

The George Washington University – Department of Statistics

COURSE AND CONTACT INFORMATION

Course: STA 2183W – Intermediate Statistical Computing Packages

Semester: Spring 2023

Time: Monday/Wednesday 6:10 PM-7:25 PM

Location: Tompkins Hall 306

INSTRUCTOR

Name: Joshua Sparks

Campus Address: Phillips 735

E-mail: josparks@gwu.edu (Put STA 2183W in Subject)

Office hours: W 5-6 PM *with other hours offered by appointment*

TEACHING ASSISTANT

Name: Kieran Zhou

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Office Hours: Th 3-5 PM

COURSE DESCRIPTION

Application of program packages (e.g., SAS, R) to the solution of one-, two- and k-sample parametric and nonparametric statistical problems. Basic concepts in data preparation, modification, analysis and interpretation of results. Includes a significant engagement in writing as a form of critical inquiry and scholarly expression to satisfy the WID requirement.

COURSE PREREQUISITE(S)

An introductory statistics course (STA 1051/1053/1111/1127).

LEARNING OUTCOMES:

Learning Focus: Disciplined logical thinking & understanding relevant concepts and arguments.

Learning Approach: One will be engaged in active learning where one will develop one's ability to think, write, and speak about statistics as a cohesive narrative. Arguments should be coherent and make good sense, all while taking ownership of the material and understanding at both the sophisticated as well as colloquial levels.

As a result of completing this course, students will be able to:

1. Describe and explain key concepts and methods in applied statistical procedures.
2. Perform statistical tests using parametric and non-parametric procedures.
3. Evaluate and compare various statistical procedures.
4. Write statistical arguments and data analytic results and conclusions, both technically and for general people, in order to develop a narrative voice to properly describe statistical data analysis and inference.

Average minimum amount of out-of-class / independent learning expected per week:

In a 15-week semester, including exam week, students are expected to spend a minimum of 100 minutes in independent learning for every 50 minutes of direct instruction for a minimum total of 2.5 hours per week or 37.5 hours for the semester. A 3-credit course, for example, would include 2.5 hours of direct instruction and a minimum of 5 hours of independent learning per week for a combined minimum total of 7.5 hours per week or 112.5 hours per semester. See the "Assignment of Credit Hour Policy" at provost.gwu.edu/policies-procedures-and-guidelines for more info.

TEXTS & RESOURCES

- (1) **Text:** Chapters from *Statistical Computing with SAS and R*, Provided in Class
- (2) **Software:** RStudio (Along with R) will be used for computing projects.
Download R: <https://mirror.las.iastate.edu/CRAN/>
Download RStudio: <https://rstudio.com/products/rstudio/download/>
You may also download SAS through the GWU Library (not required).
- (3) **Optional Texts:**
 - (a) *Introduction to Statistical Methods and Data Analysis*, by Ott, Longnecker et. al.
 - (b) *A First Course in Statistical Programming with R*, by Braun and Murdoch
 - (c) *Statistical Hypothesis Test with SAS and R*, by Taeger and Kuhnt

TENTATIVE COURSE OUTLINE

- (1) Descriptive Statistics
 - Introduction to Data, SAS, R, Univariate Statistics, Graphs and Distributions, Normality and Normal Probability Plots
- (2) One-Sample Inference
 - Sampling Distributions, Inference, Confidence Intervals, Hypothesis Tests, One-Sample Mean Inference, One-Sample Proportion Inference, One-Sample Nonparametric Inference, Introduction to Statistical Power
- (3) Data Management in SAS & R
 - Creating, Modifying, Formatting, and Converting Variables, Keeping/Dropping Observations; Missing & Irregular Data; Sorting, Concatenating, Merging, & Configuring/Transposing/Melting Data
- (4) Two-Sample Inference
 - Inference with Two Parameters, Two-Sample Means, Two-Sample Proportions, Two-Sample Nonparametric Procedures
- (5) Chi-Square Inference
 - Tables, Proportion Tests, Chi-Square Goodness of Fit Tests, Chi-Square Test of Homogeneity, Chi-Square Test of Independence, Fisher's Exact Test, Odds Ratios
- (6) ANOVA Inference
 - Inference on Variances (1-sample and 2-sample), ANOVA, Kruskal-Wallis Test, Factorial Designs, Block Designs, Friedman Test, ANCOVA, Multiple Comparisons
- (7) Introductory, Intermediate, and Advanced Regression Techniques
 - Statistical Modelling, Simple Linear Regression, Diagnostics, Predictions, Qualitative Predictors
 - Multiple Linear Regression, Interaction, Polynomial Regression, Higher Order Models, Nested Models Test
 - Multicollinearity, Model Selection, Time Series, Logistic Regression, Nonparametric Regression.

Note that lectures will focus on using the R programming language, with optional supplemental videos on SAS potentially provided.

TENTATIVE HOMEWORK/PAPER COVERAGE

Homework Coverage: Weekly assignments in the form of short problem sets (1-2 problems) covering topics from the preceding week's lectures. (Typically Low-to-No Writing)

Paper 1: One-Sample Statistical Data Procedures

Paper 2: Categorical Data Analysis

Paper 3: Analysis of Variance Techniques

TENTATIVE EXAM SCHEDULE

Midterm Exam
Final Exam Week

March 8th
May 8th – 16th

GRADING

Homework 10%
Papers 40%
Midterm Exam 25%
Final Comprehensive Exam 25%

Grading Scale: The baseline grading scale for the course is

%	< 60	60-69	70-79	80-89	90-100
Grade	F	D-range	C-range	B-range	A-range

With “+” scores from _7% through _9% and “-” scores from _0% through _3%.

WID COMPONENT

To assist with the WID component of this course, the following writing-based assessments will be used:

1. A written component of your exams, to which will be turned in separately via Safe Assign on Blackboard.
2. Three Report-Sized Papers (typically 4-8 pages, not including images or appendix), to which will be turned in separately via Safe Assign on Blackboard with required meeting times to discuss paper revisions with the instructor/TA.

CLASS POLICIES

- Students are expected to
 1. View all lectures and engage in class discussion when applicable.
 2. Review class notes after every class.
- It is expected that each student will spend on the average a minimum of two hours outside study for each hour of class time.
- An official GWU e-mail address is established for each registered student, each faculty member, and each staff member. All university communications sent via e-mail will be sent to this GWU e-mail address.

University Policy on Religious Holidays:

1. Students should notify faculty during the first week of the semester of their intention to be absent from class on their day(s) of religious observance;
 2. Faculty should extend to these students the courtesy of absence without penalty on such occasions, including permission to make up examinations;
 3. Faculty who intend to observe a religious holiday should arrange at the beginning of the semester to reschedule missed classes or to make other provisions for their course-related activities
- Homework:
Student will be assigned various homework assignments (Approximately 10) within the course.
 - Homework assignments will focus more on coding than writing.
 - Late homework will be accepted only with a valid excuse.

- Exams:
A midterm exam and final exam will be provided, covering topics in the course.
 - With each exam, there will be a take-home portion.
 - This portion will require a small writing-intensive component to which students will turn in this problem via Blackboard (roughly 1-3 pages in length).
 - Make-up exams will only be given for valid excuses and will tend to be more difficult than the original exam. If you miss an exam, contact the instructor as soon as possible via e-mail.
 - The final exam will be cumulative.

- Papers:
Three papers will be assigned during this course.
 - Each paper will be roughly 4-8 pages in size, not including images and appendix.
 - Students will have 2 weeks to submit the initial draft after being assigned.
 - Papers will be returned in one week with revisions and unofficial rubric scores.
 - There will be a required student/faculty meeting to discuss the paper and revisions.
 - The third paper will also incorporate a peer-review assessment of the introduction and background sections.
 - Final revisions will be due roughly one week after the return of initial draft.

UNIVERSITY POLICIES

Academic Integrity Code

Academic integrity is an essential part of the educational process, and all members of the GW community take these matters very seriously. As the instructor of record for this course, my role is to provide clear expectations and uphold them in all assessments. Violations of academic integrity occur when students fail to cite research sources properly, engage in unauthorized collaboration, falsify data, and otherwise violate the [Code of Academic Integrity](#). If you have any questions about whether or not particular academic practices or resources are permitted, you should ask me for clarification. If you are reported for an academic integrity violation, you should contact the Office of Student Rights and Responsibilities (SRR) to learn more about your rights and options in the process. Consequences can range from failure of assignment to expulsion from the university and may include a transcript notation. For more information, please refer to the SRR website (<https://studentconduct.gwu.edu/academic-integrity>), email rights@gwu.edu, or call 202-994-6757.

University policy on observance of religious holidays

Students must notify faculty during the first week of the semester in which they are enrolled in the course, or as early as possible, but no later than three weeks prior to the absence, of their intention to be absent from class on their day(s) of religious observance. If the holiday falls within the first three weeks of class, the student must inform faculty in the first week of the semester. For details and policy, see “Religious Holidays” at provost.gwu.edu/policies-procedures-and-guidelines.

Use of Electronic Course Materials and Class Recordings

Students are encouraged to use electronic course materials, including recorded class sessions, for private personal use in connection with their academic program of study. Electronic course materials and recorded class sessions should not be shared or used for non-course related purposes unless express permission has been granted by the instructor. Students who impermissibly share any electronic course materials are subject to discipline under the Student Code of Conduct. Please contact the instructor if you have questions regarding what constitutes permissible or impermissible use of electronic course materials and/or recorded class sessions. Please contact Disability Support Services at disabilitysupport.gwu.edu if you have questions or need assistance in accessing electronic course materials.

ACADEMIC SUPPORT

Writing Center

GW's Writing Center cultivates confident writers in the University community by facilitating collaborative, critical, and inclusive conversations at all stages of the writing process. Working alongside peer mentors, writers develop strategies to write independently in academic and public settings. Appointments can be booked online at gwu.mywconline.

Academic Commons

Academic Commons provides tutoring and other academic support resources to students in many courses. Students can schedule virtual one-on-one appointments or attend virtual drop-in sessions. Students may schedule an appointment, review the tutoring schedule, access other academic support resources, or obtain assistance at academiccommons.gwu.edu.

SUPPORT FOR STUDENTS OUTSIDE THE CLASSROOM

Disability Support Services (DSS) 202-994-8250

Any student who may need an accommodation based on the potential impact of a disability should contact Disability Support Services at disabilitysupport.gwu.edu to establish eligibility and to coordinate reasonable accommodations.

Counseling and Psychological Services 202-994-5300

GW's Colonial Health Center offers counseling and psychological services, supporting mental health and personal development by collaborating directly with students to overcome challenges and difficulties that may interfere with academic, emotional, and personal success. healthcenter.gwu.edu/counseling-and-psychological-services.

Safety and Security

- In an emergency: call GWPD 202-994-6111 or 911
- For situation-specific actions: review the Emergency Response Handbook at: safety.gwu.edu/emergency-response-handbook
- In an active violence situation: Get Out, Hide Out, or Take Out. See go.gwu.edu/shooterpret
- Stay informed: safety.gwu.edu/stay-informed

TENTATIVE COURSE SCHEDULE

Week	Monday	Wednesday
1 Jan 16/18	No Class	Syllabus, Data Sets
2 Jan 23/25	Intro to R	Univariate Data, Graphs
3 Jan 30/Feb 1	Normality and NPP, Simulation and Sampling, Intro to Writing	Inference Review, Shapiro-Wilk Test, <i>Paper 1 Assigned</i>
4 Feb 6/8	T-Test for Mean, Sign Test, Power of a Test	Data Management: Create/Modify/Format Variables, Missing & Irregular Data, Sorting, Concatenating, Merging, Transposing/Melting Data
5 Feb 13/15	Two-Sample Problems, Comparing Two Variances Paired T-test, Independent T-test	Rank Sum Test, Signed Rank Test, Tables: One- & Two-Way <i>Paper 1 Initial-Draft Due</i>
6 Feb 20/22	No Class	One-Sample Proportions, Binomial Exact Test
7 Feb 27/Mar 1	Chi-Square Procedures: Goodness-of- Fit, Homogeneity <i>Paper 2 Assigned</i>	Chi-Square for Independence Multinomial Exact Test <i>Paper 1 Final-Draft Due</i>
8 Mar 6/8	Fisher's Exact Tests, Odds Ratios Review	Midterm Exam
9 Mar 13/15	No Class	No Class
10 Mar 20/22	Go Over Midterm, Intro to Experiments	Intro to ANOVA Levene Test <i>Paper 2 Initial Draft Due</i>
11 Mar 27/29	ANOVA: CRD Kruskal-Wallis Test	ANOVA: Block Designs Friedman Tests <i>Paper 3 Assigned</i>
12 Apr 3/5	Factorial Designs Bivariate Relationships	Simple Regression, Diagnostics, Model Assessment <i>Paper 2 Final-Draft Due</i>
13 Apr 10/12	r and R^2 , Prediction Multiple Linear Regression	MLR: Higher Order Terms <i>Paper 3 Initial Draft Due</i>
14 Apr 17/19	MLR: Qualitative Predictors MLR: Nested Models Tests;	Multicollinearity <i>Peer Review Session</i>
15 Apr 24/26	Model Selection Techniques Advanced Diagnostics	Advanced Diagnostics Logistic Regression
16 May 1/3	Time Series <i>Paper 3 Final-Draft Due</i>	Nonparametric Reg / Review