MS5107 End-of-Module Exam Assignment 2022/23

Module Code: MS5107

Module Name: Business Modelling and Analytics

Objective	The objective of this individual assignment is to assess your understanding of the following learning outcome(s): • Perform comprehensive analysis of business cases and demonstrate knowledge in building prescriptive and predictive models. • Demonstrate practical skills in using MS Excel in modelling. • Demonstrate theoretical knowledge in areas, such as machine learning and data mining.
Lecturer	Anatoli Nachev
Marks Awarded	This assignment carries 50% of the overall marks for the module. Guidelines for grading this assignment are included at the end of this document.
Deliverables	An electronic file (or multiple files) constructed using Microsoft Office or equivalent. Your submission should **not exceed 3,000 words**, excluding the following components (if any): cover page, table of contents, bibliography, graphs, tables, but including any appendices.
Submission	You should submit your completed assignment through the Blackboard electronic drop box provided by **16th Dec 2022 @23:59**. Drop box is set to accept multiple submission attempts, the last one will be considered as valid. Please, **follow strictly file formats and file naming** as required by the assignment details below. If you are unable to submit your assignment via Blackboard, please email it to your lecturer anatoli.nachev@universityofireland.ie
Special Requirements	If you are registered with the Disability Support Service (DSS), you will find recommended accommodations listed on your **Learning and Educational Needs**

	Summary (LENS) report. If this assessment does not fully meet the recommendations in your LENS report, please email your lecturer attaching a copy of your LENS report.
Referencing	If you are using any references, please use the Harvard referencing style, instructions for which can be found on the NUI Galway Library Website, section Styles & Styles Guide: Citing & Referencing: http://libguides.library.nuigalway.ie/c.php?g=672922&p=4791378
Plagiarism	University of Galway Plagiarism Code of Practice. Plagiarism is the act of copying, including or directly quoting from the work of another without adequate acknowledgement, in order to obtain benefit, credit or gain. You are required to familiarise yourself with the University of Galway Plagiarism Code (http://www.universityofgalway.ie/plagiarism)and ensure that the work you submit does not contain plagiarised elements. Each module instructor reserves the right to follow up with a student by interview if there is any concern in relation to the integrity of the assignment. For any assignments not submitted via Turnitin, we reserve the right to check it using Turnitin where required.
Assignment Details	Question 1: Optimisation modelling Task: production optimisation: Celtic Candles Inc. manufactures decorative candles and has contracted with a national retailer to supply a set of special holiday candles to its 8,500 stores. These include large jars, small jars, large pillars, small pillars, and a package of votive candles. In negotiating the contract for the display in each store, the manufacturer and the retailer agreed that at least 2 feet would be dedicated to both large jars and large pillars (combined), at least 1.5 feet to both small jars and small pillar (combined), and at least 1 foot to the votive candles packages. More jars than pillars must be provided to the retailer. The manufacturer has obtained 200,000 pounds of wax, 250,000 feet of wick, and 100,000 ounces of holiday fragrance. The amount of materials and display size required for each product are shown in the following table:

	Large Jar	Small Jar	Large Pillar	Small Pillar	Votive Pack
Wax (lb)	0.5	0.25	0.5	0.25	0.3125
Fragrance (oz)	0.24	0.12	0.24	0.12	0.15
Wick (ft)	0.43	0.22	0.58	0.33	0.8
Display feet	0.48	0.24	0.23	0.23	0.26
Profit/unit	€0.25	€0.20	€0.24	€0.21	€0.16

Management of Celtic Candles want you to help answering the question: **how many of each product should be made to maximize the profit?**

To answer the question, formulate and solve a linear optimisation model using MS Excel Solver. Prepare a written report to the management containing details of the model formulation, Solver dialog box, generated reports, and their interpretation in a business context.

(10 marks)

Question 2: Data mining and predictive analytics.

Management of City Commerce Bank is concerned how to optimise marketing strategies and improve their effectiveness in selling term deposits to the customers. You have been asked to help the bank in developing a more granular understanding of its customer base, predict customers' response to its telemarketing campaign and establish a target customer profile for future marketing plans. The bank can then focus its marketing efforts on those customers.

Dataset:

The bank provides a dataset (file **Bank.xlsx**) containing data from previous telemarketing campaigns (phone calls). The dataset contains input variables, such as *age*, *job*, *marital*, *education*, etc. It also contains output variable *y* that shows if the customer has subscribed for term deposit or not (binary: "yes", "no"). Description of each variable is given in the **'Description'** worksheet.

Task: Build a predictive model.

Having the bank dataset and based on your knowledge in business modelling and analytics, you are required to:

- Using XLMiner, **build a model** that can predict if a customer will subscribe for term deposit or not.
- **Provide a report** to the bank management, briefly outlining the process of model development in the context of the CRISP-DM methodology. You are to justify your model proposal and give arguments that would convince the bank management that it is the model they are looking for. You can also briefly explain how the selected modelling technique works in order to provide the prediction required. Should you have any additional findings or insights that you believe the bank management should know, you can include them in your report.

(40 marks)

Submit to the Blackboard drop box provided the following:
- MS Word document containing answers of Q1 and Q2. **Use exam script cover page** provided. Name the file using your ID, module code, and ExamAssignment (e.g., **12345678_MS5107_ExamAssignment.docx**)

	• MS Excel file containing the Q1 model (e.g., **12345678_MS5107_ExamAssignment_Q1.xlsx**) • MS Excel file containing essential worksheets (only) of the Q2 model(s) (e.g. **12345678_MS5107_ExamAssignment_Q2.xlsx**). Essential worksheet would show your approach, rather than every single experiment or report.

To help with expectations of standard of submission, following is a general set of Grade Descriptors as proposed by the NUI Senate.

Ollscoil na hÉireann
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GRADE DESCRIPTORS, AS PROPOSED BY THE NUI SENATE

Explanatory Note:
The Grade Descriptors below are offered as indicative descriptors. It is accepted that these indicative descriptors are particularly appropriate for examinations based on essay-type questions but may be found less suitable for examinations in subjects where there are detailed marking schemes.

Grade	Marks %	Descriptor
1st CLASS HONS	90-100	Supreme performance, engaging profoundly, systematically and comprehensively with question set, brilliantly demonstrating • a superlative mastery of the subject matter, richly supported by evidence and citation, reflecting deep and broad knowledge and understanding as well as extensive reading • an outstanding ability to organise, analyse and express ideas and arguments in an original, sophisticated and discriminating manner • an optimal capacity for critical analysis • the display of rare penetrative insight, originality and creativity
	80-89	Exceptional performance, engaging deeply and systematically with the question set, with consistently impressive demonstration of • a comprehensive mastery of the subject matter; amply supported by evidence and citation, • reflecting deep and broad knowledge and critical insight as well as extensive reading • an exceptional ability to organise, analyse and present arguments fluently and lucidly with a high level of critical analysis • a highly-developed capacity for original, creative and logical thinking;

	70 -79	<u>Excellent</u> performance, engaging closely and systematically with the question set, with consistently strong evidence of • a comprehensive mastery of the subject matter, ably supported by evidence and relevant citation • excellent ability to organise, analyse and express arguments fluently and lucidly with a high level of critical analysis • a highly-developed capacity for original, creative and logical thinking
2nd CLASS HONS (Grade 1)	60-69	<u>Very Good</u> performance, engaging substantially with the question set, demonstrating strong grasp of the subject matter, well supported by evidence and relevant citation • well-developed capacity to analyse issues, organise material, present arguments clearly and cogently • some original insights and capacity for creative and logical thinking
2nd CLASS HONS (Grade 2)	50-59	<u>Good</u> performance - intellectually competent answer (i.e. factually sound) with evidence of a reasonable familiarity with the relevant literature and techniques • acceptable grasp of the subject material • ideas stated rather than developed and insufficiently supported by evidence and relevant citation • writing of sufficient quality to convey meaning but some lack of fluency and command of suitable vocabulary • omission of parts of the subject in question or the appearance of several minor errors • average critical awareness and analytical qualities • limited evidence of capacity for original and logical thinking
3rd CLASS HONS	45-49	<u>Satisfactory</u> performance – intellectually adequate answer with evidence of some familiarity with the relevant literature and techniques • basic grasp of subject matter, but somewhat lacking in focus and structure • main points covered in answer, but lacking detail • some effort to engage, but only a basic understanding of the topic portrayed • some development of argument • only some critical awareness displayed • no evidence or relevant citation included in answer • appearance of several minor errors or one major error • lacking evidence of capacity for original and logical thinking
	40–44	<u>Acceptable</u> performance – intellectually adequate answer with limited familiarity with the relevant literature and techniques • basic grasp of subject matter but limited focus on question asked • unclear presentation of argument, random layout, with some omissions or inaccuracies in answer • argument insufficiently developed • no evidence or relevant citation supplied • appearance of one major error and minor errors • inclusion of unsubstantiated statements and/or irrelevant material • descriptive rather than argumentative or analytical answer presented • an attempt to solve moderately difficult problems related to the subject material and an attempt to examine the material in a critical and analytical manner only partially successful • an incomplete or rushed answer e.g. the use of bullet points through part / all of answer
FAIL*	35-39	<u>Unacceptable</u> performance, with either - insufficient understanding of the question displayed - failure to address the question resulting in a largely irrelevant answer

		- a display of some knowledge of material relative to the question posed, but with very serious omissions / errors and/or major inaccuracies included in answer - or answer left somewhat incomplete for lack of time Also: • limited understanding of question displayed • a random layout / underdeveloped structure - not planned sufficiently • poor analytical skills, with an absence of argument • random and undisciplined development - limited structure • lack of clarity, poor spelling • material of marginal relevance predominating
FAIL	<35	<u>Wholly unacceptable</u> performance, with - deficient understanding of the question displayed - complete failure to address the question resulting in an irrelevant answer - inadequate knowledge displayed relative to the question posed - or answer left incomplete for lack of time Also: • very poor analytical skills, with an absence of argument • random and undisciplined development –poorly structured answer • confused expression, poor spelling • irrelevant material predominating
Fail* - within 'Pass by Compensation' range		