

Math 580: Statistical Theory, Spring 2022; time 10-10:50 MWF; room Neckers 0156
Instructor: David Olive *email:* dolive@siu.edu

Text: Olive, D.J. (2014), *Statistical Theory and Inference*, Springer, NY. You can download a pdf file of the book from the library website (<http://lib.siu.edu/>). The paperback version of the text is about \$25 or get the hardback for about \$100. A 2008 version of the course notes is at (<http://parker.ad.siu.edu/Olive/infbook.htm>).

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Office hours: MWThF 12:10-12:40, 2:40-3:40

I am also available by appointment and on a walkin basis.

The prerequisites for this class are Math 483 or Math 480, but M483 is better. You should be familiar with MLEs, the normal, gamma, binomial, Poisson and exponential distributions, and there is a considerable amount of integration, differentiation, and optimization.

This course covers minimum sufficient and complete statistics, maximum likelihood estimation, method of moments, the Frechet-Cramer-Rao lower bound and uniformly minimum variance estimators, estimators that minimize the mean squared error, uniformly most powerful tests, likelihood ratio tests, confidence intervals, consistency, central limit theorem, convergence in distribution, and the delta method.

To some extent, the course is the study of regular exponential families. This type of course should be taken by every student who is interested in obtaining a graduate degree in Statistics. At SIU, Math 580 is one of the four courses from which Ph.D. students regularly take qualifying exams.

Final: Monday, May 2, time 8-10 AM in the morning (emphasis is on the above topics: ch.4 - § 8.4).

The schedule below is tentative. (Drop day in Friday, March 25 with advisor, Sunday, March 27 online.)

2 homeworks may be turned in one class period late (ie on Friday) 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 Monday). Two sheets of notes are allowed on quizzes but **no notes are allowed for exams**. A calculator is permitted. I sometimes give a *B+* and *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	MON	WED	FRI
Jan 10	1.1-1.4, 1.5	1.5 1.6	1.6
Jan 17	no class	2.1, HW1	2.1, 2.2, Q1
Jan 24	2.2, 2.3	2.4 HW2	2.4, 2.5, Q2
Jan 31	2.5	2.6 HW3	2.6, Q3
Feb 7	2.7, 2.8	EXAM 1: § 1.1-2.5	2.8, 2.9
Feb 14	2.9, 3.1	3.1, HW4	3.2, Q4
Feb 21	3.2, 4.1	4.1, HW5	4.2, Q5
Feb 28	4.2	4.2 HW 6	4.2, Q6
March 7	no class	no class	no class
March 14	4.2	5.1, HW7	5.1, Q7
March 21	5.2	Exam 2	5.2
March 28	5.2, 6.1	HW8	6.2, Q8
April 4	6.2,7.1	7.1, HW9	7.1, Q9
April 11	7.1, 7.2	7.2,7.3, HW10	7.3, Q10
April 18	7.3, 8.1	8.1,HW11	8.2, Q11
April 24	8.3,8.4,	EXAM 3	rev

The Math 580 webpage is at (<http://parker.ad.siu.edu/Olive/M580.html>).

My statistical inference webpage is at (<http://parker.ad.siu.edu/Olive/infer.htm>).
The bottom of this webpage has the following two links.

The exam 3 and final review (and for some qual problems) is at (<http://parker.ad.siu.edu/Olive/sirev3.pdf>).

About 67 pages of qualifying exam problems (mainly written by me) with solutions are at (<http://parker.ad.siu.edu/Olive/squalsoln.pdf>).

The dominant text for Master's level Statistical inference is

Casella, G., and Berger, R.L. (2002), *Statistical Inference*, 2nd ed., Wadsworth Inc., Belmont, CA.

The first edition of the following text was once dominant, but the 2nd edition is too hard. Bickel, P.J., and Doksum, K.A. (2007), *Mathematical Statistics: Basic Ideas and Selected Topics*, Vol. 1., 2nd ed., Updated Printing, Pearson Prentice Hall, Upper Saddle River, NJ.

Some other references

Mukhopadhyay, N. (2000), *Probability and Statistical Inference*, Marcel Dekker Inc., NY.

Lorayne and Lucas (2000), *The Memory Book* is useful for **memorization**.

To bridge the gap between M483 and M580, the following are especially recommended:

DeGroot, M.H. (1986), *Probability and Statistics*, 2nd ed., Addison-Wesley Publishing Company, Reading, MA. Now in a 4th edition with Schervish.

Hogg, R.V., and Craig, A.T (1995), *Introduction to Mathematical Statistics*, 5th ed., Prentice Hall, Englewood Cliffs, NJ. QA276H591970 and 519.9H716i1965 Now in a 7th edition with McKean.

Rice, J. (2006), *Mathematical Statistics and Data Analysis*, 3rd ed, Duxbury Press, Belmont, CA.

These texts are at a higher level.

Lehmann, E.L. (1983), *Theory of Point Estimation*, John Wiley and Sons, NY. Now in a second edition with Casella. 519.544L523T

Poor, H.V. (1988), *An Introduction to Signal Detection and Estimation*, Springer-Verlag, NY. This is a nice Electrical Engineering text.

Rohatgi, V.K., and Ehsanes Saleh, A.K.M.D. (2001), *An Introduction to Probability and Statistics*, 2nd ed., Wiley, NY.

Shao, J. (2003), *Mathematical Statistics*, 2nd ed., Springer, New York, NY.

These texts are at a much higher level.

Cramér, H. (1946), *Mathematical Methods of Statistics*, Princeton University Press, Princeton, NJ.

Lehmann, E.L. (1986), *Testing Statistical Hypotheses*, John Wiley and Sons, NY. 519.9L523t Now in a 3rd edition with Romano.

Rao, C.R. (1965, 1973), *Linear Statistical Inference and Its Applications*, 1st and 2nd ed., Wiley, New York, NY.

Schervish, M.J. (1995), *Theory of Statistics*, Springer-Verlag, NY. 519.5S320t1995

This course is also good for people who know that they are going to use statistical theory: for example, Econometrics, Psychology, Educational Psychology, and Electrical Engineers who are taking or plan to take ECE 551, ECE 552 and ECE 555. For Actuaries, Math 580 is useful for CAS EXAM MAS-I part B (statistics).