SYLLABUS

EE 517: STATISTICS AND DATA ANALYSIS FOR ENGINEERS
Spring 2022

Spring 2022   Professor Bart Kosko
Lecture: Thursday 3:00 - 6:50 pm   Office: EEB 438
email: kosko@usc.edu   Hours: Wednesday 4 - 6
voicemail: (213) 740 - 6242   Thursday: after class

Course Summary: The course presents modern statistics with engineering applications from signal processing to machine learning. Emphasis is on rigorous *statistical reasoning*. Each team must develop and present a novel application of statistics.

Required: Mendenhall, W., and Sincich, T., *Statistics for Engineering and the Sciences*, 6th edition, CRC Press, 2016.

Required: Hogg, R. V., Tanis, E. A., and Zimmerman, D., *Probability and Statistical Inference*, 10th edition, Prentice Hall, 2019.

Recommended: Efron, B., Hastie, T., *Computer Age Statistical Inference: Algorithms, Evidence, and Data Science*, Cambridge University Press, 2016.
        Field, A., *Discovering Statistics Using SPSS*, 5th edition, Sage, 2017.
        Carlin, B. P., and Louis, T. A., *Bayesian Methods for Data Analysis*, 3rd edition, CRC Press, 2009.
        Arnold, T., Kane, M., Lewis, B., *A Computational Approach to Statistical Learning*, CRC Press, 2019.

COURSE OUTLINE

JAN 13	Overview of statistics and testing. Probability review.
JAN 20	Sampling distributions. Limit theorems. Random sampling
JAN 27	More sampling distributions. Point estimation.
FEB 3	Consistency of sample covariance. Confidence intervals.
FEB 10	Hypothesis testing. Bootstrap techniques.
FEB 17	MIDTERM I. Tests for probability densities. Contingency tables.
FEB 24	Sufficient statistics. Cramer-Rao bound. Ratio hypothesis tests.
MAR 3	Sequential tests. Linear and neural regression. Heteroscedasticity.
MAR 10	Multiple regression. Multicollinearity diagnostics. Neural classifiers.
MAR 17	No Class: Spring Break.
MAR 24	Ridge/Lasso regression. Stepwise regression. Statistical process control.
MAR 31	MIDTERM II. Logistic and multinomial regression. ANOVA.
APR 7	Project proposals due. Runs. Experimental design. Bayesian statistics.
APR 14	EM and GMMs. Hierarchical Bayes and Gibbs samplers.
APR 21	Projects: *Mandatory attendance*. Extended session.
APR 28	Project: *Mandatory attendance*. Extended session.

GRADING PROCEDURE

Summary: Class grade depends on two midterm exams and a final project.   Homework problems are optional extra credit.

1. **Midterms**. Two midterms. Each worth 25 points. Closed book. NOTE: Satisfactory performance required on *both* midterms to proceed to final project.

2. **Homework**. Checked and recorded. Not graded. A perfect set of worked homework problems can earn 10 points. Lesser homework sets earn fewer points. Grade stays as is if only some homework turned in. How much homework counts for how many points lies at the discretion of the instructor and teaching assistant. Students may discuss the homework problems among themselves but each student must work his or her own problems. Cheating warrants a course grade of F.

3. **Project**. Well prepared and presented *approved* project that demonstrates a *novel application* of statistics—but only after performing satisfactorily on both midterms.   The project counts as the final exam and is worth 50 points. Exceptional projects can earn an automatic course grade of A.   Hence: *Project excellence trumps all else*. Projects must have the instructor's written approval. Failure to present a project on schedule results in automatic course grade of F. Students who perform badly on both midterms (such as scoring a standard deviation below the class mean on the second midterm) will not qualify for a project and so will have a course grade of F. Project evaluation is at the sole discretion of the instructor. Attendance *and participation* during the project-presentation session are *mandatory*.

4. **Course Grade**. 100 points possible in course.

A	if	90 - 100
B	if	80 - 89
C	if	70 - 79
D	if	60 - 69
F	if	0 - 59

5. **Cheating**. Not tolerated. Common errors in homework and exams can count as written evidence of cheating. Penalty ranges from F on exam to F in course to recommended expulsion.

6. Academic Conduct

Plagiarism – presenting someone else's ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in *SCampus* in Section 11, *Behavior Violating University Standards* https://scampus.usc.edu/1100-behavior-violating-university-standards-and-appropriate-sanctions. Other forms of academic dishonesty are equally unacceptable. See additional information in *SCampus* and university policies on scientific misconduct, http://policy.usc.edu/scientific-misconduct.

Discrimination, sexual assault, and harassment are not tolerated by the university. You are encouraged to report any incidents to the *Office of Equity and Diversity* http://equity.usc.edu or to the *Department of Public Safety* http://capsnet.usc.edu/department/department-public-safety/online-forms/contact-us. This is important for the safety of the whole USC community. Another member of the university community – such as a friend, classmate, advisor, or faculty member – can help initiate the report, or can initiate the report on behalf of another person. *The Center for Women and Men* http://www.usc.edu/student-affairs/cwm/ provides 24/7 confidential support, and the sexual assault resource center webpage http://sarc.usc.edu describes reporting options and other resources.

7. Support Systems

A number of USC's schools provide support for students who need help with scholarly writing. Check with your advisor or program staff to find out more. Students whose primary language is not English should check with the *American Language Institute* http://dornsife.usc.edu/ali, which sponsors courses and workshops specifically for international graduate students. *The Office of Disability Services and Programs* http://sait.usc.edu/academicsupport/centerprograms/dsp/home_index.html provides certification for students with disabilities and helps arrange the relevant accommodations. If an officially declared emergency makes travel to campus infeasible, *USC Emergency Information* http://emergency.usc.edu will provide safety and other updates, including ways in which instruction will be continued by means of blackboard, teleconferencing, and other technology.