COLLEGE OF APPLIED & COLLABORATIVE STUDIES
Department of Multidisciplinary Innovation

ADAR 3020: Inferential Analysis Syllabus

Professor: Dr. Debasish Mukherjee PhD MBA

Fall, 2024

E-mail: Debasish.mukherjee@unt.edu
Office Hours: 2:00 PM to 3:00 PM
Office: FRLD 366

Class Hours: Mon - Wed 4:00 – 5:20 PM
Class Room: FRLD 234

Course Description

Inferential analysis is primarily used in diagnostic analytics to extrapolate information from a smaller sample to make predictions and draw conclusions about a larger population. Inferential statistics uses several analytical tools such as group comparison or probabilistic measures to make generalizations about population data based on a sample and inform decision-making processes. Explores potential external factors that might be impacting the patterns that inform the decision-making processes.

Most companies today collect an overwhelming amount of data. However, gaining insight from analytics continues to elude many organizations. To help meet the market demand for analytics professionals, this

course provides students with an analytical toolset that enables them to address data-driven business problems. The course makes use of the leading inferential and most available analysis tools within Microsoft Excel.

Prerequisites

Prerequisite(s): DSCI 2710, ADAR 2020, MATH 1680 or equivalent.

Course Learning Outcomes

At the end of the course, you should:

1. Recognize what is an inferential analysis and their practical applications
2. Understand estimation and hypothesis testing as two basic methodologies of statistical inference.
3. Choose the appropriate tools to estimate an unknown population parameter.
4. Apply the basic steps of hypothesis testing and challenge the status quo of phenomena.
5. Estimate and interpret linear regression models
6. Estimate and interpret non-linear regression models

Required Courseware & Suggested Textbook

There is no required textbook for this course. I curate material from different sources and provide to you through slides and datasets. However, here are some suggestions for textbooks you can consult if you want to:

- **Business Analytics: Communicating with Data** (with McGraw-Hill Connect) by S. Jaggia, A. Kelly, K. Lertwachara, and L. Chen. Published by McGraw-Hill.
- **Introductory Business Statistics 2e.** by A. Holmes, B. Illowsky & S. Dean. Published by Openstax. - Free textbook, consult it here:

As for software we are going to use primarily Microsoft Excel.

Microsoft Excel, installed in computer labs and available to download (Office 365) at https://aits.unt.edu/support/office365apps.

- **Canvas** (https://unt.instructure.com/login/ldap): The lecture notes, case files, case quizzes, all of the exams and other material will be posted on Canvas so please make sure you keep up and check Canvas often.

Course General Guidelines

Brief notes about this course:

- Please be aware that this course can include challenging material; however, the content will walk you through the statistical concepts seamlessly.
- You just need to be willing to put time to attend class consistently, work outside of class, use or develop good study strategies, and contact me when you are struggling. If you do these, you will surely develop a thorough understanding of the course material and ultimately succeed in the course.
- It is important to understand the different types of information we use to make inferences. Frequencies and probabilities are commonly used to make inferences and develop inferential analysis. Always keep in mind that inferential analysis rely on the importance of a representative sample as this is key to make accurate analysis.

Guidelines

- I encourage you to **study** all the posted material in the course. You are strongly encouraged to try and solve the problems included in the lecture slides individually or in group. Replicate all the steps to solve the problems, not simply verify that the provided solutions “make sense”.
- You should **work** independently or in groups on the homework assignments and case studies. The case studies are intended to assist you in better structuring the learning time you spend on mastering the course material. Exam questions will mostly refer to case analysis and assignments. The best way to prepare for exams is to go over the exercises seen in class.
- Therefore, **doing the assignments is essential for success in this course**. In fact, the assignments constitute a large portion of your grade in this course. You are encouraged to keep up with the homework and meet the submission deadlines.

Assessment

To demonstrate your ability on inferential analysis you need to work problem solving using statistical inference tools. You will be evaluated on a number of homework assignments or problem sets. There are several case studies where you can understand the application of inferential analysis. Exams are part of the assessment, one midterm exam and a final comprehensive exam.

Rather than being purely numerical, assignments, case studies and exams will require interpretation of results and thorough analysis of the problems presented showing a conclusion or recommendation whenever is required. Finally, you need to work on a team set-up to develop your collaborating skills. This is an important part of your formation since almost every job or role in industry will require interaction with peers, colleagues and collaborators. You will be provided with varied material to assess four main learning areas:

- Reflective: based on videos, articles, books/chapters, or guest testimonials students should respond based on a set of either provoking questions or reflections with supporting statements.
- Case analysis: a real world example of the issues or concepts seen in class, students are asked to analyze problems and research, test and present potential solutions.
- Examination: standard formal tests
- Discussions: exchange of ideas on every class meeting will take place, discussion forums are opened electronically and brought to class discussion.

	Grading Structure
1 Midterm	150 pts
1 Final exam (cumulative)	150 pts
8 Problem sets	400 pts (50 points each)
2 Case Studies	100 pts (50 points each)
1 Final Project	200 pts
TOTAL	**1,000 points**
extra-credit	5 pts for each problem set completed on time 10 pts for completing syllabus quiz *tbd* pts for SPOT evaluation

- **Exams**: The midterm and the final exams will be available on Canvas. For each exam you will be given the full class time to respond it. Both exams are in-class. You should be ready to take the timed exam at class time. The Final Exam is comprehensive, and it is expected to be completed in the class time.
- **Problem Sets**: There are 8 problem sets that need to be completed. Problem sets are posted on Canvas. The due dates for the problem sets are listed on this syllabus. These form a significant part of the course grade and must be completed by the due date to receive full credit as well as bonus points (five extra credit points per problem set). Late submissions still receive full credit, provided they are completed by the end of day on December 13th, 2024; however, no bonus points are earned. No credit is awarded for any problem set completed after this date.
- **Case Studies**: There are two case studies related to your semester project. The case studies introduce the problems for you to work on possible solutions and communicate the findings. You will be trained to use some sample reports to practice on how to articulate the value of inferential analysis in industry or social problems by communicating insights gained from a non-technical standpoint. These are an important part of the course grade. For each case, you will need to use researched data (either look for it in the web or provided by the project partner). For these case studies you can use Excel or R; I will post on Canvas the instructions for each Case two weeks in advance to their due dates.
- **Final Project**: The final project is an individual task. You will be responsible to propose the scope of your project. But such scope should be highly related to your semester project. Depending on the

scope of your project and its potential fit with your semester project, you can discuss as a team whether or not you can include this class project in your semester project. Even though this is an individual delivery, it is critical for this task that you develop teamwork skills and work collaboratively on solving a problem of issue selected by your own. General guidelines on how to choose your topic will be provided. Detailed instructions on the tasks you have to accomplish and the deliverable material including a final in-class presentation will be provided as well. The main requisite is the use of any inferential statistical technique, either a hypothesis test or a regression (or both) should be applied.

- **Letter Grades**: If you achieve the following thresholds, you are guaranteed to receive the letter grade listed next to them:

≥ 900 points (or ≥ 90%)	A
≥ 800 points (or ≥ 80%)	B
≥ 700 points (or ≥ 70%)	C
≥ 600 points (or ≥ 60%)	D
< 600 points (or < 60%)	F

- **Extra Credit**: There are some opportunities for you to earn extra credit to push your grade to the next grade letter:

  Problem sets submissions: Each problem set that you finish on time (according to the due dates posted in this syllabus) earns you 5 extra credit points. That means a student who finishes all problem sets on time will receive 40 points in addition to the 400 points for homework.

  Syllabus quiz: Since this is the main document this course is using to pursue the learning outcomes, it is critical that you read it thoroughly and understand each item on it. You can respond a quiz related to the content of this syllabus and earn 10 extra-credit points. The due date is posted in the syllabus as well, but it has to be completed on the first week of the course.

  SPOT evaluation: I will give ec points for those who respond the course evaluation at the end of the semester. You will have to send me proof of your submission to get access to this extra-credit points.

  These extra credit points are added to your total but the maximum score is still out of 1,000 points.

University and School Policies and my course learning mindset

- DIVERSITY & INCLUSION: As members of the UNT community, we have all made a commitment to be part of an institution that respects and values the identities of the students and employees with whom we interact. UNT does not tolerate identity-based discrimination, harassment, and retaliation so we will work as a class to collaborate in ways that encourage inclusivity. Although disagreements and debates are encouraged, personal attacks are unacceptable. Together, we can ensure a safe and welcoming classroom for all.

- CAREGIVER RESPONSIBILITIES: I have great respect for students who are balancing their pursuit of education with the responsibilities of caring for children or other family members. If you run into

challenges that require you to miss a class, or if your caregiving responsibilities are interfering with your ability to engage in learning, please contact me. There may be some instances of flexibility we can offer to support your learning.

- STAY INFORMED: Access regularly the course material posted on Canvas. If you feel that you are struggling with the material, please contact me.

- COMPLAINTS: I value the many perspectives students bring to our classroom. Please work with me to create a classroom culture of open communication, mutual respect, and inclusion. All discussions should be respectful and civil. If you ever feel like this is not the case, please stop by my office and let me know. We are all learning together.If you wish to register a complaint, you should first discuss your complaint with me. If you wish to carry it further, contact Dr. Dianne Gravley (the program director) and then other instances in the College, but only after first discussing it with your instructor.

- EXAMS: Even though exams are stressing, you are perfectly capable of solve them successfully. If you are under extenuating circumstances please reach out to me as soon as possible to receive support. I normally require written requests to fulfill UNT regulations. We can then discuss alternative arrangements.

- LEARNING SUPPORT: I'm here for you. My aim is to facilitate your learning process. Please do not hesitate to ask questions to me, (the professor, Dr. Palao). I will answer to your questions as quick as possible if you email me. Sometimes, similar questions may be raised by some of you, so in those cases I will post an announcement in Canvas to make sure everyone has the information. So, when you ask a generic question, others can benefit from your question. Since we do meet in person in-class questions are critical, because questions are automatically available to everyone in the classroom.

- WITHDRAWING / DROPPING THE COURSE: Keep in mind that if you are considering to withdraw the class, make sure you received all the possible support before. If you still feel necessary to do so, please check the academic calendar for properly withdraw before the scheduled last drop day. If you stop attending class, you should execute the drop procedure since failure to do so will result in a grade of "F" which cannot be changed.

- ACADEMIC INTEGRITY: This course adheres to the UNT policy on academic integrity. The policy can be found at https://vpaa.unt.edu/fs/resources/academic/integrity. Remember that if you engage in academic dishonesty you will receive a failing grade on the test or assignment, or a failing grade in the course. In addition, the case may be reported to the UNT Dean of Students/Academic Integrity Office, which maintains a database of related violations.
  Students are expected to read https://policy.unt.edu/policy/06-003 UNT's Student Standards of Academic Integrity with defines academic dishonesty and sets out the consequences of unethical behavior.

- STUDENTS WITH DISABILITIES: The New College complies with the Americans with Disabilities Act (ADA) in making reasonable accommodations for qualified students with disability. If you have an established disability you should register with the Office for Disability Accommodation (ODA) and receive further instructions. Please see contact me as soon as possible if you have any questions.

- DEADLINES: Dates of drop deadlines, final exams, etc., are published in the university catalog and the schedule of classes. Please be sure you keep informed about these dates.
- SPOT: The Student Perceptions of Teaching (SPOT) is a requirement for all organized classes at UNT. This short Web-based survey will be made available to you at the end of the semester/session, providing you a chance to comment on how this class is taught. I am very interested in the feedback I get from students, as I work to continually improve my teaching. I consider SPOT to be an important part of your participation in this class.
- INCOMPLETE GRADE (I): The grade of "I" is not given except for rare and very unusual emergencies, as per University guidelines. An “I” grade cannot be used to substitute your poor performance in class. Do not let that happen and contact me as soon as possible!
- CAMPUS CLOSING: In the event of an official campus closing, please check your UNT e-mail for instructions on how to turn in assignments, how the due dates are modified, etc.

Schedule and weekly learning goals

The description and timelines contained in the syllabus are subject to change at Professor’s discretion based on the group learning’s pace or other events that may impact the current schedule.

It is meant to be a guide and several items are subject to change. Exams may be moved in time & will be announced. I STRONGLY recommend that you adhere to the schedule below. This way, you should progress at a reasonable, sustainable pace. You will also be able to keep up with the Problem Sets, Cases, Final Project deadlines and Exam dates.

Schedule and weekly learning goals

Main Topic	Week	Dates	Topics & Sub Topics	Dues Assignments & Cases
Hypothesis Tests and Confidence Intervals	Week 1	19 Aug	Course Syllabus **L.0** Statistical concepts refresher	Read the syllabus thoroughly
		21 Aug	**L.1** Sampling	Week1 quiz due
	Week 2	26 Aug	**L.2** Estimation	
		28 Aug	**L.3** Hypothesis Testing Intro	
	Week 3	2 Sept	**NO CLASS** Labor Day	**Problem Set 1** (1 Sept)

		4 Sept	**L.4** Hypothesis Testing: One sample	
	Week 4	9 Sept	**L.5** Hypothesis Testing: Two sample-Independent	Case Study 1 Instructions out!
		11 Sept	**L.6** Hypothesis Testing: Two sample-Matched pairs	
	Week 5	16 Sept	**L.7** Analysis of Variance (ANOVA)	**Problem Set 2** (15 Sept)
		18 Sept	**L.7** Analysis of Variance (ANOVA) part 2	
	Week 6	23 Sept	Inferential Analysis Practice part 1	**Problem Set 3** (22 Sept)
		25 Sept	Inferential Analysis Practice part 2	
Linear Regression Analysis	Week 7	30 Sept	**L.8** Components of the linear regression model	**Problem Set 4** (29 Sept)
		2 Oct	**L.9** Regression Model Estimation	
	Week 8	7 Oct	Midterm preparation	**Case Study 1 Report** (6 Oct)
		9 Oct	**MIDTERM** (In class time)	

Schedule and weekly learning goals *(cont.)*

Main Topic	Week	Dates	Topics & Subtopics	Dues Assignments & Cases
Linear	Week 9	14 Oct	**L.10** Regression Model Selection	Case Study 2 Instructions out!

Regression Analysis and Logistic Regression		16 Oct	Practice	
	Week 10	21 Oct	**L.11** Regression Assumptions and Violations	**Problem Set 5** (20 Oct)
		23 Oct	Practice	Final Project Instructions out!
	Week 11	28 Oct	**L.12** Regression Models with Interaction Variables	**Problem Set 6** (27 Oct)
		30 Oct	Practice	
	Week 12	4 Nov	**L.13** Cross Validation Methods	
		6 Nov	Practice	
	Week 13	11 Nov	**L.14** Interpreting linear & Logistic Models	**Problem Set 7** (10 Nov)
		13 Nov	Practice	*I will check progress on your final project*
	Week 14	18 Nov	**L.15** Odds and Accuracy Rate	
		20 Nov	Practice	
	Week 15	25 Nov 27 Nov	**NO CLASS** Happy Thanksgiving!	
	Week 16	2 Dec	**Project Presentations**	**Problem Set 8** (2 Dec)
		4 Dec	**Project Presentations**	
	Week 17	9 Dec	Final Exam preparation	**Case Study 2 Report** (8 Dec)
		11 Dec	**FINAL EXAM** (During class time)	