



Course	GISC6301: Geo-Spatial Data Analysis Fundamentals
Professor	Michael Tiefelsdorf, Ph.D.
Term	Fall Semester 2016
Lectures & Labs	Monday 5:30 pm – 6:45 pm in GR3.402 A&B Wednesday 5:30 pm – 6:45 pm in GR3.402 A&B

Contact Information

Office Phone	(972) 883-4954
Office Location	GR3.204
Email Address	tiefelsdorf@utdallas.edu Please start the <u>subject line</u> of each email with DAF to alert me that it is a GISC6301 related email and not just junk mail.
Office Hours	Tuesday 2:00-4:00 pm in my office at GR3.204 and by appointment or for short drop-ins when my office door is open.
Other Information	Please check the E ^{LEARNING} 's course site for lecture notes, quizzes, announcements etc. on a regular basis.
Teaching Assistant	Xiaojun Pu
Office Location	GR3.318
Email Address	xjp102020@utd.edu
Office Hours	Mondays 3:00-5:00 pm and by appointment

General Course Information

Pre-requisites, Co-requisites, & other restrictions	A prior undergraduate course in basic statistical analysis is highly recommended (e.g., SOCS 3405) Ability to operate a personal computer, data handling skills, ability to use the University Library, E ^{LEARNING} and internet resources is required. No prior GISciences knowledge is necessary.
Course Description	This service course lays the methodological foundation for several technical and analytical courses in the Geo-spatial Information Sciences program and general Data Analytics practices. It provides an introduction to the special nature of spatial data that describe their underlying geo-referenced objects. Spatial observations combine locational with attribute information and are therefore multidimensional. Furthermore, inherent in spatial observations is some degree uncertainty. However, exogenous relationships among spatial objects usually constrain observed uncertainties. • This course will train its participants to read <u>statistical equations</u> and understand their internal structure. • This course provides on a <u>technical level</u> a basic introduction into spatial data handling, analysis operations and the design of numerical algorithms. Brief scripts using the open source statistical programming language  are employed to illustrate these operations. • This course introduces on a <u>methodological level</u> statistical concepts [a] to describe and measure the inherent uncertainties within aspatial and spatial data and their distributions, [b] to approach research questions and decision making processes from a statistical perspective and [c] to model simple spatial data generating processes.

The spectrum of analytical methods covers descriptive statistics, data visualization and exploratory methods, measures of spatial variability, study designs, probability and sampling theory, statistical inference and decision making, as well as basic correlation and regression analysis.

Underlying statistical concepts are emphasized, which allow selecting proper analysis instruments to answer specific research questions. Examples with aspatial and spatial data illustrate the application of these instruments. A strong focus on concepts – rather than a plain application of recipes – provides guidelines of finding appropriate analysis instruments for emerging research questions.

Geo-spatial Data Analysis Fundamentals is the first in a sequence of GISc classes focusing on the statistical analysis of aspatial and spatially distributed data:

- GISC7310: ***Advanced Geo-spatial Data Analysis***
- GISC7360: ***Pattern Analysis***
- GISC7361: ***Spatial Statistics***

GISc students are encouraged to take ***Advanced Geospatial Data Analysis*** as sequel to ***Geospatial Data Analysis Fundamentals***.

It covered in-depth spatial regression analysis and will prepare GISc for their Master's projects, several methodologically oriented GISc courses and challenges encountered at their work places.

Learning Outcomes

Upon completing this class, students will:

- *Handle data, visualize data and perform exploration tasks within the  environment using short scripts;*
- *Understand the nature of aspatial and spatial data and their implications for statistical data analyses;*
- *Perform data collections, exploratory studies and statistical analyses to answer research questions;*
- *Select appropriate statistical tools specific to particular research questions and available data structures;*
- *Be able to follow statistical arguments in textbooks and research articles.*
- *Become prepared for more advanced courses in spatial data analysis.*

Required Texts & Materials

Burt, James E., Gerald M. Barber, and David L. Rigby (2009). *Elementary Statistics for Geographers*. 3rd edition, 2nd and above printing. New York: The Guilford Press. ISBN 978-1-57230-484-0
Check www.amazon.com: new ~\$90
It is also available for a *short term loan* at UTD's library

Note: If you select to buy a used copy then **avoid** the **first** printing of the 3rd edition, it contains some confusing typos.

Supplemental Texts, Readings & Materials

Lander, J.P.  for Everyone. Advanced Analytics and Graphics. Addison Wesley, 2014. Check www.amazon.com: new ~\$38.
It is also available as **eBook** at UTD's library.

Additional reading material will be made available as required on the

course's **ELEARNING** site throughout this semester.

Software The free open source -environment for computers running Windows, Linux and Mac OS X.
More information on the installation of Microsoft's Open  (<https://mran.revolutionanalytics.com/>) and its development shell  Studio (<https://www.rstudio.com/home/>) will be provided during the first and second course week.

Assignments & Academic Calendar

[Lecture Dates, Topics, Reading Assignments, Lab and Quiz Dates]

Date	Topic	Reading	Lab & Quiz
Aug. 22	INTRODUCTION		
Aug. 24	MATHEMATICAL TYPESETTING OF EQUATIONS INSTALLATION OF 	Handout	
Aug. 29	GETTING STARTED WITH  (I)	Handout	Sample Quiz
Aug. 31	GETTING STARTED WITH  (II)	LAN04, 05, 06, 08, 09 and 10	Lab01 out
Sep. 05	LABOR DAY		
Sep. 07	STATISTICS AND SPATIAL DATA	BBR01	Quiz01
Sep. 12	DISPLAYING AND INTERPRETING DATA (I)	BBR02	Quiz02
Sep. 14	DISPLAYING AND INTERPRETING DATA (II)	LAN 07	
Sep. 19	DISPLAYING AND INTERPRETING DATA (III)	LAN10, 11 and 12	Lab02 out
Sep. 21	DESCRIBING DATA WITH STATISTICS (I)	BBR03	Quiz03
Sep. 26	DESCRIBING DATA WITH STATISTICS (II)		Lab03 out
Sep. 28	STATISTICAL RELATIONSHIPS (I)	BBR04	Quiz04 (4.1-4.3)
Oct. 03	STATISTICAL RELATIONSHIPS (II)	LAN15	Lab04 out
Oct. 05	STATISTICAL RELATIONSHIPS (III)	LAN16	Quiz05 (4.4-4.5)
Oct. 10	STATISTICAL RELATIONSHIPS (IV)		Lab05 out
Oct. 12	RANDOM VARIABLES AND PROBABILITY DISTRIBUTIONS (I)	BBR05 LAN14	Quiz06 (5.1-5.3)
Oct. 17	RANDOM VARIABLES AND PROBABILITY DISTRIBUTIONS (II)		Lab06 out Quiz07 (5.4-A5b)
Oct. 19	SAMPLING (I)	BBR06	Quiz08
Oct. 24	SAMPLING (II)		Lab07 out
Oct. 26	POINT AND INTERVAL ESTIMATION (I)	BBR07	Quiz09
Oct. 31	POINT AND INTERVAL ESTIMATION (II)		Lab08 out
Nov. 02	ONE-SAMPLE HYPOTHESIS TESTING (I)	BBR08	Quiz10

Nov. 07	ONE-SAMPLE HYPOTHESIS TESTING (II)		
Nov. 09	TWO-SAMPLE HYPOTHESIS TESTING	BBR09	Lab09 out Quiz11
Nov. 14	NONPARAMETRIC METHODS (I)	BBR10	Quiz12 (10.1-10.5)
Nov. 16	NONPARAMETRIC METHODS (II)		Lab10 out
Nov. 21	FALL BREAK		
Nov. 23	FALL BREAK		
Nov. 28	INFERENTIAL ASPECTS OF LINEAR REGRESSION (I)	BBR12	Quiz 13
Nov. 30	INFERENTIAL ASPECTS OF LINEAR REGRESSION (II)		Lab11 out
Dec. 05	EXTENDING REGRESSION ANALYSIS	BBR 13	Quiz 14
Dec. 07	REVIEW SESSION		
Dec. ??	FALL EXAM: TBA		

Labs:

Lab	Topic
Lab01	Working with  and the Equation Editor
Lab02	Visualization of Data
Lab03	Describing Univariate and Bivariate Distributions
Lab04	Correlation Analysis
Lab05	Bivariate Linear Regression
Lab06	Probability Calculus and Theoretical Distributions
Lab07	Sampling
Lab08	Point and Interval Estimation
Lab09	One- & Two-Sample Tests
Lab10	Non-parametric Statistics
Lab11	Inferential Aspects of linear Regression

Course Policies

Grading (credit) Criteria	Policies:								
	• Labs, quizzes and the final exam need to be solved <u>individually</u> unless otherwise stated. <u>Plagiarism cannot be tolerated!</u> • Participation is highly encourages 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>12 Quizzes @ 2 pts out of 14 quizzes: <u>closed book</u>, based on assigned reading of chapters or selected chapter sections in BBR <i>Note: the weakest two quizzes will not count</i></td><td>24 pts</td></tr><tr><td>11 Labs @ 4 pts: labs should be handed in as hardcopies rather than electronically by email. <i>In parts, the labs will prepare you for the final exam.</i></td><td>44 pts</td></tr><tr><td>Final Exam: based on BBR01 to BBR10 and BBR12 to</td><td>32 pts</td></tr></table>	Requirements	Points	12 Quizzes @ 2 pts out of 14 quizzes: <u>closed book</u> , based on assigned reading of chapters or selected chapter sections in BBR <i>Note: the weakest two quizzes will not count</i>	24 pts	11 Labs @ 4 pts: labs should be handed in as hardcopies rather than electronically by email. <i>In parts, the labs will prepare you for the final exam.</i>	44 pts	Final Exam: based on BBR01 to BBR10 and BBR12 to	32 pts
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	<i>BBR13. All concepts practiced in the labs are relevant. Open book and open notes. Bring a pocket calculator</i>
Late Work	Work that is late by <i>one day</i> will lead to a deduction of 10% of its points. Work that is late by <i>two days</i> will lead to a deduction of 20 % of its points. Later work will <i>not be accepted</i> 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.
UTD Syllabus Policies	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.

These descriptions and timelines are subject to change at the discretion of the course instructor.