Remote / Online Course Syllabus
GISC7310: Advanced GISc Data Analysis
Spring 2021

Professor Contact Information

Professor	Michael Tiefelsdorf
Email Address	tiefelsdorf@utd.edu
Online Office Hours	By appointment or when online on MS Teams (subject to availability)

Teaching Assistant Contact Information

Teaching Assistant	Yalin Yang
Email Address	Yalin.Yang@utdallas.edu
Online Office Hours	By appointment or when online on MS Teams (subject to availability)

Course Modality and Expectations

Instructional Mode	Online on Mondays 4:00-6:45 pm and remote after the lectures in the General tab of MS Teams.
Course Platform	MS Teams is used for course delivery and as lecture notes depository whereas eLearning is used for lab assignments and final exam.
Expectations	Interactive online participation is preferred and will enhance the learning experience.

COVID-19 Guidelines and Resources

The information contained in the following link lists the University's COVID-19 resources for students and instructors of record. Please see http://go.utdallas.edu/syllabus-policies.

Class Recordings

Students are expected to follow appropriate University policies and maintain the security of passwords used to access recorded lectures. Unless the Office of Student AccessAbility has approved the student to record the instruction, students are expressly prohibited from recording any part of this course. Recordings may not be published, reproduced, or shared with those not in the class, or uploaded to other online environments except to implement an approved Office of Student AccessAbility accommodation. Failure to comply with these University requirements is a violation of the Student Code of Conduct.

The instructor may record meetings of this course. Any recordings will be available to all students registered for this class as they are intended to supplement the classroom experience. Students are expected to follow appropriate University policies and maintain the security of passwords used to access recorded lectures. Unless the Office of Student AccessAbility has approved the student to record the instruction, students are expressly prohibited from recording any part of this course. Recordings may not be published, reproduced, or shared with those not in the class, or uploaded to other online environments except to implement an approved Office of Student AccessAbility accommodation. If the instructor or a UTD school/department/office plans any other uses for the

recordings, consent of the students identifiable in the recordings is required prior to such use unless an exception is allowed by law. Failure to comply with these University requirements is a violation of the Student Code of Conduct.

Course Pre-requisites, Co-requisites, and/or Other Restrictions

GISC6301 or equivalent: You can perform in an informed way univariate and bivariate descriptive and inferential statistic; understand the basic concepts of probability and underlying ideas of statistical hypothesis testing.

You have experience working with R either at the command prompt or with scripts.

Required and Optional Textbooks and Material

Textbooks: **[Ham]** Hamilton, Lawrence C., **1992**. *Regression with Graphics. A Second Course in Applied Statistics*. Duxbury Press. (required Chapters 1-5, and 7-8 plus appendices)
(see http://www.amazon.com or elsewhere for used book options)

[**Fox**] Fox, John, Weisberg, Sanford, **2018**. *An R Companion to Applied Regression*. 3rd edition. Sage (optional) ~ $56
The associated library **`car`** *will be used extensively*

[KZ] Kleiber, Christian and Achim Zeilis (2008). *Applied Econometrics with R*. Springer Verlag. (optional)
The associated library **`AER`** *will be used extensively.*
Note: This textbook is available as ***free pdf-download*** *at UTD's library.*

Supplements: Lecture notes and additional reading resources on special topics augment the study material.

Data: The course website stores the data that accompanies the textbook as well as R-scripts used in this course. Other data and programs will be placed there during the semester.

Software: The software for this course is freely available at www.r-project.org , https://mran.microsoft.com/ and https://www.rstudio.com/ .

Course Description

This course builds on an introductory course in descriptive and inferential statistics. It lays the foundation to multivariate data modeling and statistical analysis techniques by beginning with multiple ordinary least squares regression and its extensions using exogenous factor variables as well as interaction effects. Implications of random errors in the exogenous variables are discussed. Furthermore, maximum likelihood extensions for weighted regression, spatially autocorrelated data and the generalized linear model are introduced. The special nature of spatial data and their ramifications in regression analysis and spatial applications will be stressed in special topics sessions. Competing model specifications, diagnostic and revision strategies as well as exploratory and confirmatory interpretation skills are practiced with statistical software tools and using empirical data sets. Required statistical concepts, such as optimization techniques, mathematical and matrix operations as well as computational techniques and numerical issues are introduced.

Student Learning Objectives/Outcomes

Upon completing this class, students will:

- Conduct independently standard exploratory and confirmatory data analyses of empirical spatially distributed data sets with the appropriate linear statistical models;
- Understand the underlying data manipulation of several GIS methodologies that use regression techniques;
- Identify the appropriate model setup;
- Have acquired a statistical and mathematical skill set that empowers them to successfully complete more specialized statistical data analysis courses and analyses;
- Use statistical software to conduct specific regressions analyses tailored towards spatial data; and
- Be able to follow the arguments in research articles that make use of multivariate statistical methodologies.

Tentative Course Schedule

Dates	Title	Action
Jan. 25	INTRODUCTION – EXPECTATION, VARIANCE AND COVARIANCE. NUMERICAL INTEGRATION (HAM APP01)	
Feb. 01	VARIABLE DISTRIBUTIONS & TRANSFORMATIONS (HAM01) BIVARIATE REGRESSION & ELASTICITY (HAM02)	Lab01 out
Feb. 08	MULTIPLE REGRESSION I (HAM03)	
Feb. 15	MULTIPLE REGRESSION II (HAM03)	Lab02 out
Feb. 22	BASIC MATRIX OPERATIONS (HAMAPP03)	
Mar. 01	INSTRUMENTAL VARIABLES (HANDOUT) GIS USES OF MATRIX ALGEBRA (HANDOUT)	
Mar. 08	REGRESSION CRITICISM (HAM04)	Lab03 out
Mar. 15	**SPRING BREAK**	
Mar. 22	MAXIMUM LIKELIHOOD & FEASIBLE GENERAL LEAST SQUARES (FGLS) (HANDOUT)	
Mar. 29	ACCOUNTING FOR HETEROSCEDASTICITY (KZ05) & SPATIAL AUTOCORRELATION (HANDOUT)	Lab04 out
Apr. 05	MODELING SPATIALLY DISTRIBUTED DATA (WORKSHOP)	
Apr. 12	LOGISTIC REGRESSION (HAM07)	
Apr. 19	GENERALIZED LINEAR MODEL AND POISSON REGRESSION (HANDOUT)	Lab05 out
Apr. 26	MODELING SPATIAL INTERACTION FLOWS USING POISSON AND NEGATIVE BINOMIAL REGRESSION	
May 03	REVIEW SESSION	
TBA	FINAL EXAM	

Course Policies

Grading (credit) Criteria	**Policies:** • Labs and the final exam need to be solved ***individually***. Plagiarism ***cannot*** be tolerated.

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Participation is highly encouraged but will not be graded. Engagement with the course material will lead to participation and indirectly to an increased comprehension of the course material.
<table>
<tr><th>Requirements</th><th>Points</th></tr>
<tr><td>5 Labs @ ~13 pts: labs should be handed online to the Labs folders in eLearning. The labs will prepare you in parts for the final exam.</td><td>65 pts</td></tr>
<tr><td>Final Exam:
<u>Open book</u> and <u>open notes</u>. The exam focuses primarily on concepts and model interpretations, which have been practiced in the lab assignments</td><td>35 pts</td></tr>
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<tr><td>Late Work</td><td>Work that is late by one day will lead to a deduction of 10% of its points.
Work that is late by two days will lead to a deduction of 20 % of its points.
Later work cannot be accepted unless special circumstances can be claimed.
Preferably contact the instructor before the deadline if you think that you may need to hand your assignment in late.</td></tr>
<tr><td>UTD Syllabus Policies</td><td>All UTD syllabus policies apply to this course. It is advisable to study these policies at least once per academic year.
See http://go.utdallas.edu/syllabus-policies for details</td></tr>
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Tentative Grading Scale

Points	Grade
90 to 100	A
85 to 89	A-
80 to 84	B+
75 to 79	B
70 to 74	B-
65 to 69	C+
60 to 64	C
less than 60	F

Course & Instructor's Policies

Make-up exam/Late assignment policy: A make-up exam will only be given in extenuating circumstances.

Participants will usually have 14 days to complete a lab. A late lab will lead to a deduction of its grade. A late lab can no longer be accepted once its solution has been posted and discussed.

Plagiarism: The university's rules of plagiarism will be strictly enforced. While you are encouraged to discuss the labs with other course participants to enhance your understanding of the course material, the labs must be answered individually by each course participant unless teamwork is explicitly requested by the instructor. The labs prepare you for the final exam and train useful conceptional and technical skills.

Additional information relating to University policy on "Religious Holy Days", "Grade Appeals", "Disability Services", "Student Conduct", etc. can be found at http://go.utdallas.edu/syllabus-policies

Comet Creed

This creed was voted on by the UT Dallas student body in 2014. It is a standard that Comets choose to live by and encourage others to do the same:

"As a Comet, I pledge honesty, integrity, and service in all that I do."

The descriptions and timelines contained in this syllabus are subject to change at the discretion of the Professor.