**Statistical Models**Department of Mathematics, MATH 5305-010  
MW in Math 213

Fall 2019

Dr. Jesse Crawford

[jcrawford@tarleton.edu](mailto:jcrawford@tarleton.edu)

faculty.tarleton.edu/crawford

(254) 968-9536

Office: Math 332

Office hours: TR 9:30 – 10:30 and 1:00 – 1:30

***Course Prerequisites***

MATH 3311

***Course Description***

This course covers the basics of experimental design, mathematical theory for linear and logistic regression models in the multivariate case, and diagnostics and remedial measures for these models. Other topics will be selected from time series analysis, principle components, canonical correlations, factor analysis, discriminant analysis, and cluster analysis.

***Student Learning Outcomes***

Knowledge outcomes: Students will demonstrate knowledge of the following topics

* Basics of experimental design, such as the distinction between observational studies and experiments, randomization, blinding, and confounding variables.
* The mathematical assumptions of statistical models, such as simple and multivariate linear regression models and logistic regression models.
* Techniques of estimation and hypothesis testing for these models, including ordinary least squares, generalized least squares, maximum likelihood estimation, *t*-tests, *F*-tests, and likelihood ratio tests.

Skill outcomes: Students will demonstrate proficiency in the following skills

* Using software to fit statistical models to real data sets and make predictions.
* Assessing the appropriateness of models with diagnostics, such as the Shapiro-Wilk test, Brown-Forsythe test, Durbin-Watson test, and various residual plots.
* Addressing problems with models using remedial measures such as Box-Cox transformations and generalized least squares.
* Analyzing empirical papers that use statistical models.
* Calculation of expected values in the multivariate setting, including the covariance and correlation coefficient of two random variables.

***Required Texts, Materials, or Equipment***

* *Statistical Models: Theory and Practice, Revised Edition*, by David Freedman.

***Optional Materials***

* *Applied Linear Statistical Models*, by Kutner et al.
* *Applied Logistic Regression, 2nd ed.*, by Hosmer and Lemeshow.

***Homework***

Homework/labs will be assigned almost every class meeting and will be due a week later. It is crucial to keep up with the homework to succeed in this course.

***Final Project***

A detailed explanation of the final project is posted at the course webpage, and it is due Monday, December 2.

***Exams***

There will be a midterm exam during the semester, and the **cumulative final exam** will be held on Monday, December 9, from 6:30 – 8:30 p.m.

***Class Participation***

Although class participation does not count towards the course grade, all interactions in class will be civil, respectful, and supportive of an inclusive learning environment for all students. Students are encouraged to speak to the instructor, department chair, or an advisor, about any concerns they may have about classroom participation and classroom dynamics.

***Grading Policy***

Please refer to the current University Catalog for additional information regarding grades and course withdrawal policies. For this course, your grade will be determined in the following manner:

|  |  |
| --- | --- |
| **Assignment** | **% of Grade** |
| Homework/Labs | 40% |
| Midterm Exam | 20% |
| Final Project | 20% |
| Final Exam | 20% |

Tarleton differentiates between a failed grade in a class because a student never attended (F0 grade), stopped attending at some point in the semester (FX grade), or because the student did not pass the course (F) but attended the entire semester. These grades will be noted on the official transcript. Stopping or never attending class is considered an unofficial withdrawal and can result in the student having to return aid monies received.  For more information see the Tarleton Financial Aid website.

***Missed Exams and Late Homework***

A student who misses an exam for a valid reason, such as **serious** illness or the death of a family member will be allowed to make up the exam. Students who make up exams are required to provide documentation confirming that the absence occurred for a legitimate reason.

You may submit up to three late homework assignments during the semester, and three homework assignments will be dropped.

***Attendance Policy***

Attending class regularly and completing assignments on time is essential to performing well in mathematics courses, and you should strive to only miss class when absolutely necessary. Attendance does not count toward the final grade in this course.

***Standards of Conduct & Academic Dishonesty***

Cheating, plagiarism, or doing work for another person who will receive academic credit is impermissible. This includes the use of unauthorized books, notebooks, or other sources in order to secure or give help during an examination, the unauthorized copying of examinations, assignments, reports, or term papers, or the presentation of unacknowledged material as if it were the student’s own work. Disciplinary action may be taken beyond the academic discipline administered by the faculty member who teaches the course in which the cheating took place.

Tarleton State University expects its students to maintain high standards in personal and scholarly conduct. Students guilty of academic dishonesty are subject to disciplinary action. Academic dishonesty includes, but is not limited to, cheating on examination or other academic work, plagiarism, collusion, and the abuse of resource materials. The faculty member is responsible for initiating action for each case of academic dishonest that occurs in his/her class (TSU catalog, p. 9). Academic honesty is expected. Cheating will not be tolerated and will result in automatic failure of the course. The University’s Academic Integrity Policy will be maintained.

**Tarleton State University Core Value Statements:**

**Academic Integrity Statement**

Tarleton State University's core values are integrity, leadership, tradition, civility, excellence, and service. Central to these values is integrity, which is maintaining a high standard of personal and scholarly conduct. Academic integrity represents the choice to uphold ethical responsibility for one’s learning within the academic community, regardless of audience or situation.

**Academic Civility Statement**

Students are expected to interact with professors and peers in a respectful manner that enhances the learning environment. Professors may require a student who deviates from this expectation to leave the face-to-face (or virtual) classroom learning environment for that particular class session (and potentially subsequent class sessions) for a specific amount of time. In addition, the professor might consider the university disciplinary process (for Academic Affairs/Student Life) for egregious or continued disruptive behavior.

**Academic Excellence Statement**

Tarleton holds high expectations for students to assume responsibility for their own individual learning.  Students are also expected to achieve academic excellence by:

* honoring Tarleton’s core values.
* upholding high standards of habit and behavior.
* maintaining excellence through class attendance and punctuality.
* preparing for active participation in all learning experiences.
* putting forth their best individual effort.
* continually improving as independent learners.
* engaging in extracurricular opportunities that encourage personal and academic growth.
* reflecting critically upon feedback and applying these lessons to meet future challenges.

**Academic Service Statement**

In support of Tarleton’s core value of service, each student is expected to participate in a service learning experience as a part of the Spring term week of service. This experience will challenge students to be engaged in the local community, address a community need, connect course objectives to the world around you, and involve structured student reflection. In this service learning experience you will not only enhance your knowledge and skills, but actively use those skills as you serve your community.

**AMERICANS WITH DISABILITIES ACT STATEMENT:**

*It is the policy of Tarleton State University to comply with the Americans with Disabilities Act and other applicable laws. If you are a student with a disability seeking accommodations for this course, please contact the Center for Access and Academic Testing, at 254.968.9400 or* [*caat@tarleton.edu*](mailto:caat@tarleton.edu)*. The office is located in Math 201. More information can be found at* [*www.tarleton.edu/CAAT/*](http://www.tarleton.edu/CAAT/) *or in the University Catalog.*

**Copyright Information:**

Tarleton State University is committed to adhering to all applicable laws regarding intellectual property, specifically the rights of copyright holders and compliance with copyright law. It is the responsibility of all members of the Tarleton State University community to make a good faith determination that their use of copyrighted materials is in compliance with Title 17 U.S. Code, the United States Copyright Act, Fair use, Digital Millennium Copyright Act of 1998, and the Technology, Education, and Copyright Harmonization (TEACH) Act of 2002. Guidelines in use at Tarleton State University regarding copyright can be found on the [Fair Use, Copyright, and the TEACH Act Information page](https://www.tarleton.edu/library/services/copyright.html). For more information, please contact Ms. Jennifer Sherwood at [jsherwood@tarleton.edu](file:///C:\Users\jcrawford\Downloads\jsherwood@tarleton.edu).

Please be aware that copyright protection also extends to the use of films for educational purposes. It is acceptable to show a full-length feature film in a face-to-face class, if the film 1) was acquired through library check out or legally purchased and 2) pertains directly to the curriculum for that class. It cannot be legally shown in its entirety in an online class or to the public. A more in-depth presentation of information can be found at: <http://www.ala.org/advocacy/copyright/teachact/faq>

***Disclaimer***

The instructor reserves the right to make modifications to this information throughout the semester. The course schedule is tentative. The instructor reserves the right to change this syllabus at any time. Any changes will be announced in class in advance.

***Tentative Schedule of Topics***

|  |  |
| --- | --- |
| Monday | Wednesday |
| 26-Aug | 28-Aug |
| Introduction | Introduction |
| 2-Sep | 4-Sep |
| **Labor Day** | Controlled Experiments (FPP Packet) |
| 9-Sep | 11-Sep |
| Observational Studies (FPP Packet) | 3.1, 3.2 |
| 16-Sep | 18-Sep |
| 3.3, 3.4 | 3.4, 3.5 |
| 23-Sep | 25-Sep |
| **Lab 1** (Meeting in room 227) | 2.1, 2.2, 4.1 |
| 30-Sep | 2-Oct |
| 4.2 | **Lab 2** |
| 7-Oct | 9-Oct |
| 4.3, 4.4, Midterm Exam Review | **Midterm Exam** |
| 14-Oct | 16-Oct |
| 5.6 | 5.6, 5.7 |
| 21-Oct | 23-Oct |
| **Lab 3** | 5.7 (Categorical Variables) |
| 28-Oct | 30-Oct |
| **Lab 4** | 5.3 |
| 4-Nov | 6-Nov |
| 5.4 | **Lab 5** |
| 11-Nov | 13-Nov |
| Diagnostics and Remedial Measures I | **Lab 6** |
| 18-Nov | 20-Nov |
| Diagnostics and Remedial Measures II | **Lab 7** |
| 25-Nov | 27-Nov |
| Logistic Regression | **Thanksgiving Break** |
| 2-Dec |  |
| Final Exam Review |  |