semester 1 & 2 / Delivery Type:Mandatory)

Learning Outcomes	
Upon successful completion of this module the learner will be able to	
#	
MLO1	Design a project plan and manage the time involved to complete the industry linked project and related report.
MLO2	Formulate and communicate the industry problem or objective of the data analysis.
MLO3	Source, read and critically evaluate literature on the underlying area.
MLO4	Identify, justify and use an appropriate methodology in the addressing task.
MLO5	Critically analyse, interpret and draw conclusions from the industry data set.
MLO6	Communicate results in a clear and concise manner by means of a formal written report.
MLO7	Demonstrate the ability to work independently and also to recognise the need for, and seek, appropriate academic support.
MLO8	Formulate and communicate the industry problem or objective of the data analysis.

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 CA components and students must achieve a pass mark in each component.

Assessments

Other Assessment(s)			
Assessment Type	Presentation	**% of Total Mark for Module**	30
Indicative Week	Week 9	**Learning Outcomes**	1,2,3,4,5,8
Assessment Threshold:	None	**Assessment Role**	Group
Assessment Authenticity	Online	**Pass/Fail**	No
Assessment Description Project team makes a joint presentation, approximately 20 minutes not including Q&A. The team presentation should be given in PowerPoint or a suitable alternative.			
Assessment Type	Report	**% of Total Mark for Module**	20
Indicative Week	Week 10	**Learning Outcomes**	1,2,3,4,5,6,7,8
Assessment Threshold:	None	**Assessment Role**	Individual
Assessment Authenticity	Online	**Pass/Fail**	No
Assessment Description High-level Summary Report, 500 words not including figures and tables. Report should outline the key findings of the analysis, an overview of the modelling approach and any assumptions made.			
Assessment Type	Class Participation/Attendance	**% of Total Mark for Module**	10

Indicative Week	See Student Handbook	**Learning Outcomes**	1,2,3,4,5,8
Assessment Threshold:	None	**Assessment Role**	Individual
Assessment Authenticity	Online	**Pass/Fail**	No

Assessment Description
Attendance at weekly project meeting with group and mentor.

Assessment Type	Report	**% of Total Mark for Module**	40
Indicative Week	Week 14	**Learning Outcomes**	1,2,3,4,5,6,7,8
Assessment Threshold:	None	**Assessment Role**	Individual
Assessment Authenticity	Online	**Pass/Fail**	No

Assessment Description
Project Report (Individual),

Approximately 20 to 30 pages including figures, graphs and tables.

The report should provide a description of the problem and the data set, the objective of the modelling task, the data analysis and statistical modelling approach and methodology, an overview of the underlying statistical theory and techniques used, a discussion of the results and data narrative and a conclusion.

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

Recommended Book Resources

Michael Milton. (2009), Head First Data Analysis, "O'Reilly Media, Inc.", [ISBN: 9781449368333].
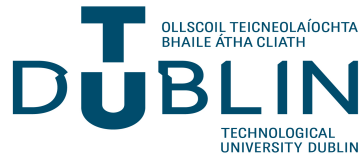
Supplementary Book Resources

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

Roxy Peck,Jay L. Devore. (2012), Statistics : the exploration and analysis of data, Brooks/Cole, [ISBN: 9780840068590].

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:	MATH 4002 Data Set Management
Version:	1
Indicative NFQ level:	Level 8
Valid From:	Sept 2019 (September 2019)
Language of Instruction:	English
ECTS Credits::	5
ISCED Code:	0541 - Mathematics
Current Coordinator::	Nicole Beisiegel
Module Coordinators:	• FIONA MURRAY (08 January 2020 to 06 January 2022) • Nicole Beisiegel (06 January 2022 to ---)
School Responsible:	School of Mathematical Sciences (CC)
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. 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	Hands on computer lab work using sample data sets and case studies.

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.

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
2.7) Aggregating data and merging data files

Module MATH 4002 - Data Set Management v1   (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 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	Lab Test	**% of Total Mark for Module**	100
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	Online	**Pass/Fail**	No

Assessment Description
One lab test mid-semester (typically excel based) and second lab test at the end of semester (typically R based).

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

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:	MATH 4001 Prob. & Statistical
Version:	1
Indicative NFQ level:	Level 8
Valid From:	Sept 2019 (September 2019)
Language of Instruction:	English
ECTS Credits::	10
ISCED Code:	0541 - Mathematics
Current Coordinator::	JOHN BUTLER
Module Coordinators:	- FIONA MURRAY (08 January 2020 to 07 January 2022) - JOHN BUTLER (07 January 2022 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.
Learning and Teaching Methods	The module will be delivered primarily through lectures, tutorials and laboratory work. Peer-to-peer learning and mentoring in an on-line environment will be utilised 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 v1   (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 Invigilated Examination and 30% threshold on Other Assessment(s) (Continuous Assessment)

Module Content & Assessment

Assessment Breakdown	%
Formal Examination	50.00%
Other Assessment(s)	50.00%

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**	Not yet determined
Assessment Authenticity	Not Online	**Pass/Fail**	No
Assessment Description End of semester examination			

Other Assessment(s)			
Assessment Type	Practical Assignment	**% of Total Mark for Module**	50
Indicative Week	See Student Handbook	**Learning Outcomes**	1,2,3,4,5,6,7
Assessment Threshold:	30	**Assessment Role**	Not yet determined
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: the exploration and analysis of data, Brooks/Cole, Pacific Grove, [ISBN: 9780840068590].

David Collett. (2003), Modelling Binary Data, Second Edition, CRC Press, Boca Raton, [ISBN: 1584883243].
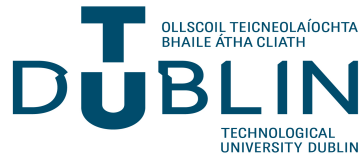
Supplementary Book Resources

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

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

Geoffrey Grimmett,Geoffrey R. Grimmett,David Stirzaker. (2001), Probability and Random Processes, Oxford University Press, Oxford, [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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MGMT 4015: Business Decision Making

Module Details

Module Code:	MGMT 4015
Module Long Title:	Business Decision Making APPROVED
Banner Title:	MGMT 4015 Business Decision M
Version:	1
Indicative NFQ level:	Level 8
Valid From:	Jan 2020 (January 2020)
Language of Instruction:	English
ECTS Credits::	5
ISCED Code:	0541 - Mathematics
Current Coordinator::	FIONA MURRAY
Module Coordinators:	FIONA MURRAY (08 January 2020 to ---)
School Responsible:	School of Mathematical Sciences (CC)
Campus:	City Campus
Module Overview	The course covers a range of techniques from management science that have a practical relevance to business decision making. The aim of the course is to develop in students the ability to apply techniques from management science to problems in business where outcomes may be uncertain or where the problem is not well defined.
Indicative Syllabus	**Decision Making:** • Decision Trees. • Decision Rules of Thumb. • Dealing with uncertainty. • Bayesian analysis. • Expected value of perfect and imperfect information. **Multicriteria Decision-Making (MCDM):** • The Analytical Hierarchy Process. • Pairwise Comparison. Synthesisation. • Ranking. • Recent Trends in Multicriteria. • Decision Analysis (MCDA) and MCDM. **Forecasting:**

- Probability models for time series.
- Univariate and multivariate Approaches to Forecasting.
- Evaluation of Forecasting.
- Forecasting Error.
- Scenario Planning.

Simulation:

- The Monte Carlo Process.
- Building a Simulation Model.
- Continuous Probability Distributions.
- Statistical Analysis of Simulation Results.
- Model Verification.
- Areas of Application of Simulation.

Learning and Teaching Methods	The module will be delivered primarily through lectures, tutorials and laboratory work.

Module MGMT 4015 - Business 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	Use decision trees to assess business decisions with and without probabilities.
MLO2	Apply decision making techniques such as min-max regret to aid the decision process. Understand the value of information in decision making.
MLO3	Use and apply stochastic processes such as Markov processes to model switching and market shares.
MLO4	Use advanced forecasting techniques to predict business growth patterns and seasonality.
MLO5	Use simulation techniques to model the consequences of business decision and predict best case scenarios.
MLO6	Use Multi-Criteria Decision Making techniques to model more complex business decisions.

Requisites

Module Content & Assessment

Assessment Breakdown	%
Formal Examination	60.00%
Other Assessment(s)	40.00%

Assessments

Formal Examination			
Assessment Type	Written Examination	**% of Total Mark for Module**	60
Indicative Week	Week 15	**Learning Outcomes**	1,2,3,4,5,6
Assessment Threshold:	None	**Assessment Role**	Not yet determined
Assessment Authenticity	Not Online	**Pass/Fail**	No
Assessment Description n/a			

Other Assessment(s)			
Assessment Type	Lab Test	**% of Total Mark for Module**	40
Indicative Week	Week 6	**Learning Outcomes**	1,2
Assessment Threshold:	None	**Assessment Role**	Not yet determined
Assessment Authenticity	Not Online	**Pass/Fail**	No
Assessment Description n/a			

Module MGMT 4015 - Business Decision Making v1   (Year/Cycle:1 / Semester:Semester 2 / Delivery Type:Mandatory)

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