

**Integrated Business and Humanities 2AD3
Statistical Data Analysis
Winter 2023 Course Outline**

**Operations Management Area
DeGroote School of Business
McMaster University**

COURSE OBJECTIVE

This course provides an in-depth knowledge of fundamental statistical techniques, and their applications in business statistics. The course covers many areas of business statistics and statistical data analysis including but not limited to working with qualitative and quantitative data, probability concepts and probability distributions, sampling and sampling distributions, hypothesis testing, regression, etc.

Extensive examples and real data will be used throughout the course to illustrate the concepts in an applied fashion. For this purpose, the use of computer software becomes an essential component of the course where MS Excel and JASP are employed to assist in applying such techniques for solving a variety of practical problems. This course provides a hands-on experience to students by applying the theoretical concepts of statistical data analysis in MS Excel and JASP.

SCHEDULE AND CONTACT INFORMATION

Instructor: Dr. Ramy Abdallah

Email: ramy.fakhry@mcmaster.ca

Office: DSB A210

Lecture: Wednesdays: 11:30 AM – 2:20 PM

Room: ABB 164

Tutorial: Thursdays: 9:30 AM – 10:20 PM

Room: CNH 106

Office Hours: By appointment via email

Teaching Assistant: Ghazal Khalili

Email: khalilig@mcmaster.ca

Note: Students who wish to correspond with the instructor or 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.

Instructor may solicit feedback via an informal course review with students by Week #4 to allow time for modifications in curriculum delivery.

Course Sites

Avenue to Learn: <http://avenue.mcmaster.ca>

Log-in using your MAC ID, and then choose IBH 2AD3 (Statistical data analysis)

Connect McGraw-Hill: <https://connect.mheducation.com/>

Top Hat: <https://app.tophat.com/e/880491>

COURSE ELEMENTS

Credit Value:	3	Leadership:	Yes	IT skills:	Yes	Global view:	Yes
Avenue:	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:	Yes	Guest speaker(s):	Yes

COURSE DESCRIPTION

Statistics has become an essential tool for modern management practice, and this course will emphasize the application of statistical techniques and modeling for business decision-making. The focus will be on analysis and interpretation of statistical methods through applying the concepts of statistical inference to the real decision-making problems. The statistical techniques in this part of the course not only can be applied to a variety of business problems, but most importantly, they will provide students with the critical skills required to assess the validity, significance, and interpretation of many of the reports that they deal with in their education and career. 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 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, analysis of the variance and its applications, 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 MS Excel and JASP software.

LEARNING OUTCOMES

This course is focused on converting data into information, with basic statistical methods and further yet - into managerial insights. 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:

- To understand sampling distributions, with emphasis on comparing population mean and variance.
- To understand the nature of statistical relationships between variables.
- To introduce fundamental ideas of experimental design, and the analysis of variance (ANOVA).
- To explore regression analysis, including simple linear regression, and multiple linear regression.
- To be able to identify common regression pitfalls.

- To learn techniques for selecting appropriate regression models for prediction.
- To be able to critically read and understand regression and factorial models in business and financial research papers.
- To become more familiar with conducting statistical tests and models using MS Excel and JASP a free statistical computing/programming software.

REQUIRED COURSE MATERIALS AND READINGS

- **Avenue registration for course related materials such as lecture slides and videos:**

- **Textbook:**

Business Statistics: Communicating with Numbers; 4th Edition by Sanjiv Jaggia and Alison Kelly (e-text)

- **Extra material:**

An Introduction to Statistical Learning with Applications in R by Gareth James, Daniela Witten, Trevor Hastie and Robert Tibshirani

- **Other helpful material will be posted on Avenue to Learn**

- **Top Hat Platform**

We will be using the Top Hat (www.tophat.com) classroom response system in class for enhanced learning experience. You will be able to submit answers to in-class questions using Apple or Android smartphones and tablets, laptops, or through text message.

You can visit the Top Hat Overview (<https://success.tophat.com/s/article/Student-Top-Hat-Overview-and-Getting-Started-Guide>) within the Top Hat Success Center which outlines how you will register for a Top Hat account, as well as providing a brief overview to get you up and running on the system.

An email invitation will be sent to you by email, but if don't receive this email, you can register by simply visiting our course website: <https://app.tophat.com/e/880491>

Note: our Course Join Code is: 880491

Should you require assistance with Top Hat at any time, due to the fact that they require specific user information to troubleshoot these issues, please contact their support team directly by way of email (support@tophat.com), the in-app support button, or by calling 1-888-663-5491.

- **Connect & Avenue to Learn**

In this course, we will be using McGraw Hill Connect online portal (<https://connect.mheducation.com/>) and McMaster's Avenue to Learn (<http://avenue.mcmaster.ca>). Students should be aware that, when they access the electronic components of this course, private information such as first and last names, user names 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.

IN-CLASS QUIZZES

Quizzes are an extension of the classroom lectures and discussion. Quizzes will be given in class, normally at the beginning to solidify the students' understanding of material covered in the previous class. The resultant effect is that the student is on a firmer ground for the new material to

be covered in class. The quizzes will be quickly debriefed before new material is introduced in class. The quizzes will be timed to about 10-15 minutes, on average.

HOMEWORK ASSIGNMENTS

- **The Homework Assignments are carefully designed to help students keep up with the course material and prepare them for the midterm exam.** There will be **7 assignments**; due dates are posted below under the “Important Course Dates” section. You will need to log in to Avenue to Learn to see the assignments on the course webpage. The assignments will be submitted online and automatically graded. You will receive their results immediately after submitting your assignments. **The lowest mark out of the 7 assignments will be dropped.**
- Homework Assignments will **strictly be due on the scheduled Monday date at 11:59 pm.** Please note that each homework assignment will be timed to take on average of about 1-2 hours! Do allow for sufficient time to start and finish the homework assignment. **Assignments will be open after Wednesday’s Lecture one week prior to due date.**
- If an MSAF is applied towards a specific Homework Assignment, then that assignment will automatically be counted as the dropped mark and the remaining 7 assignments will be utilized to calculate the mark for this component. Solutions to the assignments will be released in the week after the due date.
- The homework assignments are hosted by the McGraw Hill *Connect* platform. *Connect* is accessible through Avenue, but you will require a registration code (available through the bookstore). Homework Assignment problems also offer helpful links that direct students to the appropriate e-text material to help guide the students.

EVALUATION

The evaluation components for this course is as follows.

Component	weight
In-Class Top Hat platform questions	10%
In-Class Quizzes (11 Quizzes; best 10 will be taken; each is worth 1%)	10%
7 Assignments-submitted through Connect	25%
Midterm Exam	25%
Group Project	20%
Group Project Presentation	10%
Total	100%

MIDTERM EXAM

The Midterm will have algorithmic/arithmetic and/or True/False and/or Multiple-Choice questions. If a student files a successful MSAF for missing the midterm, the student will have to write a different midterm exam when the time allows.

- **Midterm Exam Schedule**

Midterm	Date: TBD	Time: TBD
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TEAM CONSULTING GROUP PROJECT

The Team consulting 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 Canadian Geese in flight!).

Teams must be formed by January 29th, 2023 and communicated to the panel of instructors (ramy.fakhry@mcmaster.ca; nainar@mcmaster.ca; nassia2@mcmaster.ca; francest@mcmaster.ca);. Each team 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 process, ethical and environmental considerations and other such business-related issues.

Teams must submit a 1-page project update (on page 13) by 4 pm, March 3rd, 2023 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 use statistical data analysis to gain understanding of a large population. The two main types are descriptive and inferential. However, there are other types that many businesses also use, depending on the overall goal or question the organization is looking to answer.

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, in which descriptive and inferential statistical analysis can be utilized to take a decision pertaining to those initiatives/programs. Examples include customer loyalty programs, retail gift cards, corporate restructuring obligations, 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 of best practices 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**. All students are expected to attend all presentations. **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 Presentations

* 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 Wednesday, April 12th, 2023.

Evaluation

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 (on page 14) 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).

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

CODE OF CONDUCT

You and hundreds of others are attending classes and tutorials. Please be courteous to each other, the instructor and the teaching assistants. Turn off your cell phones before class starts. Please **do not** listen to music, play computer games, check emails or Facebook, text message, read the newspaper, or hold loud conversations that may be disruptive to the rest of the class. Laptop computers should be used only for taking notes during class. If you have questions or comments, please raise your hand or come to see me later.

COMMUNICATION AND FEEDBACK

Students who wish to correspond with instructors or TAs 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 are required to provide evaluation feedback for at least 10% of the final grade to students prior to Week #9 in the term. Instructors may solicit feedback via an informal course review with students by Week #4 to allow time for modifications in curriculum delivery.

ACADEMIC DISHONESTY

You are expected to exhibit honesty and use ethical behaviour 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 behaviour 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

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 DeGroot website at the link below.

<http://ug.degroot.mcmaster.ca/forms-and-resources/misled-course-work-policy/>

POLICY FOR APPROVED MISSED ACADEMIC WORK

Students who cannot write a test, and have advanced knowledge and permission as described above, will be given the opportunity to write an alternate version of the test at an alternate time. Students who did not write a test, and subsequently provide an MSAF submission, or documentation for which they have been approved by the Student Experience – Academic Office, will have the weight of the missed work reallocated across other course components or an alternate evaluation. The student must follow up with the instructor to understand this process and decision.

Students who submit an MSAF or have been approved by the Student Experience – Academic Office, for an assignment deadline, will be given an extension for the assignment at the discretion of the instructor. Please note, the student will ultimately be required to submit the assignment

STUDENT ACCESSIBILITY SERVICES

Student Accessibility Services (SAS) offers various support services for students with disabilities. Students are required to inform SAS of accommodation needs for course work at the outset of term. 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>

POTENTIAL MODIFICATIONS 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 weekly during the term and to note any changes.

ACKNOWLEDGMENT OF COURSE POLICIES

Your enrolment in IBH 2AD3 will be considered 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

Week	Reading Material (sections)	Important Dates
#1	<ul style="list-style-type: none"> • Chapter 1: Data and Data Preparation ✓ Required reading: 1.1 to 1.3 (inclusive). • Chapter 2: Tabular and Graphical Methods ✓ Required reading: 2.1 to 2.4 (inclusive). • Chapter 3: Numerical Descriptive Measures ✓ Required reading: 3.1, 3.2, 3.4, 3.6 and 3.7. 	
#2	<ul style="list-style-type: none"> • Chapter 4: Introduction to Probability ✓ Required reading: 4.1 to 4.4 (inclusive). • Chapter 5: Discrete Probability Distributions ✓ Required reading: 5.1, 5.2, and 5.4. 	<ul style="list-style-type: none"> • Assignment 1 opens on January 18th, and due on January 23rd at 11:59 pm
#3	<ul style="list-style-type: none"> • Chapter 6: Continuous Probability Distributions ✓ Required reading: 6.1 and 6.2. 	<ul style="list-style-type: none"> • Assignment 2 opens on January 25th, and due on January 30th at 11:59 pm
#4	<ul style="list-style-type: none"> • Chapter 7: Sampling and Sampling Distributions ✓ Required reading: 7.1 to 7.3 (inclusive). 	<ul style="list-style-type: none"> • Assignment 3 opens on February 1st, and due on February 6th at 11:59 pm
#5	<ul style="list-style-type: none"> • Chapter 8: Interval Estimation ✓ Required reading: 8.1 to 8.4 (inclusive). 	<ul style="list-style-type: none"> • Assignment 4 opens on February 8th, and due on February 13th at 11:59 pm.
#6	<ul style="list-style-type: none"> • Chapter 9: Hypothesis Testing ✓ Required reading: 9.1 to 9.4 (inclusive). 	<ul style="list-style-type: none"> • Midterm Exam on February 17th from 7 pm to 10 pm
#7	<ul style="list-style-type: none"> • Chapter 10: Statistical Inference Concerning Two Populations ✓ Required reading: 10.1 to 10.3 (inclusive). 	

		<ul style="list-style-type: none"> • Group Project Update on March 3rd
#8	<ul style="list-style-type: none"> • Chapter 14: Regression Analysis <ul style="list-style-type: none"> ✓ Required reading: 14.1 to 14.3 (inclusive). 	<ul style="list-style-type: none"> • Assignment 5 opens on March 8th, and due on March 13th at 11:59 PM
#9	<ul style="list-style-type: none"> • Chapter 15: Inference with Regression Models <ul style="list-style-type: none"> ✓ Required reading: 15.1 to 15.2 (inclusive). 	<ul style="list-style-type: none"> • Assignment 6 opens on March 15th, and due on March 20th at 11:59 pm
#10	<ul style="list-style-type: none"> • Chapter 13: Analysis of Variance (ANOVA) <ul style="list-style-type: none"> ✓ Required reading: 13.1 	<ul style="list-style-type: none"> • Assignment 7 opens on March 22nd, and due on March 27th at 11:59 pm
#11	<ul style="list-style-type: none"> • Overall Review and Practical Considerations 	
#12	<ul style="list-style-type: none"> • Group Project Presentations 	<ul style="list-style-type: none"> • Written group project report on April 12th at 4 pm
#13	<ul style="list-style-type: none"> • Group Project Presentations 	

Team Project Update - One Pager (1-page MAX)

Format: 1-page, 12-point font, 1-inch margins, 1 line space, Word format.

Submit your group's detailed proposal for review by the course Instructors to ensure the project is not out of scope. The proposal should include some of the following components, but please do not use this as a checklist/table of contents...get creative:

1. Suitable Title - Should reflect the business
2. Business Goal:
 - Brief description of the company
 - Context where the data comes from if you are using data (sources)
 - Who is the stakeholder/client/Public Company
 - Recent trends/COVID impacts/Industry news
3. Brief description how you will incorporate content learned from all 4 courses into your project. Please clearly outline each course by including the course code while you describe what will be reviewed:
 - Class - IBH 2AB3
 - Class – IBH 2AC3
 - Class – IBH 2AD3
 - Class - IBH 2BA3
5. Implementation/Recommendations:
 - High-level/early thoughts/learnings on what you will be recommending/advising for your client
6. Backup
 - Submit any bibliography/list of websites, data resources, etc.

Submission will be due via email to all 4 professors (nainar@mcmaster.ca; nassia2@mcmaster.ca; francest@mcmaster.ca; ramy.fakhry@mcmaster.ca) at the end of the week after reading week (i.e, Friday, March 3rd, by 4 PM).

Please note, student groups do not get a grade for this one pager. Professors will only reach out if there are issues or concerns with the scope outlined in the above details.

PEER EVALUATION OF GROUP WORK

Write the names of all of the members of your group below, starting with your own.

Then allocate a total of 100 points across all of the names that appear, in proportion to the contribution of each group member to the group effort. You may use the following points as guideline to help you form your evaluation:

Consider whether the group member has:

1. demonstrated responsibility by attending and participating in all team meetings and keeping contact with members throughout the project;
2. demonstrated effective interpersonal skills by showing sensitivity to others' needs and feelings and helping others to become involved;
3. demonstrated effective leadership by assuming the initiative, setting goals and guidelines, leading discussions, working out problems, handling conflicts positively, and generally facilitating the task;
4. contributed significantly, in special ways, to completing the project by, for example, making a table, drawing a chart, or referencing outside material;
5. produced well-prepared individual assignments to all team members and completed an equitable share of work.

Group Member's Name	Points
_____	_____
_____	_____
_____	_____
_____	_____
_____	100 Points
	=====