STAT 621-F01/FM1: Nonparametric Statistics (3 credits)
Fall 2019 Chapman 206
MWF 9:15 – 10:15

Instructor: Dr. Julie McIntyre, 201D Chapman Hall

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Office Hours: MWF 10:30 – 11:30, Th 2:00 – 3:00, or by appointment.

Prerequisite: STAT 401 or an equivalent course in linear regression models, or permission of the instructor

Course Materials: This course will primarily use lecture notes that I will prepare and make available. We will also reference online resources including the following textbooks that are available for free download as pdf files. Links to these are posted here, as well as on Blackboard.

- *Nonparametric Statistical Methods using R* by John Kloke and Joseph W. McKean, CRC Press 2015.
- *An Introduction to Statistical Learning* by James et al., Springer, 2017.
- *The Elements of Statistical Learning, 2nd Edition*, by Hastie, Tibshirani and Friedman, Springer 2008.

Course Description: Traditional and modern nonparametric statistical techniques. Distribution-free methods for small samples including sign, rank and randomization tests, correlation estimators, and bootstrapping. Modern techniques including kernel density estimation, survival analysis models, kernel and spline regression, generalized additive models, classification methods, robust estimation, regression trees, and neural net models.

Learning Outcomes: Students completing this course will have an understanding of distribution-free statistical methods, the logic behind these methods, and their advantages and disadvantages. Students will become proficient in the application of both traditional and modern nonparametric statistical techniques. Students will be able to identify appropriate techniques for a given data set and objective. Students will lean how to use software to apply techniques, and how to correctly interpret the results.

Computation: We will R for the computer work in this class. You may download R for free at `http://www.r-project.org/` Some experience with R is assumed, e.g. at the STAT 401 level.

Instructional Methods: This is a lecture course meeting three times per week. Lectures will consist of explaination and derivation of statistical methods, followed by real data examples, including illustrations of the R software. Often a distance section of this course is offered concurrently, through UA Video Conferencing. Instructions for distance students to connect to live course lectures will be provided.

Grading: Semester grades will be determined by your performance on homework, one midterm exam and a final project and presentation. These components will be weighted as follows.

Homework	50%
Midterm	20%
Final Project	25%
Final Presentation	5%

Grading scale: A: 93-100, A-: 90-92, B+: 87-89, B: 83-86, B-: 80-82, C+: 77-79, etc.

Homework: Homework will be assigned approximately once per week. Assignments should be submitted before the end of class on the date they are due. I encourage you to discuss homework problems with other students, as well as with me. However the work you turn in must be your own. Please write neatly, properly cite any references used, and include only relevant computer output with your solutions. I do not accept late homework unless arrangements have been made prior to the due date.

Remote students should email completed assignments to me in pdf format. Fairbanks students should submit hard copies preferably, although emailed versions may be accepted in some circumstances.

Final Projects: Project topics may include an analysis of a real-life data set using distribution-free methods, a simulation study to investigate the properties of one or more methods, or a report and demonstration about a technique not covered in class. If you have trouble selecting a project topic, I will be happy to help you find one. Each student will give a presentation of their project and results during the last week of class. A final paper will be due during the final exam period (10:15 – 12:15 Wednesday Dec. 13).

Some Important Dates:

- Last day to add classes: Friday Sept. 6
- Last day to drop classes: Friday Sept. 6
- Last day for student or faculty-initiated withdraw: Friday Nov. 1

Student Protections and Services: Every qualified student is welcome in my classroom. As needed, I am happy to work with you, disability services, veterans' services, rural student services, etc to find reasonable accommodations. Students at this university are protected against sexual harassment and discrimination (Title IX), and minors have additional protections. For more information on your rights as a student and the resources available to you to resolve problems, please go the following site: `www.uaf.edu/handbook/`

Other Policies:

- The Department of Mathematical Sciences has policies on early finals and incomplete grades (see http://www.dms.uaf.edu/dms/Policies.html).
- See also the Student Code of Conduct in the UAF catalog.

Tentative Schedule STAT 621

Day	Date	Topics	Homework
M	8/26	Intro and Review	
W	8/28	CDF, EDF and GOF	HW1 Assigned
F	8/30	Signed Rank Test	
M	9/2	**Labor Day: No Class**	
W	9/4	Sign Test	HW1 Due; HW2 Assigned
F	9/6	Some Numerical Methods	
M	9/9	Some Numerical Methods	
W	9/11	Rank Sum Test	HW2 Due; HW3 Assigned
F	9/13	Mann-Whitney Statistic	
M	9/16	Kruskal-Wallis ANOVA	
W	9/18	Independence and Correlation	HW3 Due; HW4 Assigned
F	9/20	Kaplan-Meier Survival Analaysis	
M	9/23	Catch-Up	
W	9/25	Density Estimation	HW4 Due; HW5 Assigned
F	9/27	Density Estimation	
M	9/30	Density Estimation	
W	10/2	Nonparametric Regression – Linear Smoothers	HW5 Due; HW6 Assigned
F	10/4	Nonparmetric Regression – Linear Smoothers	
M	10/7	Catch-up	HW6 Due
W	10/9	**MIDTERM**	
F	10/11	Nonparmetric Regression – Splines, etc.	HW7 Assigned
M	10/14	Nonparmetric Regression – Splines, etc.	
W	10/16	GAMs	HW7 Due; HW8 Assigned
F	10/18	GAMs	
M	10/21	Classification Basics	
W	10/23	Trees	HW8 Due; HW9 Assigned
F	10/25	Trees	
M	10/28	Bagging & Boosting	
W	10/30	Bagging & Boosting	HW9 Due; HW10 Assigned
F	11/1	EM Algorithm	
M	11/4	Neural Network Models	
W	11/6	Neural Network Models	HW10 Due; HW11 Assigned
F	11/8	Neural Network Models	
M	11/11	Classification Advanced	
W	11/13	Classification Advanced	HW11 Due; HW12 Assigned
F	11/15	Classification Advanced	
M	11/18	Classification Advanced	
W	11/20	Additional Topics TBD	HW12 Due; HW13 Assigned
F	11/22	Additional Topics TBD	
M	11/25	Additional Topics TBD	
W	11/27	**Thanksgiving Break**	HW13 Due
F	11/29	**Thanksgiving Break**	
M	12/2	Presentations	
W	12/4	Presentations	
F	12/6	Presentations	
W	12/11	**(Final Exam)**	Final Paper Due 10:00am