DS 6336: Mathematics Applications in Data Science

CRN: 29421

Spring 2022

Bell Hall, room 130

Tuesdays, Thursdays, 5:00-6:20

3 credit hours

Instructor: Dr. Art Duval

Office: Bell Hall, room 303

Phone:
(915)747-6846/office: 24 hours/day; if I'm not in, please leave a message.

(915)747-6502/fax: Include a cover sheet with my name, please.

(915)545-1788/home: 9am-9pm only, please.

Internet: aduval@utep.edu,
http://www.math.utep.edu/Faculty/duval/home.html

Office hours:
- Mondays, 10:00-11:00
- Tuesdays, 2:00-3:00
- Wednesdays, 4:30-5:30
- Thursdays, 1:00-2:00

Please feel free to come by my office any time during scheduled office hours. You are welcome to visit at other times, but in that case you might want to make an appointment, just to make sure that I will be there then. You can make an appointment simply by calling me, or by sending e-mail. You can just propose a time, and I will respond either by agreeing to that time, or, if I cannot make it then, I will propose different times.

Alternatively, you can talk with me by Zoom at [an address given in class or on Blackboard] during office hours or by appointment.

You may also ask any questions directly via phone or e-mail. If I'm not in when you call, please leave a message on the voice mail or answering machine with your name, number, and a good time for me to call you back. I will try to respond to your phone or e-mail message as soon as possible.

Prerequisites:
- Computational Methods of Linear Algebra (MATH 5330)
- Statistical Programming (STAT 5329)
- Introduction to Data Mining (STAT 5474)
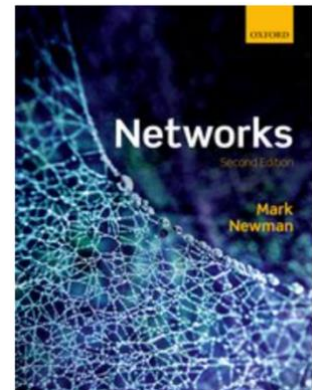
Course Objectives

Upon successful completion of this course, you will understand different graphical models of data, and how to use them in data science. You will know how to compute several different measures of a network, including centrality, degree, clustering, betweenness, connectedness, similarity, and homophily. In some cases, there will be different ways of computing the same measure. Furthermore, you will know how the distribution of these measures differs among different graph models.

Required Materials

Textbook: Networks, Mark Newman, 2nd ed. We will discuss Parts I-III. You can find more information about the textbook at the publisher's website https://global.oup.com/academic/product/networks-9780198805090?cc=us&lang=en&

Additional references:

- *Mathematics of Data Science*, Bandeira-Singer-Strohmer, draft 0.1, especially Chapter 4, available at https://people.math.ethz.ch/~abandeira/BandeiraSingerStrohmer-MDS-draft.pdf
- *Network analysis in R,* Dai Shizuka, available at https://dshizuka.github.io/networkanalysis/tutorials.html

Technology Requirements

Blackboard: Announcements, assignments, and course grades are all delivered via the Internet through the Blackboard learning management system (LMS). Ensure your UTEP e-mail account is working and that you have access to the Web and a stable web browser. Mozilla Firefox and Google Chrome are the most supported browsers for Blackboard; other browsers may cause complications with the LMS. When having technical difficulties, update your browser, clear your cache, or try switching to another browser. Check for announcements on Blackboard, or via your UTEP e-mail account (where announcements will also be sent), at least once per day.

Technical difficulties: If you encounter technical difficulties beyond your scope of troubleshooting, please contact the Help Desk as they are trained specifically in assisting with technological needs of students.

Course Assignments and Grading

Your grade for the course will be based on three similar assignments, letting you apply the ideas of the class to real-world data. For each one, we will have a guest speaker in class, who will present the ideas of research they have done, and share with the class the data for that research. You will then choose an appropriate graphical model to analyze the data, and answer research questions provided by the guest speaker. You will write a report with your analysis and conclusions. More details, including a detailed rubric, will be announced as we get closer to the date of the first guest speaker's presentation.

Final presentation

For the third and final report you write, you will also present your work to the class during our final exam time slot, which is **Tuesday, May 10, 4:00-6:45**.

Late work

Extensions on deadlines will only be given under unusual circumstances, and with an explanation. (Too much work in other classes is not a sufficient explanation.) It is generally better to submit an incomplete assignment than a late assignment.

POLICIES

Attendance

I strongly encourage you to attend every class you can (but stay home if you are sick), though there is no particular grade penalty for absences. You are responsible to find out any assignment that must be made up if you are absent. My goal is for class meetings and activities to complement, rather than echo, the textbook, and thus for every class to be worth attending.

Courtesy

We all have to show courtesy to each other, and the class as a whole, during class time. Please arrive to class on time (or let me know when you have to be late, and why); do not engage in side conversations when one person (me, or another student) is talking to the whole class; turn off your cell phone (or, for emergencies, at least set it to not ring out loud), and do not engage in phone, email, or text conversations during class.

Scholastic Integrity

Academic dishonesty is prohibited and is considered a violation of the UTEP Handbook of Operating Procedures. It includes, but is not limited to, cheating, plagiarism, and collusion. Cheating may involve copying from or providing information to another student, possessing unauthorized materials during a test, or falsifying research data on laboratory reports. Plagiarism occurs when someone intentionally or knowingly represents the words or ideas of another as one's own. Collusion involves collaborating with another person to commit any academically dishonest act. Any act of academic dishonesty attempted by a UTEP student is unacceptable and will not be tolerated. I report all suspected violations of academic integrity to the Office of Student Conduct and Conflict Resolution (OSCCR) for investigation and possible disciplinary action. To learn more, see HOOP: Student Conduct and Discipline.

Copyright Statement for Course Materials

All materials used in this course are protected by copyright law. The course materials are only for the use of students currently enrolled in this course and only for the purpose of this course. They may not be further disseminated.

Student Resources

UTEP provides a variety of student services and support:

- UTEP Library: Access a wide range of resources including online, full-text access to thousands of journals and eBooks plus reference service and librarian assistance for enrolled students.

- **Help Desk**: Students experiencing technological challenges (email, Blackboard, software, etc.) can submit a ticket to the UTEP Helpdesk for assistance. Contact the Helpdesk via phone, email, chat, website, or in person if on campus.
- **University Writing Center (UWC)**: Submit papers here for assistance with writing style and formatting, ask a tutor for help and explore other writing resources.
- **Military Student Success Center**: UTEP welcomes military-affiliated students to its degree programs, and the Military Student Success Center and its dedicated staff (many of whom are veterans and students themselves) are here to help personnel in any branch of service to reach their educational goals.

Drop Policy

To drop this class, please contact the Registrar's Office to initiate the drop process, by the deadline of Friday, April 1, 2022. After this date, you will not be able to drop the class (as per the Dean's office). Furthermore, a grade of incomplete is only for extraordinary circumstances, such as a missed exam.

I hope everyone will complete the course successfully, but if you are having doubts about your progress, I will be happy to discuss your standing in the course to help you decide whether or not to drop. You are only allowed three enrollments in this course, and only six withdrawals in your entire academic career, so please exercise the drop option judiciously.

Accommodations Policy

The University is committed to providing reasonable accommodations and auxiliary services to students, staff, faculty, job applicants, applicants for admissions, and other beneficiaries of University programs, services and activities with documented disabilities in order to provide them with equal opportunities to participate in programs, services, and activities in compliance with sections 503 and 504 of the Rehabilitation Act of 1973, as amended, and the Americans with Disabilities Act (ADA) of 1990 and the Americans with Disabilities Act Amendments Act (ADAAA) of 2008. Reasonable accommodations will be made unless it is determined that doing so would cause undue hardship on the University. If you have, or suspect you have, a disability and need an accommodation, you should contact UTEP Center for Accommodations and Support Services (CASS) at (915)747-5148 or cass@utep.edu, or apply for accommodations online via the CASS portal. You are responsible for presenting to me any CASS accommodation letters and instructions.

Exceptional Circumstances

If you anticipate the possibility of not being able to participate in the course due to exceptional circumstances such as military service and/or training, childbirth, etc., please let me know as soon as possible.

COVID-19 Precautions

If you are sick, stay home! Please stay home if you have been diagnosed with COVID-19 or are experiencing COVID-19 symptoms. If you are feeling unwell, please let me know as soon as possible, so that we can work on appropriate accommodations. If you have tested positive for COVID-19, you are encouraged to report your results to covidaction@utep.edu, so that the Dean of Students Office can provide you with support and help with communication with your professors. The Student Health Center is equipped to provide COVID-19 testing.

Vaccines. The best way that Miners can take care of Miners is to get the vaccine, which is now widely available for free in the El Paso area. The city of El Paso is administering vaccine booster shots Wednesdays and Thursdays the first two weeks of the semester (January 19, 20, 26, 27), at the Undergraduate Learning Center.   Learn more at epcovidvaccine.com.

Masks. At our current level of disease in El Paso, the Centers for Disease Control and Prevention (CDC) recommends masks for everyone (vaccinated or not) while indoors in a public setting.

Testing. UTEP is offering three convenient options for free COVID-19 testing on campus. For more details, see https://www.utep.edu/resuming-campus-operations/testing/.

UTEP is providing free walk-up COVID-19 testing for students, faculty, and staff from **9 a.m. to 2 p.m. Monday through Thursday in the University's former Honors House, behind the Academic Advising Center.**

Students, employees and the general public can pull up to the City of El Paso's COVID-19 Mega-Testing Site on UTEP property **at 3333 N. Mesa at Kern Drive.** This public site includes two dedicated priority lanes for Miners and their household members, as well as lanes for the general public.

Current UTEP students also have access to **free on-campus testing in the UTEP Student Health and Wellness Center** located in Union Building East, first floor.