THE OHIO STATE UNIVERSITY

COLLEGE OF ARTS AND SCIENCES

SYLLABUS: STATISTICS 6610
APPLIED NONPARAMETRIC STATISTICS
AUTUMN 2020

COURSE OVERVIEW

Instructor

Instructor: Professor Doug Critchlow
Email address: critchlow.1@osu.edu
Phone number: 614-292-3888
Office hours: Mondays and Wednesdays 1:15 – 2:15 pm (in person, in my office). I am also available for email help and for virtual meetings using CarmenZoom, upon request and with advance notice.
Office Location: Cockins 440G (in the alcove at the north end of the hall)

Teaching Assistant and Grader

Shawn Chen, chen.4747@osu.edu

Course description

Noncalculus treatment of nonparametric tests, confidence intervals, estimation; topics include one- and two-sample problems, one- and two-way analysis of variance, multiple comparisons, correlation. Prerequisite: 5301 (529), 6201, or 6302 (623), or equivalent, or permission of the instructor.

Course learning outcomes

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

- understand basic principles of statistical inference and the difference between nonparametric and parametric statistical procedures

- understand the importance of checking the assumptions of the underlying probability models under which inferences are valid
- understand foundational concepts of statistical tests based on ranks, and their associated confidence intervals and point estimates
- identify and implement appropriate nonparametric statistical methods for a particular inference, including methods for small sample sizes and methods based on large sample approximations

Course materials

Required

Hollander, M., Wolfe, D. A., & Chicken, E., *Nonparametric Statistical Methods*, Third Edition (2014), Wiley. Available as a print book and also online.

Course technology

For help with your password, university e-mail, Carmen, or any other technology issues, questions, or requests, contact the OSU IT Service Desk. Standard support hours are available at https://ocio.osu.edu/help/hours, and support for urgent issues is available 24x7.

- **Self-Service and Chat support:** http://ocio.osu.edu/selfservice
- **Phone:** 614-688-HELP (4357)
- **Email:** 8help@osu.edu
- **TDD:** 614-688-8743

Baseline technical skills necessary for this course

- Basic computer and web-browsing skills
- Navigating Carmen
- CarmenZoom (if requesting Zoom meetings)

Necessary equipment

- Computer: current Mac (OS X) or PC (Windows 10+) with high-speed internet connection
- Webcam: built-in or external webcam, fully installed (if requesting Zoom meetings)
- Microphone: built-in laptop or tablet mic or external microphone (if requesting Zoom meetings)

Necessary software

- This class requires you to use the statistical software package called R (The R Project for Statistical Computing; http://www.r-project.org/). This software package is available as Free Software.

  - You can download R for Windows, Mac, and Linux, from the CRAN archive at https://cran.r-project.org.
  - An in-depth introduction to R is available at http://cran.r-project.org/doc/manuals/R-intro.pdf
  - Hands-on tutorials are available in the Swirl system, which you can learn about at http://swirlstats.com/. In particular, "R Programming: The basics of programming in R" is an appropriate first tutorial for students who have never used R.
- An easier to use interface to R is available in the software package RStudio. This package is available for Windows, Mac, and Linux and can be downloaded for free from http://rstudio.org. **Note that RStudio requires R to be installed.**

Course delivery

Lectures will be delivered in person, three days per week, MWF 10:20 – 11:15 am in Baker Systems Engineering Building Room 144. Students are required to wear face masks and observe social distancing when attending class.

Grading and faculty response

Grading Scheme (tentative)

Homework Assignments	20%
Two Midterm Examinations (20% each, 55 minutes each)	40%
Final Examination (1 hour and 45 minutes)	40%

In addition, several optional "bonus homework problems" will be given in lecture, that elaborate on some of the more difficult (and hopefully intriguing) aspects of the course material.

Assignment information

- Homeworks will generally be assigned on about a weekly basis.
- Please remember to upload all your homework on Carmen Canvas as a PDF or Word file. No page files (using a Mac) will be accepted because the grader cannot open them with his PC. If you have questions about how to submit your homework, please contact the grader/TA, Shawn Chen, at chen.4747@osu.edu.

Late assignments

Generally, late homework will not be accepted. However, if there are extenuating circumstances beyond your control, please contact the course instructor immediately.

Grading scale

Students will generally receive at least the grade that they would have received on the standard "straight scale" (90-100% = A or A-, etc.). However, grades will probably be curved upwards a bit.

Faculty feedback and response time

I am providing the following list to give you an idea of my intended availability throughout the course. (Remember that you can call 614-688-HELP at any time if you have a technical problem.)

Grading and feedback

For homework assignments, you can generally expect feedback within 7 days**.**

E-mail

I will try to reply to e-mails within 24 hours on school days**.**

Attendance and participation requirements

Because this is an in-person course, your participation is based on your in-person activity, and checking email and Carmen. The following is a summary of everyone's expected participation:

- **In-person class meetings**: **REQUIRED**

  You are expected to attend all in-person lectures and you are responsible for all material presented during these lectures. Attendance will be taken in lecture. If you have a situation that causes you to miss class, you are required to discuss it with me within 24 hours of the third (and any subsequent) absence.
- **Checking email and Carmen regularly**: **REQUIRED**

  Be sure to check your email at least once per day, and to look for additional directives in your email, for example about accessing new material on Carmen. Additionally, be sure you are logging in to the course in Carmen each week, including weeks with holidays or weeks with minimal online course activity.

Other course policies

Health and safety

The Ohio State University Wexner Medical Center's Cornavirus Outbreak site (https://wexnermedical.osu.edu/features/coronavirus) includes the latest information about COVID-19 as well as guidance for students, faculty and staff.

Guidelines and requirements for campus safety from the University's COVID-19 Transition Task Force were published on July 1 on the Safe and Healthy website (https://safeandhealthy.osu.edu). They include the following:

- "A daily health check to report body temperature and health status will be required for all faculty, staff and students each day they intend to be on Ohio State's campuses in the autumn."
- Face masks must be worn in indoor settings, including classrooms.
- Members of the campus community will be required to sign a pledge "to affirm their understanding of what is needed to help fight the spread of the virus and their intention to do their part."
- "Accountability measures will be in place for those who refuse to abide by required health and safety guidelines."

Potential disruptions to instruction

- As much as is possible, students will have access to material online if they are unable to attend class because of positive diagnosis, symptoms, or quarantine required following contact tracing.
- If the instructor is unable to be present in person because of positive diagnosis, symptoms, or quarantine following contact tracing, a new instructor will be assigned to the course. Details will be given on the course website.

Student academic services

Student academic services offered on the OSU main campus http://advising.osu.edu/welcome.shtml.

Student support services

Student support services offered on the OSU main campus http://ssc.osu.edu.

Academic integrity policy

Policies for this in-person course

- **Exams**: You must complete all the midterm and final exams yourself, without any external help or communication.
- **Written assignments**: You are expected to produce original and independent work for homework assignments. Note that allowing others to copy your work is considered academic misconduct. Academic misconduct will not be tolerated and will be dealt with procedurally in accordance with University Rule 3335-31-02. (This policy can be found at http://oaa.osu.edu/coam.html.)

Ohio State's academic integrity policy

It is the responsibility of the Committee on Academic Misconduct to investigate or establish procedures for the investigation of all reported cases of student academic misconduct. The term "academic misconduct" includes all forms of student academic misconduct wherever committed; illustrated by, but not limited to, cases of plagiarism and dishonest practices in connection with examinations. Instructors shall report all instances of alleged academic misconduct to the committee (Faculty Rule 3335-5-487). For additional information, see the Code of Student Conduct http://studentlife.osu.edu/csc/.

Copyright disclaimer

The materials used in connection with this course may be subject to copyright protection and are only for the use of students officially enrolled in the course for the educational purposes associated with the course. Copyright law must be considered before copying, retaining, or disseminating materials outside of the course.

Statement on title IX

Title IX makes it clear that violence and harassment based on sex and gender are Civil Rights offenses subject to the same kinds of accountability and the same kinds of support applied to offenses against other protected categories (e.g., race). If you or someone you know has been sexually harassed or assaulted, you may find the appropriate resources at http://titleix.osu.edu or by contacting the Ohio State Title IX Coordinator, Kellie Brennan, at titleix@osu.edu

Accessibility accommodations for students with disabilities

The university strives to make all learning experiences as accessible as possible. In light of the current pandemic, students seeking to request COVID-related accommodations may do so through the university's request process, managed by Student Life Disability Services. If you anticipate or experience academic barriers based on your disability (including mental health, chronic, or temporary medical conditions), please let me know immediately so that we can privately discuss options. To establish reasonable accommodations, I may request that you register with Student Life Disability Services. After registration, make arrangements with me as soon as possible to discuss your accommodations so that they may be implemented in a timely fashion. SLDS contact information: slds@osu.edu; 614-292-3307; http://slds.osu.edu; 098 Baker Hall, 113 W. 12th Avenue.

Accessibility of course technology

This course requires use of Carmen (Ohio State's learning management system) and other online communication tools. If you need additional services to use these technologies, please request accommodations with your instructor.

- Carmen (Canvas) accessibility

Your mental health

As a student you may experience a range of issues that can cause barriers to learning, such as strained relationships, increased anxiety, alcohol/drug problems, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic performance or reduce a student's ability to participate in daily activities. The Ohio State University offers services to assist you with addressing these and other concerns you may be experiencing. If you or someone you know are suffering from any of the aforementioned conditions, you can learn more about the broad range of confidential mental health services available on campus via the Office of Student Life's Counseling and Consultation Service (CCS) by visiting ccs.osu.edu or calling 614- 292-5766. CCS is located on the 4th Floor of the Younkin Success Center and 10th Floor of Lincoln Tower. You can reach an on call counselor when CCS is closed at 614-292-5766 and 24 hour emergency help is also available through the 24/7 National Suicide Prevention Hotline at 1-800-273- TALK or at suicidepreventionlifeline.org

Disclaimer

This syllabus should be taken as a fairly reliable guide for the course content. However, you cannot claim any rights from it and in particular we reserve the right to change due dates or the methods of grading and/or assessment if necessary. Any changes will be communicated to you through official course announcements.

Course schedule (tentative)

This schedule is subject to revision. Students are expected to attend class meetings and to regularly check for updates. The corresponding textbook sections are listed after each topic.

	Approximate Number of 55-minute Lectures
Review of Basic Concepts from Classical (Parametric) Statistics, and Comparison with the Nonparametric Approach (1.1 - 1.8 and supplemental material)	2
The Dichotomous Data Problem (2.1 - 2.3)	4
Sign Test Procedures for the One-Sample Location Problem and for Paired Replicates Data; Asymptotic Relative Efficiency (3.4, 3.5, 3.6, 3.8, 3.11)	4
Signed Rank Procedures for the One-Sample Location Problem and for Paired Replicates Data (3.1, 3.2, 3.3, 3.7, 3.11)	4
The Two-Sample Location Problem (4.1, 4.2, 4.3, 4.5)	4
Kolmogorov-Smirnov Two-Sample Test for General Differences (5.4)	4
The One-Way Layout; Multiple Comparisons Procedures (6.1, 6.2, 6.5, 6.7, 6.8)	9
Kendall's Tau Procedures for the Independence Problem (8.1, 8.2)	3
The Two-Way Layout (7.1, 7.2, 7.3, 7.4, 7.5)	5
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Note: If time allows, we may cover some additional sections of the textbook. Also, occasionally some supplemental material, from outside the textbook, will be covered in lecture. You are responsible for all the material presented in lecture.