CSCI 5663 Statistical Programming Syllabus

Course Information

Course Number	CSCI 5663
Title	Statistical Programming
College	School of the Sciences
Department	Division of Computer Science
Term	Summer 2024
Format	Online
Meeting Days	Thursday
Meeting Time	4:00 - 5:00 PM
Meeting Room	Online
Meeting Link	https://twu-edu.zoom.us/j/8362252819
Weeks	10
Number of Meetings	9
Hours per Week	3
Credit Hours	3

Instructors Information

Instructor	Islam Akef Ebeid
Contact Number	(940) 898-2165
E-mail	iebeid@twu.edu
Office Days	Mondays, Wednesday, Friday
Office Hours	4:00 - 5:00 PM
Mode	drop by appointment outside these hours
Office	MCL 412
Zoom	https://twu-edu.zoom.us/j/8362252819

Course Description and Prerequisites

Design statistical programs to manipulate raw data, generate reports, and analyze data. Numerous case studies demonstrate appropriate analysis based on the experimental design and advanced statistical research methods such as ANOVA, MANOVA, repeated measures ANOVA, Multiple Linear and Logistic regression, factor analysis, and survival analysis SAS. Prerequisite: Six hours of undergraduate statistics, or three hours of graduate level statistics, or equivalent. Three lecture hours a week. Credit: Three hours.

Course Philosophy, Format, and Learning Outcomes

Philosophy

The goal of the course is first to introduce the student to an advanced set of skills that would allow them to translate the statistical concepts they have learned before into fully functional programs. Second, to introduce the student to the principles of experimental design, hypothesis testing, and quantitative and qualitative data analysis. The course flows as follows to ensure that the intended set of skills is instructed in a way that would create a cohesive context for the student.

Probability Theory: This includes a refresher of basic statistical concepts like the normal distribution, central limit theorem, and the weak law of large numbers.

Experimental Design: How to design experiments with subjects and how to analyze them.

Data Preparation: Using Python to learn how to do initial data preparation and preprocessing.

Advanced Statistical Methods: Predictive methods like linear regression and logistic regression

Report Generation: How to generate a visually appealing and accurate statistical report using both Python and R

Format

This course is entirely online and asynchronous, meaning that the content will be delivered as recordings, slides, discussions, assignments, and quizzes via Canvas. The student shall log in each week to find the available content associated with this week. The recorded sessions will consist of multiple parts; the first part will consist of a lecture on the current week's topic, followed by a discussion of the readings for this week, followed by a practical topic in statistical programming, such as a tutorial on how to use Python Pandas package or how to install and start developing code in R Studio. I will also discuss the quizzes and the assignments during the lectures. A weekly quiz should be expected. The quizzes are due 7 days from the day they are assigned. There will be a total of 4 assignments, all due by the end of the semester, and will all be revealed by midsemester each week starting the 2nd week. There will be a minimal final project due by the end of the semester.

Learning Outcomes

The student should expect the following measurable learning outcomes:

1- Accurately understand and implement different probabilistic distributions.
2- Accurately design an experiment.
3- Understanding the different methods of analyzing the collected data qualitatively or quantitively.
4- Accurately write a program to analyze the data.
5- Accurately perform statistical analysis, such as hypothesis testing.

Course Materials

Textbooks, References, and Materials

Code	Type	Title	Author	URL
[TPAD]	Textbook	Think Python	Allen B. Downey	https://greenteapress.com/thinkpython2/html/index.html
[POAD]	Textbook	Probably Overthinking It	Allen B. Downey	https://shorturl.at/bghDQ
[TBAYES]	Textbook	Think Bayes	Allen B. Downey	https://allendowney.github.io/ThinkBayes2/
[TSTATS]	Textbook	Think Stats	Allen B. Downey	https://greenteapress.com/thinkstats2/html/index.html
[FCEXP]	Textbook	First Course in Design and Analysis of Experiments	Gary w Oehlert	http://users.stat.umn.edu/~gary/book/fcdae.pdf
[RDS]	Textbook	R for Data Science	Hadley Wickham	https://r4ds.hadley.nz/
[LSR]	Textbook	Learning Statistics with R	Danielle Navarro	https://learningstatisticswithr.com/lsr-0.6.pdf
[BRIT]	Webpage	Britannica	David Anderson	https://www.britannica.com/science/statistics

[STATQUEST]	YouTube	StatQuest	Josh Starmer	https://www.youtube.com/@statquest
[3B1B]	YouTube	3Blue1Brown	Grant Sanderson	https://www.youtube.com/@3blue1brown

Software

Name	**Download**
R	https://dev.mysql.com/downloads/installer/
R Studio	https://posit.co/downloads/
Python	https://www.python.org/downloads/
PyCharm	https://www.jetbrains.com/pycharm/download/?section=windows

Course Schedule

Week	**Module/Lecture**	**Slides**	**Readings**	**Lab**	**Quiz**	**Assignments**
1 June 3	Introduction: Syllabus + Basic Statistical Concepts	Syllabus Central dogma in Statistics	Syllabus	Installing Python and R Basic statistics with Python and R.	Extra Credit Survey (Introductions + Programming Skills)	No Assignments
2 June 10	Probability Theory Python and R for Statistics	Probability Distributions Python statistical packages Basic R programming concepts	Chapter 1 in [POAD]	Python Pandas R Data Frames	Quiz 1 Due June 17	Assignment 1 Due June 24
3 June 17	Probability Distributions	The Properties of the Gaussian Distribution The Binomial Distribution	Chapter 2 in [POAD]	How to plot and fit a Gaussian distribution	Quiz 2 Due June 24	Assignment 2 Due July 12
4 June 24	Experimental Design Correlation Analysis	Quantitative and Qualitative methods Longitudinal studies, Case studies, Cross-sectional studies, and other types of experimental design.	Chapter 2 in [TSTATS]	Parametric and non-parametric correlation analysis	Quiz 3 Due July 5	Assignment 3 Due July 12
5 July 1	Hypothesis Testing Data Preprocessing and Exploratory Data Analysis	Python and R in Data Preprocessing	Chapter 3 in [TSTATS] Chapter 4 in [TSTATS]	T-Tests in Python and R	Quiz 4 Due July 8	Assignment 4 Due July 29.
6 July 8	Analysis of Variance	Analysis of Variance	Chapter 5 in [TSTATS]	Z-Test and ANOVA in Python and R	Quiz 5 Due July 15	Assignment 5 Due July 29.
7 July 15	Regression Analysis	Linear Regression in detail	Chapter 7 in [TSTATS]	Logistic Regression Linear Regression, Multiple Linear Regression, In Python and R	Quiz 6 Due July 22	Assignment 6 Due July 29.
8 July 22	Advanced Analytic Methods	Multivariate Factor Analysis Machine Learning	Chapter 11 in [TSTATS]	Factor Analysis, Survival Analysis, ANOVA, MANOVA, Repeated measures ANOVA in Python and R	Quiz 7 Due August 4	Assignment 7 Due August 4
9 July 29	Generating Reports	Types of graphs and visualizations. How to write up	No readings	Python-Matplotlib, R-gplot2	Course Recap	Course Recap

		your research findings.				
10 August 5	Final Exam Final Project	Final Exam Final Project	Final Exam Final Project	Final Exam Final Project	Final Exam Final Project	Final Exam Final Project

Grade Policy

Grade Structure

Criteria	Number of Occurrences	Points per Occurrence	Total Points	Percentage of Total
Reading Quizzes	6/10	20	120	30%
Homework/Lab Assignments	4/10	40	160	40%
Final Exam	1/10	60	60	15%
Final Project	2/10	50+10	60	15%
Total	10/10	-	400	100%

Grade Bracket

A	90%-100%	Excellent work
B	80%-90%	Good work
C	70%-80%	Satisfactory work
D	50%-70%	Needs work
F	Below 50%	Failure to show competence

Academic Resources

General guidelines for succeeding in this course:

- If you are having trouble finishing an assignment, seek help.
- A good grade could be achieved if you showed effort and explained your thought process despite having an incorrect result.
- See your errors and mistakes as opportunities to learn more.
- I will provide you with feedback. Sometimes, the input will sound like criticism. Not everyone likes that. Please understand that the feedback comes from my intention to ensure you know the content and build the necessary skills.
- Show effort instead of focusing on getting everything right. I grade based on effort.

Technology

Please let me know if you need a computer or a laptop for this class. If you need any assistance with technology, please reach out to the IT Solutions (https://twu.edu/technology/)

Library Services

Please don't buy textbooks or software that you might need for this class before checking in at the library first. https://twu.edu/library/. If you have any questions about the library or how to find a resource, please get in touch with me or Susan Whitmer (swhitmer@twu.edu)

Food Security

Minerva's Market is in The Student Union at Hubbard Hall, Room 1203
Social Work Food Pantry is in the Old Main Building, Room 406

Mental Health

If you need help with any issue that is affecting your academic performance, please refer to: https://twu.edu/student-health-services/mental-health/

or

https://twu.edu/counseling/

If you need immediate help, please go directly to Jones Hall Room 269 (M-F 8 AM to 6 PM) or call the Crisis Line: (940) 898-4357

Writing

If you have difficulty communicating in written English language, please let the instructor know, and please refer to the following:

https://twu.edu/write-site/

Tutoring

If you would like additional help for the class or any other classes, please notify the instructor and refer to:

https://catalog.twu.edu/graduate/services-available-students/tutoring-centers/

University Policies

For general university policies, please refer to https://web.saumag.edu/academics.

Disability Access Policy Statement

Texas Woman's University strives to make all learning experiences accessible. If you anticipate or experience academic barriers based on your disability (e.g., mental health conditions, learning disabilities, chronic medical conditions, etc.), please register with Disability Services for Students (DSS) to establish reasonable academic accommodations. After registration with DSS, please contact me to discuss how to implement your accommodation.

DSS contact information: DSS website (https://twu.edu/disability-services/); dss@twu.edu; 940-898-3835; CFO Ste. 106.

If you have any questions regarding disability, please reach out to me or Nadaya Cross (ncross1@twu.edu)

Title IX: Sexual Violence Education

TWU is committed to providing a safe learning environment free of all forms of sexual misconduct, including sexual harassment, sexual assault, domestic violence, dating violence, and stalking. Federal laws (Title IX and the Violence Against Women Act) and TWU policies prohibit discrimination based on sex and therefore prohibit sexual misconduct. As students, if you or someone you know is experiencing sexual harassment, relationship violence, stalking, or sexual assault, there are campus resources available to provide support and assistance. Alleged sexual misconduct can be non-confidentially reported to the Title IX Coordinator at the Report an Incident website (https://twu.edu/civility/report-an-incident/) or at (940) 898-2968. Additionally, please be aware that under Title IX of the Education Amendments of 1972, all employees must disclose information about

such misconduct to the Title IX Office. Students who wish to speak to a confidential employee who does not have this reporting responsibility can contact TWU Counseling and Psychological Services at (940) 898-3801 for the Denton Campus, (214) 689-6655 for the Dallas Campus, and (713) 794-2059 for the Houston Campus.

Title IX: Pregnant Students

Title IX is a federal law that requires schools that receive federal funds to provide reasonable accommodation to students who are pregnant or have pregnancy-related conditions. This includes pregnancy, pre-natal doctor appointments, childbirth, false pregnancy, miscarriage, termination of pregnancy, or recovery from any of these conditions. Students needing academic accommodations due to pregnancy-related conditions should complete the Pregnancy Accommodation form (https://twu.edu/pregnancy-accommodation-form/) to coordinate educational needs.

Academic Integrity

Honesty in completing assignments is essential to the mission of the University and the development of the personal integrity of students. In submitting graded assignments, students affirm that they have neither given nor received unauthorized assistance and abided by all other provisions of the Academic Integrity Policy and the Student Code of Conduct as found on the TWU website and in the TWU Student Handbook. Cheating, plagiarism, collusion, dual submission of a paper, or other academic dishonesty will not be tolerated. It will result in appropriate sanctions, including failing an assignment, failing the class, being removed from an educational program, or being suspended or expelled. Allegations of academic dishonesty in this course may be reported to the Office of Civility and Community Standards. The specific disciplinary process for academic dishonesty is in the TWU Student Code of Conduct (https://public.powerdms.com/TWU1/documents/1745742) and Academic Integrity Academic Integrity Policy (https://public.powerdms.com/TWU1/documents/1748544). For details on avoiding plagiarism, review the library Tutorial: Avoiding Plagiarism (https://libguides.twu.edu/c.php?g=270163&p=1803990).

To ensure the integrity of the academic process, Texas Woman's University vigorously affirms the importance of academic honesty as defined by the Academic Integrity Policy and the TWU Student Code of Conduct. Therefore, Texas Woman's University faculty members may use Turnitin to compare a student's work with multiple sources to detect and prevent plagiarism. It then reports a similarity percentage and provides links to those specific sources. The tool itself does not determine whether a paper has been plagiarized. Instead, that judgment must be made by the individual faculty member. Some of the required assignments in this course may be checked for plagiarism using Turnitin.com.

Attendance Policy

Consistent attendance is vital to academic success and is expected of all students. Grades are determined by academic performance, and instructors may give students written notice that attendance related to specific classroom activities is required. Absence does not exempt students from academic requirements. Even if documented, excessive absences may result in a student's failing the course. Excused absences are within the purview of the instructor. Students must consult with instructors regarding make-up work.

Departmental Policies

Grading Policy

https://docs.google.com/document/d/1eeTJG916awbljyMG6zIOsuak2U_ozbCN/edit?usp=drive_link

AI Usage Policy

https://docs.google.com/document/d/1rPm6TjS8FRFTLbWD9ERbbBySfXCcHg9j/edit?usp=drive_link

Academic Honesty

https://docs.google.com/document/d/1n2yJvdRV2BzUb0QezPLeZwJyUJp_eE3Z/edit?usp=drive_link

Instructor Policies

Code of Conduct

Please respect that this is a respectable higher education institution and behave accordingly. Please keep your communication with your instructor and colleagues positive and constructive.

Late Assignments

Late work is not accepted unless there is a compelling reason. If this is the case, please communicate promptly and appropriately.

Academic Dishonesty

I rely on Turnitin to gauge the level of plagiarism in your work. This applies to writing and coding. The above 30% similarity is too much, and I consider this plagiarism. Using internet resources is allowed with restrictions that the instructor will mention during the classroom. Yet please don't copy and paste code or answers for any questions.

Holidays

The instructor will follow the federally and state-recognized holiday schedule by the University, which can be found here:

https://twu.edu/media/documents/registrar/Calendar-at-a-Glance-2022-2023.pdf

However, if you need special accommodation for religious or other types of holidays that you observe, please let the instructor know beforehand.

Diversity

The instructor is committed to diversity, inclusion, and equality in the classroom and by the university policies, regardless of cultural background, country of origin, religion, race, ethnicity, and sexual orientation. Please let the instructor know how you would like to be addressed. During the first lecture, the instructor will ask the students about their names, pronouns, and other forms of addressing they want to be referred to. Please notify the instructor if that changed or if you were addressed mistakenly.

Office Hours

Generally, email is the best way to reach me. You may drop by my office anytime within the specified hours if you need help. However, you should email first because multiple people might come simultaneously. If that's the case, I will meet with people on a first come, first served basis. I will also have to limit the sessions to 15 minutes if people are waiting. If two or more students come simultaneously, it will be in the order of the last name. Please come prepared to office hours with questions.

Conflict

In case of conflict between students in the classroom, the instructor will act as a mediator until proper university authorities or public safety are notified.