Math 582-Large Sample Theory, Spring 2022. TuTh Neckers 0218 1-2:15

Instructor: David Olive

Prereq: Math 581 or Math 580 or concurrent registration in Math 580

Text: Lehmann, E.L. (1999), *Elements of Large–Sample Theory*, Springer, New York, NY.

This course is useful for students planning to do research in Probability or Statistics or who need a tested or untested minor for the PhD oral exam. The course is often given after Math 581, but I use large sample theory for my Statistics courses past Math 483, and will try to teach the course at about the level of Math 580. Math 481, 580, and 581 also cover some large sample theory topics. Qualifying exams for Math 580, 581, and 584 often have large sample theory problems.

Topics include convergence in distribution, convergence in probability, the central limit theorem, the delta method, the law of large numbers, the multivariate central limit theorem, and large sample theory for multiple linear regression, generalized linear models, and time series estimators.

I have simplified bootstrap theory, simplified theory for shrinkage estimators and variable selection estimators used in Statistical Learning (such as forward selection, backward elimination, lasso, and ridge regression), developed theory for prediction intervals and prediction regions, and developed the theory for practical high breakdown robust regression estimators and practical robust estimators of multivariate location and dispersion. Hopefully some of these topics will be covered.

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Office hours: TBA I am available by appointment and on a walkin basis.

The Final is sometime TBA.

The grading and schedule below is tentative.

2 homeworks may be turned in one class period late (ie on Thursday) with no penalty. A third late will be accepted with 25% penalty. 2 quizzes may be taken late before the next class period (ie on Tuesday). **At least two sheets of notes are allowed on quizzes and exams.** A calculator is permitted. I sometimes give a $B+$ and a $C+$.

Grading:

HW	300		Quizzes	100	
exam1	100	exam 2	100	exam 3	100
final	300			total	1000
min. grade	points	min. grade	points	min. grade	points
A	900-1000	B	800-899	C	700-799
D	550-699				

Week of	Tu	Th
Jan. 10	skim ch.1, 2.1	2.1, 2.2, 2.3
Jan. 17	no class,	2.3, 2.4, HW1, Q1
Jan. 24	2.4, 2.5, HW2	2.5, Q2
Jan 31	2.5, 2.6, HW3	2.6, Q3
Feb. 7	4.2 4.3	Exam 1
Feb. 14	4.3, 7.1 HW4,	7.1, Q4
Feb. 21	7.2, HW 5	7.3, Q5
Feb 28	7.3, 7.4, HW6	7.4, Q6
March 7	no class	no class
March 14	5.1 HW7	5.1, 5.2, Q7
March 21	5.2, 5.3, 5.4	Exam 2
March 28	5.4, 7.5, HW8	7.5, Q8
April 4	7.6, 6.2, HW9	6.2, Q9
April 11	6.2, 4.1 HW10	4.1, Q10
April 18	3.2, skim 3.3 and 3.4, HW11	7.7, 3.1, Q11
April 24	Exam 3	3.1

Other texts include the following.

Serfling, R.J. (1980), *Approximation Theorems of Mathematical Statistics,* John Wiley and Sons, NY.

Ferguson, T.S. (1996), *A Course in Large Sample Theory*, Chapman & Hall, NY.

Sen, P.K., and Singer, J.M. (1993), *Large Sample Methods in Statistics: an Introduction with Applications,* Chapman & Hall, NY.

Olive, D.J. (2008, ch. 8), *A Course in Statistical Theory*, at (http://parker.ad.siu.edu/ Olive/infbook.htm).

Olive, D.J. (2014, ch. 8), *Statistical Theory and Inference,* Springer, New York, NY.

Olive, D.J. (2021), *Theory for Linear Models*, at (http://parker.ad.siu.edu/Olive/linmodbk.htm)

Olive, D.J. (2021), *Robust Statistics*, at (http://parker.ad.siu.edu/Olive/robbook.htm).

I may incorporate relevant material from the last 4 manuscripts into Olive, D.J. (2022) *Large Sample Theory.*