

## **ECON4130: Statistics 2, fall term 2016**

**Lecturer:** Harald Goldstein (Room 1106 ES) Tel: 22 85 51 36  
Cell: 92 406 377

E-mail: [h.e.goldstein@econ.uio.no](mailto:h.e.goldstein@econ.uio.no)

**Lectures:** Mondays 12:15 – 14, Aud 5 ES, and  
Tuesdays 12:15 – 14, Aud 5 ES  
week 34 – 46 (except teaching free week 40 )

**Seminar leader:** Yudi Wen mailto: [yudi.weng@econ.uio.no](mailto:yudi.weng@econ.uio.no)

See also the course webpage for times and venues for lectures, seminars and computer instruction.

Discussions are encouraged in the class, both during lectures, where emphasis is on theory, and in the seminar where exercises, applications and problems are in focus. Do exercises as much as possible. The learning through exercises is essential for this course. The exam is an open book exam with more weight on understanding than mere reproduction, and, therefore, requires a skill level which is hard to achieve without exercise training.

Because of the resource situation there will not be any portfolio (“mappe”) evaluation this semester. Also there will be seminars every second week only, starting week 36 –see the teaching schedule.

For “no-seminar weeks” exercises will be put on the net and solutions later in the week. First time in week 35.

The main focus of the course is theoretical but some computing will be required. Computing will be done in STATA. An introduction to STATA is arranged in week 35 only. There are two groups set up for STATA, and the students may chose freely which group is convenient (one group is sufficient). The instruction will be in terms of a tutorial that should be downloaded from the course web page. The students will work on the tutorial by themselves, but the lecturer will be present to help out if someone gets stuck.

The computer groups for week 35 are:

Group I: Tuesday 30 August , 10:15 – 12, PC-room 035 in Harriet Holter

Group II: Monday 29 August, 10:15 – 12, PC-room 035 in Harriet Holter

The textbook (**Rice edition 3, “Mathematical Statistics and Data Analysis”**) is good (in the sense of interesting examples and good formulations), but has the drawback of being written for students with a somewhat stronger mathematical basis than our

students. The use of this book in our course then requires navigation between sections and examples to be skipped (mainly due to the need for a stronger mathematical background and sometimes due to irrelevant topics). On the other hand, the book is sometimes too thin on some subjects relevant for econometrics, and supplementary lecture notes have been written to fill this need. Note that the “reading list” on the course web page contains information on what to read and what to skip.

A tentative plan for the course follows below. It may be subject to revisions and updated later in the term.

This term is the fourth term with two lectures per week for stat 2 (Mondays and Tuesdays). The reason for two lectures per week is that the course previously (one lecture per week until 2012) clearly was subject to too little time for covering important topics relevant for econometrics. In particular this concerns hypothesis testing which had to be reduced to almost nothing. The students need not worry that the course is filled with many new topics due to extended lectures. The only new material is a little bit more on testing (likelihood ratio tests and F-tests) and prediction, i.e., two topics that was originally part of the course but had to be skipped due to limited lecture time. Otherwise we will have more time for examples and a more relaxed discussion of topics treated in previous versions of the course. An introduction to Logistic Regression normally given at the end has to be skipped this semester due to an early exam date (21 November).

The aim of the first part of the course is to consolidate the students’ understanding of the concept of *probability distribution* which is an ABC-concept and tool for creating and handling econometric models as well as making econometric problems precise. Secondly, an introduction to approximation methods common in econometrics (based on consistency and limits in distribution) will be presented. Finally, we present an introduction to some common ways of constructing econometric methods of handling data (as, e.g., maximum likelihood, moment methods, likelihood ratio testing (with F-testing in regression models as a special case) ).

The primary focus will be on cross section data – the idea being that a proper understanding of cross section data analysis will facilitate the handling of other data types (like, e.g., panel and time series data) discussed in other courses.

### **Tentative Lecture/Seminar Plan**

(May be subject to modifications during the course)

**Textbook: J.A. Rice edition 3, “Mathematical Statistics and Data Analysis”**

Week	Book sections In Rice	Topics	Seminar
34 (Aug)	Mo 2.1, 2.2 (until 2.2.1)	Review, discrete/continuous distributions (pmf, pdf, cdf.)	
	Tue 2.2	Uniform, normal, exponential distributions. Poisson events.	

35	<b>Mo</b> 2.2, 2.3	Gamma distribution. Transformation of random variables (rv's). Inverse functions and simulation of continuous rv's..	<i>No seminar.</i> Try the following exercises from <b>chapter 2:</b> 13, 24 (review of binomial and geometric distr.) 31, 35, 40, 41, 45 (Solutions on the net on Thursday 1 Sept..)
	<b>Tue</b> 2.3, 4.1, 4.2	The meaning of a transformed random variable. Linear transformations in the normal distribution. Expectation and variance in continuous distributions.. Moments.	
36 (Sept)	<b>Mo</b> 3.3, 4.1 (ex. G,H), 4.4 (4.3 read yourself))	The expectation may not exist! Heavy tailed distributions. Joint and marginal distributions. Multiple integrals. (Read yourself about covariance, correlation in sec. 4.3 )	<i>Seminar:</i> <b>Chap. 2:</b> 60, 61 <b>Chap. 4:</b> 2, 6, 10, 12, 21
	<b>Tue</b> 3.4, 3.5, 4.4	Independence, conditional distributions, and conditional expectations.	
37	<b>Mo</b> 4.4.1	More on conditional distributions. Theorem of total (or iterated) expectation.Theoretical basis for regression. Random sums.	<i>No seminar</i> (Exercises for this week are put on the net with solution on the net at the end of the week.)
	<b>Tue</b> 3.3(Ex.F), 3.5(Ex.C), 4.3(EX.F) ; (or supplementary note on the net)	Normal distributions (uni-, bivariate, conditional).	
38	<b>Mo</b> 4.5,	Moment generating functions (mgf).	<i>Seminar:</i> Supplementary Exercises 1-4 (on the net)
	<b>Tue</b> 4.1 (Theorem A) 4.2 (Theorem C), Chap. 5 + Lecture notes to Rice chapter 5 on the net.	Limit theorems, Markov's and Chebysjev's inequalities. Weak law of large numbers. Consistency and its continuity property.	
39	<b>Mo</b> Lecture notes to Rice chapter 5	More on limit theorems, central limit theorem (CLT),	<i>No seminar</i> (exercises on the net)
	<b>Tue</b> Lecture notes to Rice chapter 5	More on limit theorems, central limit theorem (CLT), Slutsky's lemma. Application to confidence intervals.	
40 (Oct)	-----	<b>NO TEACHING</b> (exercises for this week will be announced with solution at the end of the week)	-----
41	<b>Mo</b> (Read 8.1-8.3 yourself) 8.4, 8.5, 8.7 (Theorem A)	Estimation: Moment method (MME), and maximum likelihood method (MLE) Efficiency, Cramer-Rao bounds.	To be announced
	<b>Tue</b> 8.5	More on MLE and asymptotic properties. Asymptotic unbiasedness and efficiency.	

42	<b>Mo</b> (Regular exam 2012)	On the Laplace distribution. (Exam 2012).	<i>No seminar</i>
	<b>Tue</b> Supplementary lecture notes.	Interpretation of regression coefficients. Prediction. Confidence intervals, prediction intervals.	
43	<b>Mo</b> Supplementary lecture notes.	More on prediction and prediction intervals. The iid model.	To be announced
	<b>Tue</b> “Lecture notes to Rice chapter 8”	Review of simple matrix algebra. Random matrices. Multivariate normal distribution and its covariance matrix	
44 (Nov)	<b>Mo</b> “Lecture notes to Rice chapter 8”	Inference based on the multivariate normal distribution and its covariance matrix applied to multiparameter MLE.	<i>No seminar</i>
	<b>Tue</b> “Lecture notes to Rice chapter 8”	Multiparameter estimation continued. Inference based on the multivariate normal distribution and its covariance matrix. Special case: OLS, multiple regression and a discussion of “the marginal propensity to consume”.	
45	<b>Mo</b> 3.3, 8.2	Multinomial models. Pearson’s chi-square tests.	To be announced
	<b>Tue</b> 9.4, 9.5 (Read 9.1, 9.3 yourself)	Testing independence and homogeneity in $r \times s$ frequency tables.	
46	<b>Mo</b> Chapter 6	Likelihood ratio (LR) testing	To be announced
	<b>Tue</b> Chapter 6 and Supplementary lecture note.	F-testing	