#### **Department of Criminal Justice and Criminology**

# CRIJ7389.01 Advanced Statistics II Spring 2018

Professor: Yan Zhang, Ph.D. Office: C-221 Phone: 936-294-3034 Email: zhangyan@shsu.edu Class Hours: Wednesday 1:00 pm – 3:50 pm Class Room: CJA-111 Office Hours: Tuesday 1:30 pm – 2:30 pm; or by appointment

## **Required Text**

Garson, David. 2013. Generalized Linear Models/Generalized Estimating Equations. Statistical Associates Publishing. NC: Asheboro.

Byrne, Barbara. 2012. Structural Equation Modeling with Mplus: Basic Concepts, Applications, and Programming. Routledge. NY: New York.

*Further required/recommended readings* will be provided through the blackboard system.

## **Course Description**:

This course introduces students to generalized linear models (GZLM) and structural equation modeling. Building upon the analysis of variance and regression models, this course reviews regression models and logistic models for binary/categorical dependents, and focuses on demonstrating the Poisson regression for count data, gamma regression for skewed models, and negative binomial regression for overdispersed count data. This course also introduce to students the basic concepts of structural equation modeling, and illustrates its basic applications using the Mplus program. This course emphasizes the application of these methods and will introduce computer programming using software of SPSS and Mplus.

Prerequisite: CRIJ 7442 or an equivalent course.

#### **Course Objectives**

Upon completion of the course, the student should be able to:

- Understand the basic concepts of generalized linear models,
- Understand types of data distributions, types of link functions, and apply GZLM models

- Understand the basic concepts associated with SEM, the processes of model building, and the formulation of covariance and mean structure modeling
- Utilize SPSS program for GZLM, and
- Familiarize with the Mplus program and its application to SEM

# **Course Requirements**

Class lectures are not intended to be your only source of information for this course. It is very important that you read all the outlined chapters, review these chapters as necessary, and seek other materials that could supplement your knowledge or assist you in better understanding the materials we are covering in class. You are encouraged to form study groups with other members of the class, but you need to work independently on the assignments or research projects.

Students are expected to keep up with the readings and to complete assignments on time. Late assignments will not be accepted. If you cannot complete assignments on time due to an emergency, you must let me know before the assignment is due if this is humanly possible.

## Mplus Software and Data

This course relies on Mplus software. You can access the software in the graduate computer lab. We will spend time in class going over programming, but students are expected to familiarize themselves with the software package.

Datasets for your assignments will be provided on blackboard. Dataset for your research project will be provided as needed. Please note that datasets used for your research projects (if the datasets are provided by the instructor) should not be used for any other purpose; and should not be shared or otherwise distributed to people outside of the course without permission from the instructor.

#### Your grade for this course will be comprised of two parts:

• Five Assignments (20 points each)

There will be five assignments based on different statistical techniques discussed in class. These assignments are intended to help you to understand the statistical methods and learn how to use SPSS and Mplus. While you are encouraged to work together and help each other in learning SPSS and Mplus and interpreting the results, you need to complete your assignments independently.

For each assignment, students will be required to conduct analysis of the dataset, and write a brief summary of the results. Mplus output should be attached as an appendix.

Assignments must be turned in at the beginning of class on the day they are due or they will be considered late. For each day that an assignment is late (regardless of the reason), two points will be subtracted from the grade.

• Term Project (100 points).

Each student will write a research project utilizing either the GZLM or the SEM. Student needs to identify a research topic as well as datasets that allow the application of the appropriate statistical models by February 14<sup>th</sup>.

The components of the term project should include:

- 1. Title of your research project;
- 2. Introduction, which briefly states the problems, purpose and objectives, and establishes the importance of your research;
- 3. Literature review, which briefly reviews the relevant literature, formulates theoretical structure and/or conceptual scheme, and summarizes the research status of the questions;
- 4. Develop research questions and hypotheses;
- 5. Describe the methods, including dataset, measures of variables, and statistical models; conduct empirical analysis; and explain and interpret statistical results; and
- 6. Discuss the impact as well as the limitations and weaknesses of your research.

The data analysis and interpretation of your results should take up a greater proportion of your paper. You should fully explain what your statistics mean and what you can deduct from them as they relate back to your hypotheses and literature review.

The project is expected to be an original work developed solely for this class. The final paper will be 15-20 pages in length (not including the required cover page, table of contents, references pages or appendix).

A minimum of 15 refereed journal sources is required for the paper. All papers must be referenced according to the APA format, with long quotes (3 or more lines) indented and double-spaced. Standard margins and fonts should be used.

The final project should be suitable for presentation and subsequent publication.

Authorship: If the research topic and dataset are provided by the instructor, the instructor will hold the primary or secondary authorship on that paper.

Procedure and guidelines for your research project

1. Research topic (Due Feb 21<sup>st</sup>, 2018) –20 points

Identify a provisional research topic. Explain what the purpose of your study is, and what the research questions that will be examined are. Describe the dataset that will be used, including the original data collection procedure, sample size, and variables available measuring the major concepts of your research questions. Even if the topic is provided by the instructor, students still need to clarify these issues.

Please submit a short proposal (two pages, double spaced), with at least 5 refereed journal references.

2. Research proposal with finished literature review (Due March 21<sup>st</sup>, 2018) –20 points

3. First formal draft with focus on modeling building and analysis (Due April 18<sup>th</sup>, 2018) –40 points

4. Presentation and final formal project (Due May 2<sup>nd</sup>, 2018) –20 points

Grading:

89.5—above A 79.5—89.4 B 69.6—79.4 C

Make-up Exam Policy: No make-up exams.

**Student Academic Policies** concerning Attendance, Academic Honesty, Disabled Student and Services for Disabled Students, and Absences on Religious Holy days may be found at:

http://www.shsu.edu/dept/academic-affairs/aps/aps-students.html.

Use of Telephones and Text Messages in Academic Classrooms and Facilities: http://www.shsu.edu/dept/academic-affairs/aps/aps-curriculum.html

# **Course Schedule:**

The reading material listed for each lecture should be read before attending that class. Extra readings will be posted on blackboard. This schedule is subject to change over the course of the semester. Advance notice of changes will be announced during class.

Week 1	Introduction		
Jan 17			
Week 2	Overview of GZLM	Garson	
Jan 24	types of data distribution, link function,		
	and model		

Week 3	GZLM model	Garson	
Jan 31	Ordinal Logistic Regression		
Week 4	GZLM model	Garson	Assignment 1-
Feb 7	Poisson Regression		due
Week 5	ACJS		Assignment 2-
Feb 14			due
Week 6	GZLM model	Garson	Research Topic
Feb 21	Negative Binomial Regression		Due
Week 7	Introduction to SEM	Byrne, Chaps 1	Assignment 3-
Feb 28		& 2	due
Week 8	First-Order CFA	Byrne, Chaps 3	
Mar 7	A Theoretical Construct		
Week 9	Spring Break		
Mar 14			
Week 10	First-Order CFA	Byrne, Chap 4	Literature review
Mar 21	A Measuring Instrument		due
Week 11	Second-Order CFA	Byrne, Chap 5	Assignment 4-
Mar 28			due
Week 12	Full SEM	Byrne, Chap 6	
April 4			
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Week 13	Testing the Equivalence of a Measuring	Byrne, Chap 7	Assignment 5-
April 11	Instrument		due
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Week 14	Testing the Equivalence of Latent Factor	Byrne, Chap 8	First draft due
April 18	Means		
Week 15	Testing the Equivalence of a Causal	Byrne, Chap 9	
April 25	Structure		
Week 16	Project Presentation		Project due
May 2			-
Week 17	1:00 pm – 3:50 pm		
May 9	Final Exam		