CIRP 6346 | ADVANCED DATA ANALYSIS

COURSE SYLLABUS | SPRING 2016

Instructor: Prof. Ard Anjomani
Office: **ARCH 418** | Email: **anjomani@uta.edu**
Spring 2016 | Thursday - 7:00PM - 9:50 PM

CAPPA College of Architecture, Planning and Public Affairs
The University of Texas at Arlington

CIRP 6346 SYLLABUS – ADVANCED DATA ANALYSIS | SPRING 2016

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Office Hours	Thursday | 3:00 - 5:00 pm
Section Information	CIRP 6346
Time and Place of Class Meeting	ARCH 329 - Thursday - 7:00PM - 9:50PM

Course Description

The objective of the course is to discuss applied statistics, particularly regression analysis and logit models, and apply these models to examples of social science and urban and regional analysis. The aim is to understand the techniques better through their use, to evaluate critically their use by others, and to learn to appreciate the subtle interplay of "scientific" methods and personal judgment in research and analysis. We will learn to make sense out of data through statistical analysis and to put the data in a format that people can understand. We will emphasize understanding why one method is used over another in different circumstances and the interpretation of the results from the computer. It is my expectation that the student will learn what method to use as well as why it is used, to interpret the inferential statistics and to “tell the story” of the dependent and independent variables.

We begin with introduction to research design, which includes an assignment whereby students prepare a research proposal, hopefully toward student’s dissertation, in which regression and/or logit analysis will be used. Students’ progress will be discussed every session till the due date of the research proposal. A brief review of statistics as a refresher will begin the statistics part of the course before moving on to linear regression. A multitude of topics under linear regression will be covered in depth, the purpose of which is to expose the student to many of the pitfalls one may encounter in conducting research and to become versed in regression applications and interpretation of results. It should also be noted that a brief review of important related statistical concepts will be discussed when the need arises. After a thorough treatment of bivariate and multivariate regression models we pay special attention to the case of the limited dependent variable. We often try to explain a phenomenon with only information on whether or not an event occurred or whether one of several possible events occurred. We will examine logit (and probit) models as methods to use in such occasions.

Since not everything is explainable by a single equation and that in some research the dependent variable may also play the part of an independent variable, multiple equation systems are often necessary. We will finally briefly explore Structural Equation Modeling (SEM) and multiple equation systems that include both two-stage least squares and path analysis. These models explore multivariate relationships in an integrated manner. Finally, on an ongoing basis, an introduction to the application of statistics in spatial modeling drawing on Geostatistical Analyst Tools and Spatial Statistics Tools will be discussed.

Learning Outcomes

By the end of this course, students should be able to:

- Understand the process of research design and how to prepare research proposal
- Understand and explain regression analysis and apply them in urban and regional analysis
- Evaluate and choose the appropriate techniques needed in urban and regional research
- Identify and explain bivariate and multivariate regression models
- Identify and explain logit and probit models and apply them in real world projects
- Identify and explain Structural Equation Modeling (SEM) and multiple equation systems.

Required Textbooks and Other Course Materials

There is no required textbook for the course, although the following textbooks are highly recommended. In addition to the useful chapters selected from the textbooks listed below, the instructor will make his presentation notes available to aid in the study and understanding of the readings throughout the semester in the course Blackboard at https://elearn.uta.edu/.

- Berenson, M. L., Levine, D. M., & Krehbiel, T. C. (2012) *Business Statistics: Concepts and Applications* (12th ed.). Upper Saddle River, NJ: Pearson Prentice Hall.
- Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E., (2014). *Multivariate Data Analysis* (7th ed.). Upper Saddle River, NJ: Pearson Prentice Hall.
- Mendenhall, W., Beaver, R., & Beaver, B. (2008). *Introduction to Probability and Statistics.* Belmont, CA: Cengage Learning.
- Mendenhall, W. & Sincich, T. (2012). *A Second Course in Statistics - Regression Analysis* (7th ed.), Upper Saddle River, NJ: Prentice Hall.
- Stevens J. P. (2009) *Applied Multivariate Statistics for the Social Sciences*. (5th ed.), New York: Routledge.
- Studenmund, A. H. (2014). *Using Econometrics: A Practical Guide* (6th ed.), Upper Saddle River, NJ: Prentice Hall.
- Wooldridge, J. M. (2013) Introductory Econometrics: A Modern Approach, (5th ed.), Mason, OH: South-Western.

There are two highly recommended resources in addition to the textbooks mentioned above, which provide students with hands-on experience in statistical analysis using SPSS.

- Hinton, P. R., McMurray, I., & Brownlow, C. (2014). *SPSS Explained*. New York: Routledge.
- Lomax, R. G., & Hahs-Vaughn, D. L. (2012). *Statistical Concepts: A Second Course*. New York: Routledge.

Course Requirements

- To attend the entire class session every week and to participate in class discussions and all activities. In-class activities and discussions are an integral part of our learning together.
- To complete all required readings, assignments, exercises, and examination.

- If you fail to submit your assignments or exercises on time due to an emergency, contact the instructor for the possibility of an extension.

Description of Major Assignments and Examinations

- Attendance and Class Participation

  Apart from the attendance required for every session, I expect active participation and careful reading of the assigned texts and respectful acknowledgement of views that may differ from yours.

- Assignments

  Students are required to complete two course assignments, being designed to help them to put together and test a useful model and interpret the results.

- Exercises

  During the semester, students are required to complete three course exercises, which have been prepared to help them put the knowledge and skills they have acquired into practice.

- Final Examination

  At the end of the semester a final exam is given to students to evaluate the understanding and critical thinking of students to identify and explain the reading materials discussed in the class. At the end of the semester, a prep-exam similar in nature to that of final exam is given to students to help them prepare for the final examination.

Attendance

At The University of Texas at Arlington, taking attendance is not required. Rather, each faculty member is free to develop his or her own methods of evaluating students' academic performance, which includes establishing course-specific policies on attendance. The attendance policy for this course requires regular class attendance from all students (If you must miss a class due to a conflict, please let the instructor know ahead of time). Students are responsible for all course information, content, and assignments that may be missed due to absence. The material is cumulative through the semester and missed material is necessary in subsequent meetings.

Classroom Etiquette

Please arrive at class on time or before the starting time. Your cell phone devices should be turned off if they cannot be set to a silent mode. Please be prepared for the class discussions. Please try to be pleasant and positive in your classroom behavior. Show respect for all class members. We can learn a great deal from each other, but this can only happen in a comfortable learning environment for everyone in the class. We have people from many different backgrounds in this class and people with many different levels of academic preparation. So please use a respectful and calm tone of voice all the time and avoid sarcasm, heavily judgmental or confrontational comments that will create an inhospitable classroom atmosphere.

Grading

Assignments	Points
• Attendance and Class Participation	10
• Exercises	15
• Assignments	30
• Final Examination	45
Total	**100**

Grade Scale	Description	Points
• A	Excellent	90-100
• B	Good	80-89
• C	Fair	70-79
• D	Passing	60-69
• F	Failure	0-59

Course Calendar

As the instructor for this course, I reserve the right to adjust this schedule in any way that serves the educational needs of the students enrolled in this course. – A. Anjomani

Week 1 - January 21

Introduction to the Course and Explain the Expectations and Requirements
Instructor's PPT 1 — Introduction to the Course

Week 2 - January 28

Introduction to Research Design
Instructor's PPT 2 — Introduction to Research Design

Required readings:

- Blaikie, N. (2010). *Designing Social Research* (2nd ed.). Cambridge: Polity Press – Chapter 1: Preparing Research Design and Chapter 8: Sample Research Designs.
- Neuman, W. L. (2014). *Social Research Methods: Qualitative and Quantitative Approaches* (7th ed.). Edinburgh Gate: Pearson – Chapter 6: Strategies of Research Design.

Recommended readings:

- Creswell, J. W. (2014). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches* (4th ed.). Thousand Oaks, CA: Sage Publications – Chapter 1: The Selection of Research Approach.

Assignment 1 – Part 1 – Conceptualizing a Research (Due February 25th)

Week 3 – February 04

Review of Statistics | Intro to Geo/Spatial Stat Tools
Instructor's PPT 3 — Review of Fundamental Concepts (Part I)
Discussion of Students' Research Design Progress

Required readings:

- Mendenhall, W., Beaver, R., & Beaver, B. (2008). *Introduction to Probability and Statistics.* Belmont, CA: Cengage Learning – Introduction & Chapter 1: Describing Data with Graphs.
- Mendenhall, W. & Sincich, T. (2012). *A Second Course in Statistics - Regression Analysis* (7th ed.), Upper Saddle River, NJ: Prentice Hall – Chapter 1: A Review of Basic Concepts.

Week 4 - February 11

Review of Statistics| Geo/Spatial Stat Tools
Instructor's PPT 4 — Review of Fundamental Concepts (Part II)
Discussion of Students' Research Design Progress

Required readings:

- Mendenhall, W., Beaver, R., & Beaver, B. (2008). *Introduction to Probability and Statistics.* Belmont, CA: Cengage Learning – Chapter 2: Describing Data with Numerical Measures.

Week 5 - February 18

Correlation and Regression | Geo/Spatial Stat Tools
Instructor's PPT 5 — Correlation and Regression
Discussion of Students' Research Design Progress

Required readings:

- Mendenhall, W. & Sincich, T. (2012). *A Second Course in Statistics - Regression Analysis* (7th ed.), Upper Saddle River, NJ: Prentice Hall – Chapter 3: Simple Linear Regression.

Recommended readings:

- Hinton, P. R., McMurray, I., & Brownlow, C. (2014). *SPSS Explained*. New York: Routledge – Chapter 14: Linear Correlation and Regression.

Week 6 - February 25

Regression Analysis | Geo/Spatial Stat Tools
Instructor's PPT 6 — Regression Analysis
Discussion of Students' Research Design Progress

Required readings:

- Lomax, R. G., & Hahs-Vaughn, D. L. (2012). *Statistical Concepts: A Second Course*. New York: Routledge – Chapter 7: Simple Linear Regression – Section 7.4: SPSS – Section 7.6: Template and APA-Style Write-Up.

Assignment 1 – Part 2 – Regression Analysis (Due March 31th)

Week 7 - March 03

Multiple Regression | Geo/Spatial Stat Tools
Instructor's PPT 7 — Multiple Regression Models
Discussion of Students' Research Design Progress

Required readings:

- Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E., (2014). *Multivariate Data Analysis* (7th ed.). Upper Saddle River, NJ: Pearson Prentice Hall – Chapter 3: Multiple Regression Analysis.
- Lomax, R. G., & Hahs-Vaughn, D. L. (2012). *Statistical Concepts: A Second Course*. New York: Routledge – Chapter 8: Multiple Regression – Section 8.7: SPSS – Section 8.9: Template and APA-Style Write-Up.

Recommended readings:

- Hinton, P. R., McMurray, I., & Brownlow, C. (2014). *SPSS Explained*. New York: Routledge – Chapter 15: Multiple Regression and Multiple Correlation.

Application Example: (Presentation time permitting)

- Anjomani, A. & Sekio, K. (2006). *Examining Polarization Effects of Globalization - The Case of Large U.S. Metropolitan Areas*, Unpublished.

Submission of Assignment 1 – Part 1 – Conceptualizing a Research

Week 8 – March 10

Multiple Regression – Further Issues | Geo/Spatial Stat Tools
Instructor's PPT 8 — Multiple Regression Further Issues

Required readings:

- Mendenhall, W. & Sincich, T. (2012). *A Second Course in Statistics - Regression Analysis* (7th ed.), Upper Saddle River, NJ: Prentice Hall – Chapter 7: Some Regression Pitfalls.
- Wooldridge, J. M. (2013) *Introductory Econometrics: A Modern Approach*, (5th ed.), Mason, OH: South-Western – Chapter 6: Multiple Regression Analysis: Further Issues.

Application Example: (Presentation time permitting)

- Anjomani, A. and Madapaka, P. (2014) Impacts of Transit Oriented Developments (TOD) and Mixed Use Centers (MUC) on Housing Values: a Study in Dallas-fort Worth Metroplex. In J. Trevino, (ed.) *Geography of Three Social Issues: STDs, Energy Consumption, & TOD impacts*, Universidad Autonoma de Nuevo, Monterrey, Mexico.

March 17 – Spring Break

Week 9 - March 24

Multiple Regression with Dummy Variables | Geo/Spatial Stat Tools
Instructor's PPT 9 — Dummy Variables and Residual Analysis

Required readings:

- Mendenhall, W. & Sincich, T. (2012). *A Second Course in Statistics - Regression Analysis* (7th ed.), Upper Saddle River, NJ: Prentice Hall – Chapter 8: Residual Analysis.
- Wooldridge, J. M. (2013) *Introductory Econometrics: A Modern Approach*, (5th ed.), Mason, OH: South-Western – Chapter 7: Multiple Regression Analysis with Qualitative Information: Binary (or Dummy) Variables.

Application Example: (Presentation time permitting)

- Anjomani, A. & and Shebeed, O. (2002). *Safety and Efficiency: Regression Results for Left Turn Movements.* Unpublished.

Week 10 - March 31

Multiple Regression and Model Building| Geo/Spatial Stat Tools
Instructor's PPT 10 — Interactions and Model Building

Required readings:

- Berenson, M. L., Levine, D. M., & Krehbiel, T. C. (2012) *Business Statistics: Concepts and Applications* (12th ed.). Upper Saddle River, NJ: Pearson Prentice Hall – Chapter 15: Multiple Regression Model Building – Chapter 15: Multiple Regression Model Building.
- Pardoe, L. (2012) *Applied Regression Modeling* (2nd ed.) John Wiley & Sons – Chapter 4: Regression Model Building I.

Week 11 - April 07

Logistic Regression | Geo/Spatial Stat Tools
Instructor's PPT 10 — Introduction to Logistic Regression and Logit Models

Required readings:

- Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E., (2014). *Multivariate Data Analysis* (7th ed.). Upper Saddle River, NJ: Pearson Prentice Hall – Chapter 6: Logistic Regression: Regression with a Binary Dependent Variable – Part I.

- Studenmund, A. H. (2014). *Using Econometrics: A Practical Guide* (6th ed.), Upper Saddle River, NJ: Prentice Hall – Chapter 12: Dummy Dependent Variable Techniques – Section 2: The Bionomial Logit Model.

- Wooldridge, J. M. (2013) *Introductory Econometrics: A Modern Approach*, (5th ed.), Mason, OH: South-Western – Chapter 17: Limited Dependent Variables Models and Sample Selection Corrections – Section 17.1: Logit and Probit Models for Binary Response.

Recommended readings:

- Hinton, P. R., McMurray, I., & Brownlow, C. (2014). *SPSS Explained*. New York: Routledge – Chapter 14: Linear Correlation and Regression – Logistic Regression.

- Lomax, R. G., & Hahs-Vaughn, D. L. (2012). *Statistical Concepts: A Second Course*. New York: Routledge – Chapter 9: Logistic Regression – Section 9.8: SPSS – Section 9.10: Template and APA-Style Write-Up.

Application Example: (Presentation time permitting)

- Anjomani, A. & and Shebeed, O. (2002). *Safety and Efficiency: Regression Results for Left Turn Movements.* Unpublished.

Submission of Assignment 1 – Part 2 – Regression Analysis

Week 12 - April 14

Logistic Regression | Geo/Spatial Stat Tools

Instructor's PPT 12 — Interpretation and Application of Logistic Regression

Required readings:

- Afifi, A. & Clark, V. (1984). *Computer-Aided Multivariate Analysis*, (3rd Ed.) New York: Chapman & Hall/CRC - Chapter 12: Logistic Regression.

- Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E., (2014). *Multivariate Data Analysis* (7th ed.). Upper Saddle River, NJ: Pearson Prentice Hall – Chapter 6: Logistic Regression: Regression with a Binary Dependent Variable – Part II.

Application Example: (Presentation time permitting)

- Lour, J. & Anjomani, A. (2002) Modal Choice Analysis for Multicenter Cities - The Case of Dallas-Fort Worth Metropolitan Area, *Unpublished*.

Week 13- April 21

Logistic Regression | Geo/Spatial Stat Tools
Instructor's PPT 13 — Multinomial and Nested Logit models

Required readings:

- Aldrich, J. H., & Nelson, F. D. (1984). Linear Probability, Logit, and Probit Models (VOl. 45) Thousand OaksSage, CA: Sage – Chapter 3: Estimation of Probit and Logit Models for Dichotomous Dependent Variables.
- Aldrich, J. H., & Nelson, F. D. (1984). Linear Probability, Logit, and Probit Models (VOl. 45) Thousand OaksSage, CA: Sage – Chapter 4: Minimum Chi-square Estimation and Polytomous Models.
- Ben-Akiva, M. E., & Lerman, S. R. (1985). *Discrete Choice Analysis: Theory and Application to Travel Demand*. MIT Press – Chapter 10: Models of Multidimensional Choice and the Nested Logit Model.
- Wrigley, N. (1985) Categorical Data Analysis for Geographers and Environmental Scientists, Caldwell: Blackburn Press – Part 4: Statistical Models for Discrete Choice Analysis.

Assignment 2 – Logistic Regression Assignment (Due May 4th)

Week 14 – April 28

Systems of Equations | Geo/Spatial Stat Tools
Instructor's PPT 14 — Systems of Equations/ Structural Equations Modeling [SEM]

Required readings:

- Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E., (2014). *Multivariate Data Analysis* (7th ed.). Upper Saddle River, NJ: Pearson Prentice Hall – Chapter 11: Structural Equations Modeling Overview.
- Stevens J. P. (2009) *Applied Multivariate Statistics for the Social Sciences*. (5th ed.), New York: Routledge – Chapter 16: Structural Equation Modeling.
- Wooldridge, J. M. (2013) *Introductory Econometrics: A Modern Approach*, (5th ed.), Mason, OH: South-Western – Chapter 16: Simultaneous Equations Models.

Application Example: (Presentation time permitting)

- Anjomani, A. (2002). Regional Growth and Interstate Migration. *Socio-Economic Planning Sciences*, 36(4), 239-265.

Week 15 – May 04

Course Review and Wrap-up Discussions

Submission of Assignment 2 – Logistic Regression

Final Examination will be made available online through Blackboard on **May 06** and the due date is **May 13, 11:59 pm**.

Drop Policy

Students may drop or swap (adding and dropping a class concurrently) classes through self-service in MyMav from the beginning of the registration period through the late registration period. After the late registration period, students must see their academic advisor to drop a class or withdraw. Undeclared students must see an advisor in the University Advising Center. Drops can continue through a point two-thirds of the way through the term or session. It is the student's responsibility to officially withdraw if they do not plan to attend after registering. **Students will not be automatically dropped for non-attendance**. Repayment of certain types of financial aid administered through the University may be required as the result of dropping classes or withdrawing. For more information, contact the Office of Financial Aid and Scholarships (http://uta.edu/aao/fao/).

Americans with Disabilities Act

UT Arlington is on record as being committed to both the spirit and letter of all federal equal opportunity legislation, including The Americans with Disabilities Act (ADA), The Americans with Disabilities Amendments Act (ADAAA), and Section 504 of the Rehabilitation Act. All instructors at UT Arlington are required by law to provide "reasonable accommodations" to students with disabilities, so as not to discriminate on the basis of disability. Students are responsible for providing the instructor with official notification in the form of a letter certified by the **Office for Students with Disabilities** (OSD). Students experiencing a range of conditions (Physical, Learning, Chronic Health, Mental Health, and Sensory) that may cause diminished academic performance or other barriers to learning may seek services and/or accommodations by contacting:
The Office for Students with Disabilities, (OSD) www.uta.edu/disability or calling 817-272-3364.
Counseling and Psychological Services, (CAPS) www.uta.edu/caps/ or calling 817-272-3671.
Only those students who have officially documented a need for an accommodation will have their request honored. Information regarding diagnostic criteria and policies for obtaining disability-based academic accommodations can be found at www.uta.edu/disability or by calling the Office for Students with Disabilities at (817) 272-3364.

Title IX

The University of Texas at Arlington does not discriminate on the basis of race, color, national origin, religion, age, gender, sexual orientation, disabilities, genetic information, and/or veteran status in its educational programs or activities it operates. For more information, visit uta.edu/eos. For information regarding Title IX, visit www.uta.edu/titleIX.

Academic Integrity

Students enrolled in this course are expected to adhere to the UT Arlington Honor Code:

> *I pledge, on my honor, to uphold UT Arlington's tradition of academic integrity, a tradition that values hard work and honest effort in the pursuit of academic excellence.*
>
> *I promise that I will submit only work that I personally create or contribute to group collaborations, and I will appropriately reference any work from other sources. I will follow the highest standards of integrity and uphold the spirit of the Honor Code.*

UT Arlington faculty members may employ the Honor Code as they see fit in their courses, including (but not limited to) having students acknowledge the honor code as part of an examination or requiring students to incorporate the honor code into any work submitted. Per UT System Regents' Rule 50101, §2.2, suspected violations of university's standards for academic integrity (including the Honor Code) will be referred to the Office of Student Conduct. Violators will be disciplined in accordance with University policy, which may result in the student's suspension or expulsion from the University.

Electronic Communication

UT Arlington has adopted MavMail as its official means to communicate with students about important deadlines and events, as well as to transact university-related business regarding financial aid, tuition, grades, graduation, etc. All students are assigned a MavMail account and are responsible for checking the inbox regularly. There is no additional charge to students for using this account, which remains active even after graduation. Information about activating and using MavMail is available at http://www.uta.edu/oit/cs/email/mavmail.php.

Student Feedback Survey

At the end of each term, students enrolled in classes categorized as "lecture," "seminar," or "laboratory" shall be directed to complete an online Student Feedback Survey (SFS). Instructions on how to access the SFS for this course will be sent directly to each student through MavMail approximately 10 days before the end of the term. Each student's feedback enters the SFS database anonymously and is aggregated with that of other students enrolled in the course. UT Arlington's effort to solicit, gather, tabulate, and publish student feedback is required by state law; students are strongly urged to participate. For more information, visit http://www.uta.edu/sfs.

Final Review Week

A period of five class days prior to the first day of final examinations in the long sessions shall be designated as Final Review Week. The purpose of this week is to allow students sufficient time to prepare for final examinations. During this week, there shall be no scheduled activities such as required field trips or performances; and no instructor shall assign any themes, research problems or exercises of similar scope that have a completion date during or following this week unless specified in the class syllabus. During Final Review Week, an instructor shall not give any examinations constituting 10% or more of the final grade, except makeup tests and laboratory examinations. In addition, no instructor shall give any portion of the final examination during Final Review Week. During this week, classes are held as scheduled. In addition, instructors are not required to limit content to topics that have been previously covered; they may introduce new concepts as appropriate.

Emergency Exit Procedures

Should we experience an emergency event that requires us to vacate the building, students should exit the room and move toward the nearest exit, which is located up the stairs. When exiting the building during an emergency, one should never take an elevator but should use the stairwells. Faculty members and instructional staff will assist students in selecting the safest route for evacuation and will make arrangements to assist individuals with disabilities.