STAT 432/512 (MATHEMATICAL STATISTICS) - Spring 2016

SYLLABUS, COURSE REQUIREMENTS, AND OTHER INFORMATION

Lecturer: Dr W J Ewens
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* It is not part of the TA's job description to help students with questions, homework problems, etc. Please contact Dr Ewens for help with these matters. Office hours are "open" and meetings are arranged by email – email contact information is given above. However you should contact the TA if you need help accessing "canvas", where all handouts for this course and homework and exam point scores will be posted.

The purpose of this course is to discuss theoretical aspects of estimation theory and hypothesis testing procedures, together with some of their more important applications. The broad nature of the material to be covered is indicated below. It is assumed that each student in the class has taken probability theory to the level discussed in STAT 430, as well as a good introductory course in Statistics, a year of calculus and a good introduction to matrix theory. Any student not having this background should contact the course lecturer Dr Ewens - see contact information above - as soon as possible.

Background knowledge. There are various standard results concerning probability and Statistics that are assumed known. These will be handed out in a "What you should know" handout. If you are not familiar with these, please see Dr Ewens as soon as possible. There are also some mathematical results that will be handed out that will be needed in this class. In particular, properties of the gamma function will be handed out.

Location. The lecture room for the course is room **** Huntsman Hall (the "Wharton" building). Classes are held Tues – Thurs 3:00 – 4:30 pm.

Textbook. The course is based on D. D. Wackerley, W. Mendenhall and R. L. Scheaffer "Mathematical Statistics with Applications" , seventh edition, (Thomson Books/Cole 2008), ISBN 978-0-495-11081-1. However the lectures are self-contained, and although it would be useful for you have this book, it is not required. A slightly higher level book is "Introduction to Mathematical Statistics", by R.V. Hogg, J. W. McKean and A. T. Craig, (HMC) sixth edition, (Prentice Hall, 2005). Some class material will be at the higher level as given in the HMC book, but this book is *certainly* not required.

References to the book by Wackerley et al. (as WMS) are given below against each topic covered in the course. While it will be assumed that the material covered in WMS chapters 1-6 is known, some of it will be reviewed in the first few lectures of the course.

Examinations. There will be a mid-term exam during class hours soon after the mid-term break. (More details later.) The final exam will be held on *********. This time is set by the university and cannot be changed. You will be told the location of this final exam once it is decided. The final exam will have more weight than the mid-term exam, and although it will tend to focus on the material covered in the second half of the semester, will cover the material in the entire semester.

Homework. Homework problems will be handed out each week in class, and are due in a week later. Homework performance will count towards the final grade. Homework material as well as the topics covered in the course will be discussed in a review/tutorial session which will be arranged once the class meets.

Office hours. Dr Ewens' office hours are "open", so that he is available a*t all reasonable times* to discuss any aspects of this course. Contact information – email is best – is given above. Never hesitate to contact him if you have problems that you wish to discuss.

Course material. The main topics covered will include estimation theory, including in particular the desirable properties of estimators and how the properties can be achieved, as well as the concepts of sufficient statistics and maximum likelihood estimation, confidence intervals, hypothesis testing theory and the various methods of hypothesis testing, distribution-free methods of hypothesis testing, and tests involving linear models. **The focus of the class is on finding *optimal* ways of carrying out statistical inference procedures.**

The material below is organized by topic and NOT by the order in which the various topics will be given in class. Also, some topics may be deleted and others added during the semester.

TOPIC	WMS
Background	
Review of basic material	Chapters 1 – 5
Functions of random variables.	6.2
Transformation theory.	6.4, 6.6
Order statistics.	6.7
Estimation	
Various elementary properties of estimators	8.1-8.4
More advanced properties of estimators. The Cramér-Rao inequality.	9.1-9.3
The concepts of sufficiency. The Rao-Blackwell theorem.	9.4
The method of moments.	9.6
The likelihood function and maximum likelihood estimation.	9.7 – 9.8

Hypothesis testing

Concepts of hypothesis testing. Elementary examples.	10.1 - 10.9
Neyman-Pearson theory and likelihood ratio tests. Applications.	10.10 - 10.11
Sequential tests.	-------
Distribution –free (non-parametric) tests.	15.1 -15.6
ANOVA.	13.1-13.9
Hypothesis testing for linear models.	11.1-11.11