UNIVERSITY OF MASSACHUSETTS LOWELL
Manning School of Business

POMS.6120.201 Statistics for Predictive Analytics
Fall 2023

CREDITS:	3
WEBSITE:	https://uml.umassonline.net
CLASS LOCATION:	Pulichino Tong Bldg 150
CLASS TIME:	Thursday 5:00PM-7:50PM
PROFESSOR:	Dr. Nichalin S. Summerfield **Email**: nichalin_summerfield@uml.edu **Office hours**: Thursday 3pm-5pm Friday 11am-12pm
PRE-REQUISITES:	POMS.6010, or Matriculated MSBA, or MSA, or MSF, or MSEM, or MSEI, or GCBA, or permission of graduate business programs coordinator.

COURSE DESCRIPTION:
This course introduces statistical methods and techniques for predictive analytics. This is part of the business-analytics umbrella of courses. The main focus of this course is on regression, a powerful and widely used predictive method. Topics covered include simple linear regression, multiple regression, variable selection, model diagnostics, and systems of regression equations. The course also covers classification techniques using statistical methods such as linear discriminant function and logistic regression. Spreadsheet software, such as MS Excel, and statistical software, such as SAS and R, will be heavily utilized.

COURSE OBJECTIVES:
1. To develop the ability to apply predictive analytics to business problems and be able to identify when the concomitant tools are appropriate.
2. To develop the capability to diagnose effectively and solve appropriate problems using spreadsheet models and statistical software packages.
3. To develop the ability to apply valid data and logical analysis to business decisions that may not have only quantitative solutions.
4. To enhance oral and written communication skills in both interpersonal and group contexts.

To achieve these objectives, we will examine problems in different environments and organizations. Through several in-class exercises, quantitative problems, and projects, students will learn about predictive analytics and the context in which they are used. After completing the course students should be able to apply their learned tools and techniques to solve related problems in the business environment. It is expected that they will have obtained considerable analytics experience working with data.

Relationship of course to program context and effectiveness

This is intended as an introductory graduate course serving as one of three major components of business analytics. Business analytics generally begins with the collection, organization, and manipulation of data. Its other two components are descriptive analytics and prescriptive analytics. Descriptive analytics utilizes data to get a better understanding of past and current business performance to make knowledgeable decisions. This is how most businesses should start. Predictive analytics analyzes past performance in order to predict the future by studying historical data, detecting patterns or relationships in these data, and then extrapolating these relationships forward in time. Prescriptive analytics uses optimization techniques to identify the best alternatives to maximize or minimize some objective.

It is fairly evident that statistics for predictive analytics has a uniquely effective relationship in preparing graduate students to become valuable decision makers upon entering the workaday business world. This is the principal course for enabling students to use a variety of statistical techniques for problem solving.

The Master of Science in Business Analytics program includes the following learning goals:

- Analytical Skills
- Communication Skills
- Ethical Data Management Skills
- Team Management & Leadership Skills

This course supports the learning goals of Analytical Skills and Team Management & Leadership Skills.

COURSE MATERIAL:

Class materials	Slides and assignments will be posted on Blackboard system. **URL: http://uml.umassonline.net** **** Please check Blackboard system, at least, every week ****
Required Text	James, Witten, Hastie, and Tibshirani. *An Introduction to Statistical Learning: With Applications in R*. 2nd Edition PDF is also available at www.StatLearning.com

Optional text for reviewing basic statistics

Anderson, Sweeney, and Williams et al.
Essentials of Statistics for Business and Economics.
Cengage Learning. 9th edition

Computer Hardware Please follow the UML's recommendation
https://www.uml.edu/it/services/hardware/student-hardware-recommendations-software-licenses.aspx

Required Software **Microsoft Excel**
R can be downloaded from http://www.r-project.org/
RStudio can be downloaded from http://www.rstudio.org

CLASSROOM POLICY:

This course will be conducted in a series of lectures supplemented by assigned readings. Please plan to spend an hour on self-studying the course materials for every hour of time spent in class. Do not fall behind in understanding the materials. Get your questions answered immediately. Send an email to me if you need help. I will be available to meet in-person during office hours and via Zoom by appointment. You can also utilize the tutoring services offered at the tutoring center.

Interaction Guidelines – Communication and Participation:
In our course, we will be using *Discussion Forum* and *Email*.

Discussion Forum:
You can access Discussion Forum on the Course Menu. This is the place to ask any content or assignment related questions that may arise. I will respond as needed. Also, feel free to respond to one another's questions. No need to wait for me!

Email:
We will be communicating via UML email system. Email will be used for all personal communication that you don't want to share with your classmates, such as questions about your grade or personal schedule. You can expect to hear back from me within **72 hours**. If I am unable to respond within 72 hours, I will let you know beforehand. Please check your mail often.

Class participation & attendance:
Attendance is strongly recommended and expected, as regular attendance is one of the most important contributors to student success. You are also expected to actively participate in class discussions. If you miss a class, you will have to read the textbook chapter covered during that class and watch the lecture video. **There is no grade penalty for being absent.** However, lack of class attendance may impact financial aid eligibility in some students. In addition, student-athletes must adhere to the Athletic Academic Policy.

In the case of a **prolonged medical or personal absence**, please contact me as soon as possible so we can discuss whether it is advisable for you to remain in class, and if so, to come up with a plan for you to make up missed work. I try to be very accommodating to students who are experiencing attendance challenges, but you must communicate your situation with me regularly and with as much advance notice as possible.

Likewise, if I should need to miss class, I will communicate with you via email as soon as possible with clear instructions.

Tutoring:
Centers for Learning and Academic Support Services (CLASS) will be offering tutoring and Writing Center services both in-person and virtually. I strongly urge you to take advantage of this opportunity to reinforce your learning. If you need a tutor, you need to put in a request online as soon as possible because there is currently no tutor for this course.

Health and Safety:
The safety and health of the UMass Lowell community is our shared priority. In seeking to provide the fullest academic and campus life experience possible, UMass Lowell will rely on all members of our community to act responsibly. Do not come to class if you are feeling ill.

Student Mental Health and Well-being:
We are a campus that cares about your wellbeing and success. Your personal health and well-being are of utmost importance to faculty and campus administrators. I'm available to talk about your stresses or concerns related to your coursework in my class.

Here are some resources to support your well-being:

> Counseling Services provide crisis intervention, assessment, referrals, short term individual counseling and group therapy. Call to book an appointment at (978) 934-6800.
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> UMatter2 is a university-wide initiative to support students and promote mental health. They can be reached at (978) 934-6671. You will find information at that website on how to access Togetherall, an online community which is a peer-to-peer platform dedicated to mental health support.
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> Centers for Learning and Academic Support Services (CLASS) provides advising services including goal setting, course selection, SIS functions, changing majors/minors and course deletions. (978) 934-2936 or Advisement@uml.edu.
>
> The mission of the Office of Student Life & Wellbeing is to advance the holistic concept for student success by infusing health-promoting actions and collaboration into campus culture. They can be reached at 978-934-4342 or Wellbeing@uml.edu.

Disability Services:
If you are registered with Disability Services and will require course accommodations, please notify me via the Accommodate semester request process as soon as possible so that we might make appropriate arrangements. It is important that we connect to discuss the logistics of your accommodations; please speak to me during office hours or privately after class as I respect and want to protect your privacy. If you need further information or need to register for academic accommodations, please visit the Disability Services Website.
Additionally, Student Disability Services supports software for ALL students (not just those registered with their office). The university has literacy software that allows you to read on-screen text aloud, research and check written work, and create study guides. You can download the software from the IT Software webpage on the UML assistive technologies website.

Diversity, Inclusion, and Classroom Community Standards:
UMass Lowell—and your professor—value human diversity in all its forms, whether expressed through race and ethnicity, culture, political and social views, religious and spiritual beliefs, language and geographic characteristics, gender, gender identities and sexual orientations, learning and physical abilities, age, parenting status and social or economic backgrounds. Enrich yourself by practicing respect in your interactions, and enrich one another by expressing your point of view, knowing that diversity and individual differences are respected, appreciated, and recognized as a source of strength.

The Office of Multicultural Affairs (OMA) supports and advocates for students while leading diversity-related programming. At the same time working to create an inclusive environment for LGBTQ+ individuals via the LGBTQ+ Resource Center. Contact (978) 934-4336 or Multicultural_Affairs@uml.edu

Academic Integrity Policy:
The University has an Academic Integrity Policy that specifies our institutional expectations for honesty and integrity in the learning environment. It is the students' responsibility to familiarize themselves with these policies. Students are responsible for the honest completion and representation of their work. You can find the university policy regarding academic dishonesty at: http://www.uml.edu/Catalog/Graduate/Policies/Academic-Integrity.aspx

This policy notes that "*Examples of academic misconduct include, but are not limited to: cheating on an examination; collaborating with others in work to be presented, contrary to the stated rules of the course; submitting a paper or assignment as one's own work when a part or all of the paper or assignment is the work of another; submitting a paper or assignment that contains ideas or research of others without appropriately identifying the sources of those ideas; getting unauthorized access to examinations or course materials; submitting, without the permission of the current instructor, work previously presented in another course; tampering with the laboratory experiment or computer program of another student; knowingly and intentionally assisting another student in any of the above, including assistance in an arrangement whereby any work, classroom performance, examination or other activity is submitted or performed by a person other than the student under whose name the work is submitted or performe*d." All academic dishonesty will be reported to the Office of the Provost.

For international students, please beware that any suspension due to academic dishonesty may result in termination of F-1 or J-1 status.

Credit Hour Policy
Federal definition of a credit hour requires that for every course credit awarded, a course must offer 15 hours of instructor-led course activities and 30 hours of out-of-class student work. This means that a standard 3 credit hour course requires 45 hours of instructor-led course activities and 90 hours of out-of-class student work

University Privacy Statement:
UMass Lowell recognizes the importance of mutual trust between students and faculty. Massachusetts is a two-party consent state, which means it is illegal to record someone without their permission. Recordings of classroom lectures are the intellectual property of the instructor. Instructors have the right to prohibit audio and video recording of their lectures, unless the requesting student is registered with Disabilities Services and recording of class sessions is an approved accommodation. In addition, sharing or selling recordings of classroom activities, discussions or lectures with any other person or medium without permission of the instructor is prohibited.

Student Feedback (Course Evaluations):
Student feedback on teaching is a highly valued and helpful mechanism for monitoring and improving the quality of the Manning School of Business's programs and instructional effectiveness. To that end, course evaluations are administered during the last few weeks of classes. Students are encouraged to participate actively in this process.

Syllabus Change Policy:
This syllabus is a guide to provide an overview of the course. However, circumstances and events may make it necessary for me to modify the syllabus during the semester and may depend, in part, on the progress, needs, and experiences of the students. Changes to the syllabus will be made with advance notice.

EVALUATION POLICY:

Your final course grade will be based on the following:

Evaluation method	Percentage of final grade
5 x Discussion Participation (1% ea.)	5%
5 x R Lab (2% ea.)	15%
5 x Assignments (5% ea.)	20%
1 x Group Assignment	20%
Midterm exam	20%
Final exam	20%
Total	100%

Your final course letter grade will be determined as follows:

Numeric Grade:	Letter Grade:
97 - 100	A+
93 - below 97	A
90 - below 93	A-
87 - below 90	B+
83 - below 87	B
80 - below 83	B-
77 - below 80	C+
70 - below 77	C
0 - below 70	F
Failed due to Academic Misconduct (may not be replaced or deleted)	FX

Discussion Participation
The "Forum of the Chapter" is a required element of the course. There are many forums. Only 5 forums will be graded. Posting to each of the forums is worth 1% towards your final course grade, for a total of 5% towards your final course grade. You will earn the full 1% credit for each forum by posting at least 3 grammatically correct, complete, thoughtful sentences to the initial forum questions (posted by me). You can either comment on the initial questions, or you can reply to a fellow classmate's post. Your post will be graded within 7 days after the due date.

Labs
The purpose of R Labs is for you to learn R. You will be reading the step-by-step instructions from the textbook and running the R code along with it. Then you will copy and paste the R result into MSWord (or any other word processing software) and upload it into the corresponding R lab drop box on Blackboard. Your R Lab submission will be graded based on completeness.

Assignments
Assignments will be on Blackboard. You will access the link to the assignments from Blackboard. There may be both multiple-choice and fill-in-the-blank calculation questions. Your assignment submission will be graded within 7 days after the due date.

Group Assignment
Group assignment must be done in a team of 3-4 students. I will form all student groups based on skills and availability. The details of the assignment and its rubric will be posted on Blackboard. The assignment may involve R coding.

Midterm and Final Exams
The midterm and final exams are in the same format. They will be taken online on Blackboard. As soon as you submit your exams, your multiple-choice and fill-in-the-blank grades will be calculated. Any short-answer questions will be graded manually within 7 days after the due dates. You will not be able to see your grade or your results until after the availability period of each exam.

The number of questions on the exams will be announced the week of the exams. Approximately 3/4 of the exams will be multiple-choice or true/false, and 1/4 will be short-answer or fill-in-the-blank. The Final exam is non-cumulative.

You will have a limited amount of time to complete the exam, e.g., you need to submit the exam within a couple of hours after you start. The exams cannot be paused once they begin, and they will be submitted automatically when the allotted time ends. If your internet is disconnected during the exam, you will have to re-login as soon as possible to continue the exam where you left off. The exams can be taken any day during the exam weeks.

General exam policy

- You may consult your notes, your assignments, or any of the other course materials to complete the exams. However, if you must look up every answer, you will run out of time.
- During the exam allotted time, you may not communicate with anyone other than the course instructor. Everything you write must be in your own words.
- During the exam weeks, you must not communicate at all with your classmates about the exams.
- You may not copy and/or distribute the exams to anyone, even after the exam due dates.
- Any violation will be handled according to the Academic Integrity Policy.

Make Up Policy

Make-ups for discussion forums, labs, and assignments:
There is no late penalty of late discussion forum, lab, or assignment submission. However, no work will be accepted after the final exam date.

Make-ups for midterm and final exams:
There will be no make-up for the midterm and final exams unless prior arrangements have been made with the instructor.

In cases of emergency or medical situation:
In case of emergency or medical situation, requests for make-up work may be discussed with the instructor (via email) and will be handled on an individual basis, following the university's policies and guidelines.

CLASS SCHEDULE*:

*The class schedule is tentative and is subject to change at the instructor's discretion.

Week	Date	Topics
1 2 3	9/7 9/14 9/21	**Syllabus & Review of Statistics**
4	9/28	**Ch 1-2 Intro to Statistical Learning** - Bias-Variance Trade-Off
5	10/5	**Ch 3 Linear Regression** - Simple Linear Regression, Multiple Linear Regression
6	10/12	**Ch 4A Classification** - Logistics Regression
7	10/19	**Ch 4B Classification** - LDA, QDA
8	10/23-10/29	**Midterm Exam (Review of Statistics and Chapters 1-4A)**
9	11/2	**Ch 5 Resampling Methods** - Cross-Validation, Bootstrap
10	11/9	**Ch 6 Linear Model Selection and Regularization** - Subset Selection - Shrinkage Methods - Dimension Reduction Methods
11 12	11/16 11/30	**Ch 7 Moving Beyond Linearity** - Polynomial Regression - Regression Spline, Smoothing Spline
13	12/7 12/14	**Supplemental materials** **Review**
14	TBD	**Final Exam (Chapters 4B-7)**

Assignment	Due Date	Corresponding Contents
Mandatory survey (non-graded) Assignment (non-graded)	9/28	Review of Stats.
R Lab (non-graded) Assignment (non-graded) Discussion participation (non-graded)	10/5	Stat & Chapters 1 & 2
R Lab 1 Assignment 1 Discussion participation 1	10/12	Chapter 3
R Lab 2 Assignment 2 Discussion participation 2	10/19	Chapter 4A
R Lab 3 Assignment 3 Discussion participation 3	11/9	Chapters 4B & 5
R Lab 4 Assignment 4 Discussion participation 4	11/16	Chapter 6
R Lab 5 Assignment 5 Discussion participation 5	12/15	Chapter 7
Group assignment	12/15	