The University of Oklahoma **Fall 2023**
Department of Economics

ECON 5023: Statistics for Decision Making

The University of Oklahoma

Department of Economics

Instructor: Dr. Ibrahim Kekec
Office: Department of Economics, Room 332/CATE 1
E-mail: ibrahim.kekec-1@ou.edu
Office Hours: 4:30pm-6:30pm on Wednesdays and 10:30am-12:30pm on Thursdays (in-person or virtual, book me here)
Meeting Time and Place: 3:00pm-4:15pm on Mondays and Wednesdays, Room 174/CATE 1
Course Website: Canvas
Teaching Assistant (TA): Mahla Shourian (mahla.shourian@ou.edu)
TA Office Hours: By appointment

COURSE DESCRIPTION

This course focuses on the applications of statistics or econometrics in the decision-making process. A statistical approach to decision making, unlike informal intuition or a qualitative approach, is based on two things: modern computer programs and analysis of large-scale data. The traditional "paper-and-pencil" type of introductory statistics courses usually covers some theoretical concepts and techniques, but fails to include much programming and data analysis, which is nowadays at the heart of "data science". Because of this, emphasis of this course will be placed on combining programming techniques and statistical concepts simultaneously through the analysis of real-life data sets taken from various sources. Our goal is to demonstrate how economists use data analysis to aid decision making and to answer important questions about complex social and economic issues. Throughout the process, we will learn how to programming with R and to manipulate and explore data in R, although this is not an R course.

At the end of the semester, you should gain a basic understanding of how one could apply statistical techniques to analyze micro, macroeconomic, financial events and issues, or even other social issues. You will learn not only theoretical concepts and tools, but also how to use statistical softwares to analyze real-life data. The 'application' aspect entails becoming familiar with statistical software (R will be heavily used). You will develop competency in R in order to apply the techniques learned. Learning by Doing!

OUR GOALS: THREE LAYERS

Our ultimate goal is to provide statistical foundations for further learning of data science and machine learning, and more importantly, an overarching system to connect all those seemingly unrelated and complex statistical topics.

1. We will review **basic concepts**, which have been covered in your previous statistics courses. This is to make sure that everyone is on the same page. But more importantly, we want to take this opportunity to introduce how you can implement these concepts using a programming language and apply them them to some real-life data.

2. We will focus on the "Why" behind the basic concepts to gain better and **deeper understanding** of them. We will provide a unified framework to organize and connect all these concepts and tools, as opposed to "pieces". Throughout the process, we will offer a more rigorous reintroduction of some basic concepts, as well as intuition and historical background behind their development. Hopefully such process will help you think about what may be a more appropriate method to apply in a real-life setting, and what you can do differently (with some creativity).

3. We will introduce some **new concepts or methods**. Some can only be introduced when computers are available to us (such as Monte Carlo simulation and Bootstrap), some are more complicated extensions of the basic concepts (e.g., exponential smoothing methods if time permits), and some are concepts more specific to decision making (e.g., criteria for model selections).

A theme that runs through the entire learning process is "hands-on real-life applications' where we will apply what we will learn to simplified yet real-life topics. The examples are taken from different fields to underscore the variety of possible applications of our materials. For example,

1. **Discrete Variables**: Classification and Text Analysis in Machine Learning

2. **Continuous Variables**: Risk Management in Finance

3. **Computational Statistics**: Numerical Integration and Differentiation.

Some former students' previous comments summarize nicely what traditionally we would like to achieve.

1. As one former student said, this course "helped simplify my approach to thinking about ostensibly complex concepts in statistics."

2. Another student commented on this course, "this is a great course to encourage independent and creative thinking. Dr. Wang really pushed us to use our imagination when it came to statistics, and he truly had the attitude that no question was a stupid question."

3. Another student said, "it pushed me out of my comfort zone."

DELIVERY and COMMUNICATION

This course will primarily be delivered in a synchronous and in-person format. The course is scheduled to run for 14 consecutive weeks. The course entails participating in lectures interactively, reading lecture slides (and suggested material if necessary), engaging with in-class exercises and quizzes, working on problem sets and taking examinations. We will meet for two and a half hours every week.

This syllabus is only tentative and subject to change. I will update it according to the progress of this course. **It is your responsibility to check Canvas course website for updates, course material, and problem sets.** I will share the content for each week ahead of the class through the corresponding weekly content area on the Canvas course website. There may be changes regarding the course such as grading policy, exams and empirical project if deemed necessary, but they will be explicitly announced in class at least one month ahead. During the final week of the course, special attention will be given to addressing your questions, particularly concerning the final examination.

Email is the fastest way to contact me.

POSSIBLE OBSTACLES to LEARNING PROCESS

Conceptual vs. Real Understanding - Importance of Practice: A common scenario (From Barbara Oakley's WSJ Opinion): I just don't see how I could have done so poorly. I understood it when you taught it in class.

That one think he/she understood an idea in a classroom "doesn't necessarily mean that this person truly understood the idea. It certainly doesn't mean that the student will retain that idea. And it absolutely doesn't mean that the student has mastered the idea." "Understanding is key. But not superficial, light-bulb moments of understanding or conceptual understanding. In [a field like this], true and deep understanding comes with the mastery gained through practice."

Asking and Answering Vague Questions: Sometimes, students are afraid to ask a question especially when he or she cannot formulate it clearly yet. Sometimes, the students complain that the professor sometimes asks vague questions that they do not know how to answer.

Frustration: "Frustration is natural when you start programming in R, because it is such a stickler for punctuation, and even one character out of place will cause it to complain. But while you should expect to be a little frustrated, take comfort in that it is both typical and temporary: it happens to everyone, and the only way to get over it is to keep trying." R for Data Science by Garrett Grolemund and Hadley Wickham

General Solutions: Lack of (positive and constructive) communication is the biggest obstacle to learning. Lets ensure that this does not happen. Show understanding and patience to each other, and collectively come up creative solutions to address any challenges that may get in the way of our learning during this particular challenging time.

EVALUATION

Throughout the course, you will engage in various assessments, including in-class discussions, quizzes, problem sets, midterm examination and final examination. Your successful completion of the course will be determined by your performance in these assessments. Attendance in classes is highly recommended. Please feel free to inform me about your absences if you find it suitable.

It is expected that there will be students who become ill or face some other special circumstances that prevent them from attending a class, taking an examination or a quiz, or completing a problem set. To accommodate students in such situations, I have a grading system that already takes into account these cases (see the next paragraphs for more.) So, do not worry about retaking the examination, quiz, or problem set you miss due to unexpected events. In fact, I do NOT give any make-ups. If you insist on taking a make-up, you would lose the privilege of dropping the lowest one.

Examinations: There will be one midterm examination (**tentative date: 10/18/2023**) and one final examination (**at CATE 174, from 4:30pm-6:30pm on Thursday, 12/14/2023**). **No make-up exams will be given.** If a student misses a midterm examination **for any reason**, the weight of that examination will be added to that of the final examination (e.g., missing midterm examination would make the final examination worth 60% of the course grade). I would like to have the flexibility to speed up or slow down depending on how I think the class understands the material. So, the midterm date may be subject to change according to the progress but will be announced one week in advance.

Problem Sets: There will be homework assignments following each topic. The total number of homework assignments will depend on the progress of the class. **Problem sets will be due at the beginning of class and will be handed over to me. Late submissions will not be graded for credit.** It is important to know that the problem sets are very important in that the basic ideas covered by them invariably show up on the midterm and the final examinations. If you know you are going to miss a class on the day a problem set is due, hand in your work **in advance** to receive full credit.

- Your submission should be organized and legible. You can use R Markdown (see Software Packages section.) This is also courteous to your TA who would be grading the homework. She cannot grade properly if your submission is not readable!
- Group discussion is encouraged when working on the problem sets. Your answers should show individual understanding of the materials and be written in your own words. If you collaborate with other student(s), everyone in your group should be acknowledged at the beginning of the homework. Identical problem sets would receive a zero.

Quizzes: There will be several short quizzes (short answer and/or multiple-choice) given throughout the semester. Such quizzes are **not announced** beforehand and will usually be administered in the first five to ten minutes of the class. These quizzes are designed to help you better understand the materials covered and find out whether you have any problems with the materials and have done any assigned readings that I may have asked you to do. **No make-up quizzes** will be given. If you must miss a class due to legitimate (and documented) circumstances

beyond your control, be sure and contact me beforehand so that I will know of your circumstances. If excused, I will correspondingly excuse you from any quiz that may be given that day. The lowest quiz grade will also be dropped.

Mistakes in Grading: Your TA and I are human beings. Sometimes it is possible that we make some mistakes in grading or misplaces your problem set, quiz, or examination papers. If that occurs, please report the incidence within **three days** after they are handed back and recorded on Canvas; after that, I would not be able to make any changes except in special documented circumstances such as illness that prevenst you from doing so. Discuss first with your TA about your concerns or objections, and if it is not resolved, then present a written document to me for final decision on the matter.

Participation: During my lectures, students will have ample opportunity via discussions and directed questions to engage in class material. To enhance the learning experience, I intend to incorporate various active learning activities such as one-minute papers, think-pair-share, and concept mapping as students consider questions posed by either themselves or me. These activities are specifically designed to facilitate a deeper comprehension and understanding of the course material. Your active participation in these activities will contribute to the allocation of participation points, acknowledging your contributions to the learning process.

GRADING

The weights in the final grade are assigned as follows:

Weight Scheme	
Problem Sets	20%
Quizzes	15%
Midterm Exam	25%
Final Exam	35%
Participation	5%

The grading scale is:

Total Score in % (x)	Letter Grade
$90 \leq x$	A
$80 \leq x < 90$	B
$70 \leq x < 80$	C
$60 \leq x < 70$	D
$x < 60$	F

I reserve the right to change the grading scale. The required score for the final grade could be lower but not higher. For example, the current requirement for an A is at least a 90%, but later I may change the cut-off point to 85%, but will not change it to 95%.

REQUIRED READING LIST

Note: We do not follow the books closely. Rather, I will use my own structure to organize select topics. As a student, it is your responsibility to find out what would be the corresponding material in the book and independently look for additional readings if needed. Two approaches: look for the index at the back of the textbooks listed below, or Google material on the topic.

- Statistical Techniques in Business & Economics by Lind, Marchal, and Wathen (hereafter LMW).
- Forecasting: Principles and Practice by Rob J. Hyndman and George Athanasopoulos (hereafter FPP). The latest version of the book is available for free at https://otexts.org/fpp2/. All the examples are written in R.
- Introduction to Probability and Statistics Using R by G. Jay Kerns freely available at http://www.atmos.albany.edu/facstaff/timm/ATM315spring14/R/IPSUR.pdf
- R for Data Science freely available at https://r4ds.had.co.nz

The first book provides detailed material on introductory statistics and the applications of these elementary concepts and methods in business and economics, while the second book provides a more specific purpose for statistics and econometrics, namely forecasting. I will also try to supply my slides or provide pointers (additional readings) for the topics that are not covered or in less detail by these two books.

SOFTWARE PACKAGES

1. R can be downloaded at http://cran.r-project.org/bin/windows/base/
2. RStudio, a powerful IDE for R, can be downloaded at http://www.rstudio.com/
3. R Markdown for creating reproducible documents with code and text together. For more, see https://rmarkdown.rstudio.com/

Bring a laptop to classroom. However, you should use it only when we need to use R for practice or a quiz.

Question-Asking Etiquette:

1. You need to show your independent work before asking your TA or me. This is also a way to help you develop skills to solve problems and issues independently.
2. When asking about coding, you need to include the exact error message and the code to replicate such message. You cannot simply say that my code does not work.

USEFUL DATA SOURCES

1. Analyze Data for Free at http://www.asdfree.com/
2. UC Irvine Machine Learning Repository at https://archive.ics.uci.edu/
3. Interuniversity Consortium for Political and Social Research at https://www.icpsr.umich.edu/web/pages/

RECOMMENDED READING LIST

There is no single textbook that covers every topic well. Here I also list some books that may be useful for certain topics under "Introductory Level", and some books for more advanced and technical treatments under "Advanced Level".

Machine Learning:

1. Sugiyama, Masashi. Introduction to statistical machine learning. Morgan Kaufmann, 2015.
2. Robert, C. (2014). Machine learning, a probabilistic perspective.

Introductory Level

1. OpenIntro Statistics 3rd Edition. Available for free at https://www.openintro.org/stat/textbook.php
2. Business Forecasting: Text Alone by J.Holton Wilson, Barry P. Keating, and Solutions Inc. Publisher: McGraw-Hill Publishing Co.; 5th edition (August 5, 2011) ISBN-10: 0072979674; ISBN-13: 978-0072979671. This textbook contains more detailed discussions of the contents and many useful examples. The software is however dated.
3. Elements of Forecasting by Francis X. Diebold, Cengage Learning; 4th edition (December 8, 2006), ISBN-10: 0324359047
4. An Introduction to Statistical Learning by Gareth James, Daniela Witten, Trevor Hastie and Robert Tibshirani, available for free at https://www.statlearning.com/

Advanced Level

1. The Elements of Statistical Learning: Data Mining, Inference, and Prediction. by Trevor Hastie, Robert Tibshirani, Jerome Friedman. available for free at https://web.stanford.edu/∼hastie/Ele
2. Introduction to Econometrics, 4th Edition, Maddala and Lahiri, Wiley: 2009, ISBN: 9780470015124
3. Introductory Econometrics: A Modern Approach, Jeffrey M. Wooldridge, (2019). Mason, OH: South-Western Cengage Learning; 7th edition ISBN: 9781337558860
4. Symposium on Econometric Tools, Journal of Economic Perspectives, Vol. 15, No. 4, Fall 2001

5. Time Series Data Analysis Using EViews, First Edition, Gusti Ngurah Agung, Wiley: 2008, ISBN: 9780470823675

6. Applied Time Series Econometrics, 1st Edition, by Lukepohl and Krazig, Cambridge: 2004, ISBN: 0521547873

7. Applied Econometric Time Series, 4th (or 3rd) edition by Walter Enders, Wiley: 2014, ISBN:9781118808566

UNIVERSITY POLICIES

Accommodations for Special Students: At the University of Oklahoma (OU), we are dedicated to ensuring the complete inclusion of all students, including those with disabilities, to enrich their OU experience. In accordance with Section 504 of the Rehabilitation Act of 1973, the Americans with Disabilities Act (ADA), and the Americans with Disabilities Act Amendments Act (ADAAA), the Accessibility and Disability Resource Center (ADRC) offers personalized accommodations, services, and support to students with documented disabilities on a case-by-case basis.

Possible disabilities include, but are not limited to, learning disabilities, AD(H)D, mental health, and chronic health. Additionally, we support students with temporary medical conditions (broken wrist, shoulder surgery, etc.) and pregnancy. To discuss potential accommodations, please contact the ADRC at 730 College Avenue, (ph.) 405.325.3852, or adrc@ou.edu. To ensure timely arrangements, kindly submit your written accommodation request within the first week of class.

Academic Integrity: Cheating is strictly prohibited at OU, because it devalues the degree you are working hard to earn. As a member of the OU community, it is your responsibility to protect your educational investment by knowing and following the rules. For specific definitions on what constitutes cheating, review the Student's Guide to Academic Integrity at https://www.ou.edu/integrity/students.

Religious Observance: It is the policy of the University to excuse the absences of students that result from religious observances and to reschedule examinations and additional required classwork that may fall on religious holidays, without penalty. Please feel free to contact me if any of the due dates for assessment components conflict with your religious commitments.

Title IX Resources and Reporting Requirement: Anyone who has been impacted by gender-based violence, including dating violence, domestic violence, stalking, harassment, and sexual assault, deserves access to resources so that they are supported personally and academically. OU is committed to offering resources to those impacted, including: speaking with someone confidentially about your options, medical attention, counseling, reporting, academic support, and safety plans. If you would like to speak with someone confidentially, you may contact OU Advocates (available 24/7 at 405-615-0013). You may also choose to report gender-based violence and discrimination through other means, including by contacting the Institutional Equity Office (ieo@ou.edu, 405-325-3546) or police (911). Because OU is committed to the safety of you and other students, faculty members (including me), graduate and teaching assistants are mandatory reporters. This means that we are obligated to report gender-based violence that has been disclosed to us to

the Institutional Equity Office. This includes disclosures that occur in: class discussion, writing assignments, discussion boards, emails and during office hours. For more information, please visit the Institutional Equity Office.

Adjustments for Pregnancy/Childbirth Related Issues: Should you need modifications or adjustments to your course requirements because of documented pregnancy-related or childbirth-related issues, please contact me or the Disability Resource Center at 405-325-3852 as soon as possible. Also, see the Pregnant and Parenting Students' Rights at http://www.ou.edu/eoo/faqs/pregnancy-faqs.html for answers to commonly asked questions.

Final Exam Preparation Period: Pre-finals week will be defined as the seven calendar days before the first day of finals. I may cover new course material throughout this week. For specific provisions of the policy please refer to OU's Final Exam Preparation Period policy.

Emergency Protocol: During an emergency, there are official university procedures that will maximize your safety. If you receive an OU Alert to seek refuge or hear a tornado siren that signals severe weather,

1. LOOK for severe weather refuge location maps located inside most OU buildings near the entrances.
2. SEEK refuge inside a building. Do not leave one building to seek shelter in another building that you deem safer. If outside, get into the nearest building.
3. GO to the building's severe weather refuge location. If you do not know where that is, go to the lowest level possible and seek refuge in an innermost room. Avoid outside doors and windows.
4. GET IN, GET DOWN, COVER UP.
5. WAIT for official notice to resume normal activities.

Armed Subject/Campus Intruder: If you receive an OU Alert to shelter-in-place due to an active shooter or armed intruder situation or you hear what you perceive to be gunshots,

1. Avoid: If you believe you can get out of the area WITHOUT encountering the armed individual, move quickly towards the nearest building exit, move away from the building, and call 911.
2. Deny: If you cannot flee, move to an area that can be locked or barricaded, turn off lights, silence devices, spread out, and formulate a plan of attack if the shooter enters the room.
3. Defend: As a last resort fight to defend yourself. For more information, visit OU's Emergency Preparedness site at https://www.ou.edu/cas/modlang/emergency-preparedness

Fire Alarm/General Emergency: If you receive an OU Alert that there is danger inside or near the building, or the fire alarm inside the building activates,

1. LEAVE the building. Do not use the elevators.
2. KNOW at least two building exits.
3. ASSIST those that may need help.
4. PROCEED to the emergency assembly area.
5. ONCE safely outside, NOTIFY first responders of anyone that may still be inside building due to mobility issues.
6. WAIT for official notice before attempting to reenter the building. For more information, visit OU's Fire On Campus site at https://www.ou.edu/campussafety/fire-marshal/policies/fire_on_campus

Mental Health Support Services: If you are experiencing any mental health issues that are impacting your academic performance, counseling is available at the University Counseling Center (UCC). UCC is located on the second floor of the Goddard Health Center, at 620 Elm Rm. 201, Norman, OK 73019. To schedule an appointment call 405-325-2911. For more information, please visit UCC at https://www.ou.edu/ucc.

Inclusivity: In the vibrant OU community, each member brings a wealth of experiences and ideas that profoundly enrich our classrooms and campus life. As fellow community members, we are presented with a remarkable opportunity to learn and evolve collectively by wholeheartedly valuing and embracing the diverse contributions of every individual.

Throughout this course, I wholeheartedly encourage each and every one of you to cultivate an open-minded approach towards one another. Let us foster a nurturing and supportive learning community where each student can flourish as individuals. Do not hesitate to openly share your thoughts, ideas, and personal experiences. Together, we can collaboratively create an all-encompassing and nurturing learning space where fairness, equality, and objectivity are upheld, ensuring that everyone is treated equitably and without discrimination. If you harbor any thoughts, suggestions, or concerns regarding how we can enhance our inclusive community, please feel free to reach out to me. For more information, visit the Gender and Equality Center at https://www.ou.edu/gec

If you have any questions concerning the course, feel free to contact me or schedule an office hour appointment. I am committed to being responsive and will check my emails daily throughout the course. Rest assured that I will provide timely answers to all students' inquiries related to the course.

TENTATIVE COURSE SCHEDULE

Note that the schedule is subject to change depending on the pace of the course. Not all material would be covered, and extensions of the basic models not listed below may be added to deepen our understanding of these techniques. Moreover, the material will not be necessarily covered in the same order as below.

1. Introduction
2. R and R Studio
3. R Markdown
4. Introduction to Statistics and Forecasting
5. Time Series and Forecasting Methods
6. Basic Probability Theory
7. Discrete Variables and Classification
8. Text Minining
9. Continuous Variables and Financial Risks
10. Features of Distributions and Applications
11. Computational Statistics and Monte Carlo Simulations
12. Hypothesis Testing
13. Bootstrapping
14. Test of Means

IMPORTANT DATES

Examination Schedule		
	Date Distributed	Date Due
Midterm Examination	10/18	10/18
Final Examination	12/14	12/14