DeGroote
SCHOOL OF BUSINESS
EDUCATION WITH PURPOSE

McMaster
University

Integrated Business and Humanities 2AD3
Statistical Data Analysis
Winter 2022 Course Outline

Operations Management Area
DeGroote School of Business
McMaster University

COURSE OBJECTIVE

This course will help students learn about principles of business statistics and their relationships to data analysis. The course covers many areas of business statistics and statistical data analysis including working with qualitative and quantitative data, probability concepts and probability distributions, sampling and sampling distributions, hypothesis testing, regression, etc.

In addition to learning about these concepts, the course aims to teach students the application of the methods using the R programming language specifically R-commander. R is one of the most important and commonly used programming languages in data analysis and data science. This course helps students learn how to apply statistical and data analysis in R using R commander!

SCHEDULE AND CONTACT INFORMATION

C01: Wednesdays 08:30AM – 11:20AM   Class Location: ABB 165

Instructor:
Amin Shahmardan
shahmara@mcmaster.ca
Office Hours:
Additional office hours can be scheduled by appointment

Teaching Assistant:
Sina Khosravinia
khosrs3@mcmaster.ca
Office hours will be announced on Avenue!

COURSE ELEMENTS

Credit Value:	3	Leadership:	No	IT skills:	Yes	Global view:	Yes
A2L:	Yes	Ethics:	Yes	Numeracy:	Yes	Written skills:	Yes
Participation:	Yes	Innovation:	No	Group work:	Yes	Oral skills:	Yes
Evidence-based:	Yes	Experiential:	Yes	Final Exam:	No	Guest speaker(s):	Yes

COURSE DESCRIPTION

Data is everywhere! Businesses are more interested than ever in acquiring, classifying, and analyzing data generated by their current or potential customer to derive insights that will help them make better decisions. Statistics is the cornerstones of data analysis. This course covers many different aspects of business statistics that are commonly used in everyday data analysis. The focus will be on concepts from descriptive, diagnostic, inference, as well as predictive analytics to address problems from different disciplines of business and humanities. Students learn about many different concepts in business statistics including data and data types, visualizing and summarizing quantitative and qualitative data, defining and measuring the centre and dispersion of data, fundamental probability concepts and probability distributions, random variables and their characteristics, sampling from a population and sampling distributions, analysis of confidence intervals for population parameters, fundamental hypothesis testing methods, regressions and making inference based on regression results, etc. Numerous examples will illustrate the practical applications of statistical analysis in business. Emphasis will be placed on connecting theory to real-world problems from different business disciplines.

The course also covers the application of the statistical methods used in the R programming language and more specifically R Commander. R is one of the most commonly used data analysis and data science software in the industry as well as academia.

LEARNING OUTCOMES

This course deals with basic statistical methods, in converting data into information, and further yet - into knowledge. Primary focus is on business related data, but data coming from other sources (e.g., economic, social, etc.) will also be explored, analyzed, and discussed. Upon completion of the course, students will be able to:

- ➢ Use R commander to perform elements of data analysis
- ➢ understand, describe, summarize, visualize, and interpret statistical (both qualitative and quantitative) data

- ➢ understand randomness and basic probability concepts (random variables, probability density functions, etc.)
- ➢ estimate, test and draw inferences about important characteristics of data
- ➢ identify, test, and draw inferences on comparison of parameters between two populations
- ➢ identify the hypothesis that needs to be tested and conduct hypothesis testing
- ➢ understand output of different statistical analyses (outputs are usually similar regardless of the software used to perform the analysis).
- ➢ understand correlation and measure the strength of linear correlation between variables.
- ➢ understand and use simple and multiple regression methods to perform predictive analytics based on data provided.

COURSE MATERIALS AND READINGS

➢ Slides (and other required material) will be available on Avenue to Learn (http://avenue.mcmaster.ca)

➢ Business Statistics: Communicating with Numbers (Fourth Edition) by Jaggia and Kelly. ISBN: 978-1260716306, click here.

➢ "Business Analytics for Managers," by W. Jank, Springer, New York, 2011. – Main text (**Optional**), accessible through McMaster library.

➢ "Using the R Commander: A Point-and- Click Interface for R", by John Fox, Chapman and Hall, 2016. – Manual for using Rcmdr (**Optional**)

You can buy the book/connect account from the bookstore. Please check the following shortened link: https://bit.ly/3HI2bl9

Note: The textbook is **highly recommended but is not required**!
Note: the "Connect" online companion is **NOT** mandatory for this course and is **absolutely optional**!

EVALUATION

Missed tests/exams will receive a grade of zero unless the student has submitted and been approved for a Notification of Absence or MSAF. Your final grade will be calculated as follows:

Component	weight
Quizzes	10%
Assignments submitted through A2L	20%
R Assignment	10%
Midterm Exam	30%
Integrative Team Project	30%
Total	**100%**

NOTE: Only the use of a **McMaster standard calculator** is allowed during examinations in this course. See McMaster calculator policy.

NOTE: Weight of components may be changed based on students' performance in each component.

Grade Conversion

At the end of the course your overall percentage grade will be converted to your letter grade in accordance with the following conversion scheme.

Letter Grade	Percent	Letter Grade	Percent
A^+	90-100	C^+	67-69
A	85-89	C	63-66
A-	80-84	C-	60-62
B^+	77-79	D^+	57-59
B	73-76	D	53-56
B-	70-72	D-	50-52
		F	00-49

Course Deliverables

Quiz (10%)
There will be some quizzes during the term and the dates will be announced before each quiz.

Assignments submitted through A2L (20s%)
The assignments are designed to help students keep up with the course material and prepare for quizzes and the midterm exams. All assignments are available in Avenue to Learn and will be automatically graded.

Group R Commander Assignment (10%)
The project involves the application of the R programming language and R commander to conduct analysis using statistics and data analysis methodologies as taught in the course. The same team of individuals for the "Integrative Team Project" will work on the assignment. There is no presentation in the class and no slide is required, but each group should **submit a report**. The report will be marked by the instructor\TA. The mark for the group project is assigned to all members of the group. The information on how to access the assignment will be announced in class and on Avenue.

Midterm Exam (30%)
The midterm exam is mandatory.

Exam	Data	Time	Room
Midterm	March 11	2:30 PM-5:30 PM	T13 127

Software

The R (R programming language) is a leading free tool used for data science and statistical data analysis. Instead of writing code, we will use a library "*R Commander*" which facilitate all processes. It helps to do analysis without explicitly writing codes. Students in this course learn how to conduct basic data analysis in the R through R Commander. We will also use Excel for some basic calculations and learn how Excel can be used for data analysis.

Guest Speakers

A Guest speaker will be invited to speak to the class and share their experience regarding statistics, statistical data   analysis, and how R helps them to analyze data.

Communication and Feedback

Students who wish to correspond with instructors or the TA directly via email must send messages that originate from their official McMaster University email account. This protects the confidentiality and sensitivity of information as well as confirms the identity of the student. Emails regarding course issues should NOT be sent to the Area Administrative Assistants.

Instructors may solicit feedback via an informal course review with students to allow time for modifications in curriculum delivery.

INTEGRATIVE TEAM PROJECT

The integrated team project is a hands-on exercise with the goal of enhancing students' understanding of real business issues and challenges. As the integrative project for all of your IBH courses this semester (i.e., IBH 2AB3, IBH 2AC3, IBH 2AD3, IBH 2BA3), the project will give you an opportunity to consider how the concepts and techniques discussed in the program apply to real business challenges and opportunities.

A team of individuals (4-6) will take on the role of a consulting engagement team for a publicly-traded Canadian company. Please remember that a **team** is a small number of people with **complementary skills** who are committed to a common purpose and high performance for which they hold themselves **accountable**. (Please **view** the teamwork exhibited by <u>Geese in flight</u>!).

Teams must be formed by January 31st, 2022, and communicated to the panel of instructors. The group will select a Group Coordinator who will liaise with the Professor(s). After the teams are formed, each team will be assigned a primary faculty adviser, who will be the first point of contact for the team on the project.

Deliverables for this project will include a written report and a class presentation, which should be prepared as though you are a consulting engagement team presenting recommendations to the organization's board of directors. In other words, you get to pretend (dry-run) to be a *Management Consultant.* **The project is worth 30% of the final grade in each of your 4 IBH courses this semester.**

General Instructions

The team is required to select a company; investigate publicly available information about that company to develop an understanding of its challenges and opportunities; and develop a series of recommendations that would enable the company to effectively respond to one or more of these challenges and opportunities. The recommendations you make must be based on research and analysis and must consider and address multiple dimensions of the business, including accounting, information system principles, statistical data analysis, human resources processes, ethical and environmental considerations, and other such business-related issues.

Teams must submit a 1-page project update (guidelines to be provided) by 4 pm, March 4th, 2022 to the panel of instructors. This update will not be marked and is more of a nudge to ensure that the project teams are well underway in their project work. Many of you will encounter this as time-sheets in your work environment upon graduation.

Specific Instructions

Organizations can use a variety of strategic initiatives, programs, etc. to respond to challenges and opportunities in their environment. These initiatives and programs can relate to accounting, information system principles, ethics, environmental considerations, and human resources processes. Examples include customer loyalty programs, retail gift cards, corporate restructuring obligations, job redesign, air miles programs, product liability lawsuits, environmental liabilities, and employee benefit programs.

Choose the most relevant items for your company from amongst the examples above, or from other concepts covered in the program. Research your choices using, as appropriate, international and Canadian sources, and prepare recommendations in these areas for your organization.

Note - You are not to contact the organization or interview people for this project. You must use publicly available sources available through the library, internet, etc.

Project Presentation

Each group must be ready to give a presentation of their report in class. The presenting group will have **20 minutes** maximum (and a minimum of 15 minutes) to present the highlights of its project. Please note that this is a group presentation, so one person cannot present but rather it has to be a group effort. Following the presentation, the rest of the class is expected to fully participate in the discussion of the highlights presented for a maximum of about **5 minutes**. <u>All students are expected to attend all presentations.</u> **Please provide a digital copy of your slides to the instructor panel prior to the presentation. The presentation will be worth 10% of your final grade in the course.**

Written Report

Effective communication – both oral and written – is an essential component of success in the business world. All assignments will be evaluated both in terms of their substantive content and their communication effectiveness.

The format of your written project report should be as follows:

* Table of Contents

* Executive Summary
This is a free-standing summary of the total report. It should be written **last** and should **not** exceed **one** page.

* Introduction
This may include brief history of the industry and company chosen and why they were chosen for study etc.

* Conception of Business Issue (s)
* Deeper dive into component issues in HR, IS, OR and MA.
  - e.g., Talent management, Budgeting games, Financial Impact and Presentation

* Conclusion
    This section will state the important findings etc.

* References
    Ensure all references are cited in the body of the report and vice-versa.

* Appendices

Overall, the body of the report excluding the table of contents, executive summary and appendices should **not exceed 10 double-spaced printed pages with font size not below 12 pitch**.

The written project report is due no later than 4:00 p.m. on Tuesday, April 12ᵗʰ, 2022.

<u>Evaluation</u>

The written project report will be worth 20% of your final course grade. That mark will be assigned to each of the group members unless the instructor determines, based on feedback from team members, that there has not been equal participation and that the mark should not be assigned on an equal basis. For this purpose, you will be given an opportunity to make your confidential peer evaluation in writing. **Non-completion** of this peer evaluation forms will be understood as implying equal effort participation by individual group members.

Please note that you will be assigned a primary faculty adviser upon the submission of the information of the formation of the project group and title. He should be first point of contact if you have any questions on the project. Further, in the event of any possible group conflict etc., please signal this to your primary faculty adviser at the earliest.

Please feel free to ask your instructors or TAs for further guidance if any of the requirements are not clear. Because the project involves multiple domains of business – that correspond to the various 2nd year IBH courses you are taking – please be mindful to direct your questions to the instructor and/or TA that are most closely aligned with the subject matter of your question(s).

Course Instructors

IBH 2AB3 – Thomas Francescutti (francest@mcmaster.ca)
IBH 2AC3 – Aaron Schat (schata@mcmaster.ca)
IBH 2AD3 – Amin Shahmardan (shahmara@mcmaster.ca)
IBH 2BA3 – Khalid Nainar (nainar@mcmaster.ca)

ACADEMIC INTEGRITY

You are expected to exhibit honesty and use ethical behavior in all aspects of the learning process. Academic credentials you earn are rooted in principles of honesty and academic integrity.

Academic dishonesty is to knowingly act or fail to act in a way that results or could result in unearned academic credit or advantage. This behavior can result in serious consequences, e.g., the grade of zero on an assignment, loss of credit with a notation on the transcript (notation reads: "Grade of F assigned for academic dishonesty"), and/or suspension or expulsion from the university.

It is your responsibility to understand what constitutes academic dishonesty. For information on the various types of academic dishonesty please refer to the *Academic Integrity Policy*, located at:

www.mcmaster.ca/academicintegrity

The following illustrates only three forms of academic dishonesty:

1. Plagiarism, e.g., the submission of work that is not one's own or for which other credit has been obtained.
2. Improper collaboration in group work.
3. Copying or using unauthorized aids in tests and examinations

ONLINE COURSE COMPONENTS

Students should be aware that when they access the electronic components of this course, private information including first and last names, usernames for the McMaster e-mail accounts, and program affiliation may become apparent to all other students in the same course. The available information is dependent on the technology used. Continuation in this course will be deemed consent to this disclosure. If you have any questions or concerns about such disclosure, please discuss this with the course instructor.

REQUESTING RELIEF FOR MISSED ACADEMIC WORK

Students may request relief from a regularly scheduled midterm, test, assignment or other course components. Please refer to the policy and procedure on the DeGroote website at the link below.

http://ug.degroote.mcmaster.ca/forms-and-resources/missed-course-work-policy/

STUDENT ACCESSIBILITY SERVICES

Students who require academic accommodation must contact Student Accessibility Services (SAS) to make arrangements with a Program Coordinator. Academic accommodations must be arranged for each term of study. Student Accessibility Services can be contacted by phone 905-525-9140 ext. 28652 or e-mail sas@mcmaster.ca.

For further information, consult McMaster University's Policy for Academic Accommodation of Students with Disabilities:

http://www.mcmaster.ca/policy/Students-AcademicStudies/AcademicAccommodation-StudentsWithDisabilities.pdf

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ACADEMIC ACCOMMODATION FOR RELIGIOUS, INDIGENOUS OR SPIRITUAL OBSERVANCES (RISO)

Students requiring academic accommodation based on religious, indigenous or spiritual observances should follow the procedures set out in the RISO policy. Students requiring a RISO accommodation should submit their request, including the dates/times needing to be accommodated and the courses which will be impacted, to their Faculty Office normally within 10 days of the beginning of term or to the Registrar's Office prior to their examinations. Students should also contact their instructors as soon as possible to make alternative arrangements for classes, assignments, and tests.

POTENTIAL MODIFICATION TO THE COURSE

The instructor reserves the right to modify elements of the course during the term. There may be changes to the dates and deadlines for any or all courses in extreme circumstances. If either type of modification becomes necessary, reasonable notice and communication with the students will be given with explanation and the opportunity to comment on changes. It is the responsibility of the student to check their McMaster email and course websites frequently during the term and to note any changes.

The University reserves the right to change the dates and deadlines for any or all courses in extreme Circumstances (e.g., severe weather, labour disruptions, etc.). Changes will be communicated through regular McMaster communication channels, such as McMaster Daily News, A2L and/or McMaster email.

ACKNOWLEDGEMENT OF COURSE POLICIES

Your enrolment in IBH 2AD3 will be considered to be an implicit acknowledgement of the course policies outlined above, or of any other that may be announced during lecture and/or on A2L. **It is your responsibility to read this course outline, to familiarize yourself with the course policies and to act accordingly.**

Lack of awareness of the course policies **cannot be invoked** at any point during this course for failure to meet them. It is your responsibility to ask for clarification on any policies that you do not understand.

COURSE SCHEDULE

Integrated Business and Humanities 2AD3
Statistical Data Analysis
Winter 2022 Course Schedule

Note: Depending on the pace of the lectures the schedule below may change slightly.

Note: If, for any reason, any section or part from the material stated in the table below is to be removed from the covered material, it will be announced on the course webpage on Avenue.

Note: Additional material may be provided and used by the instructor in the form of handouts.

Week (excl. reading week)	Reading Material

#1	• **Chapter 1: Data and Data Preparation**
	    Sections 1.1, and 1.2
	• **Chapter 2: Tabular and Graphical Method**
	    Sections 2.1, 2.2, 2.3, 2.4, and 2.5

#2	• **Chapter 3: Numerical Descriptive Measures**
	    Sections 3.1, 3.2, 3.4, 3.6 (just the empirical rule), and 3.7
	• **Chapter 4: Introduction to Probability**
	    Sections 4.1, 4.2, 4.3, 4.4 and 4.5

#3	• **Chapter 5: Discrete Probability Distributions**
	    Sections 5.1, 5.2, 5.4, (5.5 may be covered)
	• **Chapter 6: Continuous Probability Distribution**
	    Sections 6.1, and 6.2 (6.3 just exponential may be covered)

#4	• **Chapter 7: Sampling and Sampling Distributions** Sections 7.1, 7.2, and 7.3
#5	• **Chapter 8: Interval Estimation** Sections 8.1, 8.2, 8.3, and 8.4
#6	• **Chapter 9: Hypothesis Testing** Sections 9.1, 9.2, 9.3, and 9.4
#7	• **Chapter 10: Statistical Inference Concerning Two Populations** Sections 10.1, 10.2, and 10.3

#8	• **Chapter 14: Regression Analysis**
	    Sections 14.1, 14.2, and 14.3
	• **Chapter 17: Regression Models with Dummy Variables**
	    Sections 17.1, and 17.2

#9	• **Chapter 15: Inference with Regression Models** Sections 15.1, 15.2, and 15.4
#10	• **Chapter 16: Regression Models for Nonlinear Relationships** Sections 16.1, and 16.2 (if time permits) • Guest Speaker
#11	• **Group project presentations**
#12	• **Group project presentations**