Statistics 464/864: Time Series

Fall 2006

Lectures M 10–11:30, W 8:30–10

Instructor David Steinsaltz, 403 Jeffery Hall, steinsaltz@mast.queensu.ca

Office Hours Tuesday, 10–12, or by appointment. Contact me by email or in class.

Tutorial and cancelled classes Wednesday, 12:30–1:30. These will be led by Andrey Pavlov, and devoted to learning practicing R programming. They will be held in the Macintosh lab on the second floor of Jeffrey Hall. Three classes will be cancelled, for various reasons (including Thanksgiving). These will be made up by pre-empting the tutorials on Sept. 27, Oct. 4, 18, Nov. 1, with additional lectures, in 101 Jeffrey Hall.

Text *Time Series Analysis and its Applications (With R Examples)*, Robert Shumway and David Stoffer.

If you are at all uncomfortable with some basic notions of statistics — sampling, hypothesis tests, confidence intervals, linear regression, etc. — the book *Statistics* by Freedman, Pisani, and Purves cannot be recommended highly enough. It has almost no mathematics, but it explains the concepts with unfailing wit and clarity. It will be on reserve in Douglas.

Course web site Go to `http://www.mast.queensu.ca/~steinsaltz` and click on STAT 464.

Homework There will be four homework assignments in the semester: Two computer/data-analysis assignments, due on Oct. 27 and Nov. 29; and two theoretical assignments, due on Oct. 11 and Nov. 8. (Note: Oct. 27 is Friday. There is no class on that Wednesday.) The assignments will be posted to the course website at least two weeks before they are due. There will be a few additional lists of recommended problems

posted to the website occasionally. Students will be expected to know how to do all of these problems. You are welcome to write up any or all of these problems and turn them in to be corrected, or meet with me to discuss them.

It is recommended that assignments be done in pairs. Each pair of students will submit one set of solutions. Graduate and undergraduate students should not work together.

Final project Graduate students enrolled in the course will write an approximately five-page paper on a topic taken from current research literature. Undergraduates may choose to do the final project. If they do, their grade will be computed as the maximum of the graduate and undergraduate formulas.

Final exam There will be a take-home final exam in this course. Work must be done independently. The final exam will be similar to the homework and the optional problems.

Graduate students Graduate students will be expected to base their projects on research papers. There will be some additional homework and exam questions for the graduate students.

Grading Grades for undergraduates will be based 40% on homework and 60% on the final exam. Grades for graduate students will be based 30% on homework, 30% on projects, and 40% on the final exam.

Programming Data analysis requires computer programming. In this course we will use the R programming language, which is well-suited to statistical work, is fairly straightforward, and (most important) is free. (Note that R is functionally equivalent to the commercial software S-Plus.) No prior computer-programming experience is assumed. There will be one hour a week of tutorial. If you have your own computer, it is strongly recommended that you try to install R before the first tutorial. The department can provide computer access to those who need it.

R may be downloaded for Macintosh, Windows or Linux at `http://probability.ca/cran/`. Free basic manuals for R are available at

the same address, and full documentation is included with the software distribution. Some good books that you may wish to consider purchasing are:

- *Using R for Introductory Statistics*, John Verzani
- *Introductory Statistics with R*, Peter Dalgaard
- *Data Analysis and Graphics Using R*, John Maindonald and John Braun

The first two will be on reserve in Douglas Library.

Calculator It is strongly recommended that you bring some kind of calculator to class.

Week	Topic	Reading
9/11	Plotting, smoothing, trends	Chapter 1,2
9/18	Basic frequency domain, Stochastic models	Chapter 1,2
9/25	ARMA models: Forecasting	Chapter 3.1–3.5
10/2	ARMA: estimation, integrated models	Chapter 3.6–3.9
10/9	Spectral analysis, filters	Chapter 4.1–4.5, 4.7
10/16	Cross-spectrum, Lagged regression, signal extraction	Chapter 4.6,4.10,4.11
10/23	Hidden Markov models	
10/30	Frequency-domain regression	Chapter 7.1–7.6,7.9
11/6	State-space models	Chapter 6
11/13	Demographic projections	
11/20	Wavelets	Section 4.9+TBA
11/27	Wavelets	