STAT 432/512 (MATHEMATICAL STATISTICS) - Fall 2018

GENERAL INFORMATION, COURSE REQUIREMENTS, AND SYLLABUS

Lecturer: Dr W J Ewens
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General Information

Dr Ewens' office is Room 424 Huntsman Hall (the "Wharton" building). To access this office, take the elevators towards the Walnut St end of Huntsman, turn LEFT out of the elevator and go through the door a few yards directly in front of you. (Despite the existence of a card-swipe machine near the door you do not need to swipe your Penn card to get through the door between 8 am and 6 pm weekdays.) Dr Ewens' office is then the second room on the right after you go through that door.

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 (*only* via email) is given above. Never hesitate to contact him by email if you have any matter that you wish to discuss. Do not send emails to Dr Ewens via a reply mechanism to emails sent to the entire class (and thus headed "folks"). Your reply might go to the entire class. Also do not send emails via canvas or any similar mechanism.

Email. Important messages relating to this course will be sent by email. Therefore check your email regularly, at least once every day.

Location. The lecture room for the course is Huntsman Hall room G55. (G stands for ground floor.) Classes are held Tues – Thurs 4:30 – 6 pm. The first lecture is on Tuesday August 28.

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 on the **Tuesday October 9**, that is the Tuesday immediately following the mid-term break.

There will be *final exam* Tuesday December 18, 6 - 8 pm. The location of the final exam will be indicated later when it becomes finalized. The time of the final exam is set by the university and cannot be changed. 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, it will cover the material in the entire semester.

Homework. Homework problems will be handed out each week on Thursdays in class, and are due in a week later, in class. You should read each homework soon after getting it to check for possible typos, ambiguities, etc.

Assessment. Final grades in this course are based 10% on homeworks, 35% on the mid-term exam and 55% on the final exam.

The Weingarten Center. Please contact Dr Ewens if you take exams through the Weingarten Center.

Course requirements

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 Dr Ewens - see email contact information above - as soon as possible.

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. This handout will also be posted on canvas. If you are not familiar with these standard results, please contact 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.

Syllabus

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 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.**

SYLLABUS

The material below is organized by topic as given in Wackerley *et al.* (WMS) and NOT necessarily by the order in which the various topics will be discussed 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
Distribution –free (non-parametric) tests.	15.1 -15.6
ANOVA.	13.1-13.9
Hypothesis testing for linear models.	11.1-11.11