

# ECON 307/STAT 310: Probability and Statistics

Date: Fall 2017  
Time: TTh 1300 – 1415 (Course 16883/16885, Section 2)  
Location: Duncan Hall DH 1046

## Instructor

Prof. John A. Dobelman  
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## Teaching Assistant (TA)/Grader

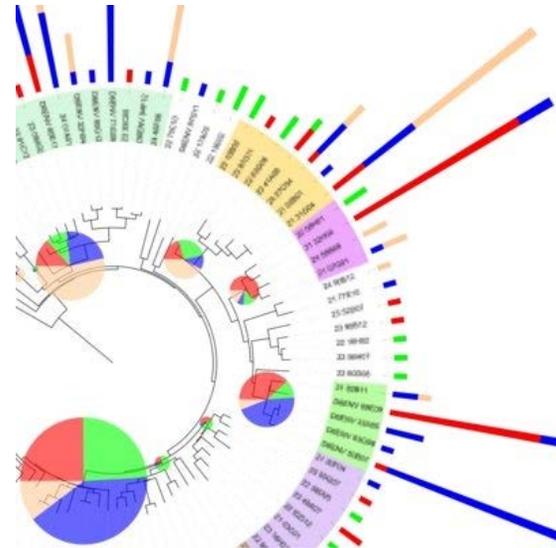
Mr. Michael D. Jackson, [mdj3@rice.edu](mailto:mdj3@rice.edu)  
DH 1038; Tel: 682 554 6377  
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Office Hours: By app't

## Course Website

<http://dobelman.rice.edu> (see courses)  
We will also be using Canvas



## Course Text

Kandethody M. Ramachandran and Chris P. Tsokos. *Mathematical Statistics with Applications in R, 2nd Edition*, Academic Press, 2015. ISBN-10: 0124171133, ISBN-13: 978-0-12-417113-8

## Other Recommended Textbooks and Resources

*Schaum's Outline of Probability and Statistics*, 4<sup>th</sup> (2012), available online from Amazon for <\$20. Hundreds of solved problems; this will really help you. Some reports of typos in the 3<sup>rd</sup> edition.

Alfredo H-S. Ang and Wilson H. Tang, *Probability Concepts in Engineering: Emphasis on Applications to Civil and Environmental Engineering*, 2nd Ed., 2007.

Robert V. Hogg, Joseph McKean, Allen T Craig. *Introduction to Mathematical Statistics, 7th Edition*, Pearson, 2013. ISBN-10: 0-321-79543-1, ISBN-13: 978-0-321-79543-4

Robert V. Hogg, Elliot A. Tanis, and Dale Zimmerman, *Probability and Statistical Inference, 9th ed.*, Pearson, 2015. ISBN-13: 978-0-321923271, ISBN-10: 321-92327-8. (A little gentler introduction.)

Various online statistics resources are available at [Dr. Dobelman's website](#) (and of course all over the internet).

## Course Description

This course is a calculus-based introduction to the concepts of mathematical probability and statistics. Topics covered include probability and the central concepts and methods of statistics

including probability distributions, expectation, estimation, hypothesis testing, sampling distributions, and linear models. Applications are to general use in multiple disciplines including engineering, economics, marketing, finance and the social sciences.

### **Grading**

25% Homework Exercises; 65% Exams; 10% Class Participation. Since solutions for many of the homework exercises are provided, it is imperative that you show your work; simply stating an answer will result in no credit for the problem.

### **Use of Canvas**

The Canvas system is the course management tool for announcements, assignments, resources, etc. Please do not email the instructor/TA questions about the course or assignments, but rather post as a discussion on Canvas so that all can see the conversation. If online submission for assignments is required, please upload in the appropriate area (usually in the assignments section).

### **Assignment Submission and Late policy**

Homework assignment will generally NOT REQUIRE a canvas submission (for exceptions see the assignment writeup). Late homeworks will not be accepted without a university approved excuse. A 20% penalty for HW turned in by next class; no credit for later than this. You might be able to negotiate with the grader. Homework/labs must be printed out and submitted in class. Certain assignments will require a submission to Canvas well as. The instructor/TA will not be able to print out emailed homework.

### **Exams**

Exams will be closed book, open calculators. If take-home, NO INTERNET is permitted. A single page, hand-written cheat-sheet is permitted for each exam. If you miss an exam we will try to find a time that is convenient to both you and the instructor in which to take the missed exam. If no such time period is available, you will take the missed exam during the final exam period in addition to the final exam. You must finish both exams in the time allotted for the final exam period. If you miss a second exam you will receive a zero - no exceptions.

### **Attendance**

Students are expected to attend class. Much material is presented in class which might not otherwise be in texts, notes, etc. Attendance will be reflected in the Class Participation portion of the course grade. Although we plan on keeping the course website up to date, if a student misses a class, then he/she is responsible for keeping up with the course material and finding out if any exams, quizzes, or homeworks have been assigned or scheduled. Similarly, important due date changes might sometimes be made in class to your benefit which might not be immediately posted on Canvas.

### **Laptops and Wearable/Portable Electronic Devices (PED)**

Unless so requested by the instructors, please do not use these devices during class, they are a distraction to other students. Prohibited devices include laptops, earbuds, gaming devices, mp3/music/media players, cell/smart-phones, PDA's, Kindle/e-book readers, tablet computers/readers, Apple watch/i\* devices, multi-purpose wrist communicators, cameras, GPS/GIS devices, Google glasses, etc. Hearing aids are acceptable to use in accordance with the last item (disabilities) and procedures herein. From time to time the instructors may ask a student to look something up, but in most cases this is not necessary. If the student requests, such devices may be permitted, if the purpose is clearly articulated in advance. The student will

be asked to put away their PED's if they are taken out in class; upon the second request, the student will be dismissed from class.

## **Software**

It is impossible to perform statistical/quantitative data analysis today without some sort of computer software, and it is expected that the student will become proficient with one or more statistical software packages. The most widely used data analysis software in the real world today is Microsoft Excel, and its capabilities are impressive. However, more specialized software is sometimes needed, such as Matlab, R/S-Plus, SAS, Python, SQL, Resampling Stats, SPSS, Stata, StatTools, StatExact, Lisrel, @Risk, Maple, Mathematica, C-Plex, etc. Of these, R and Python have become the choice of many because of their relative ease of use and low cost (FREE!) [Download information](#) for some of these packages is available on the course website(s).

One can also program most statistical procedures in a "high-level" programming language such as Java, C++, Fortran, VB, etc., along with specialized add-in routine libraries, but these require a lot of work to code and debug. Additionally, you will find that most corporate employers will not be paying for the nice software that is available for you here on campus. Consequently, to enhance your future value to your future employer, we suggest that you become proficient in Excel, R/Python and SQL/SAS.

## **Course Content**

We plan to cover most of this material. Topics/chapters include

### **Probability**

Basic Concepts Properties of Probability Methods of Enumeration Conditional Probability Independent Events Bayes' Theorem

### **Discrete Distributions**

Random Variables of the Discrete Type Mathematical Expectation Bernoulli Trials and the Binomial Distribution the Moment-Generating Function The Poisson Distribution

### **Continuous Distributions**

Continuous-Type Data and EDA Random Variables of the Continuous Type The Uniform and Exponential Distributions The Gamma and Chi-Square Distributions Distributions of Functions of a Random Variable Additional Models

### **Multivariate Distributions**

Distributions of Two Random Variables The Correlation Coefficient Conditional Distributions Transformations of Random Variables Independent Random Variables Distributions of Sums of Independent Random Variables Chebyshev's Inequality and Convergence in Probability

### **The Normal Distribution**

A Brief History of Probability The Normal Distribution Random Functions Associated with Normal Distributions The Central Limit Theorem Approximations for Discrete Distributions The Bivariate Normal Distribution Limiting Moment-Generating Functions Importance of Understanding Variability

### **Estimation**

Sample Characteristics Point Estimation Sufficient Statistics Confidence Intervals for Means Confidence Intervals for Difference of Two Means Confidence Intervals for Variances Confidence Intervals for Proportions Sample Size Order Statistics Distribution-Free

Confidence Intervals for Percentiles A Simple Regression Problem More Regression  
Resampling Methods Asymptotic Distributions of Maximum Likelihood Estimators

### **Bayesian Methods**

Subjective Probability Bayesian Estimation More Bayesian Concepts

### **Tests of Statistical Hypotheses**

Tests About Proportions Tests About One Mean and One Variance Tests of the Equality of Two Normal Distributions The Wilcoxon Tests Chi-Square Goodness of Fit Tests Contingency Tables One-Factor Analysis of Variance Two-Factor Analysis of Variance Tests Concerning Regression and Correlation Kolmogorov-Smirnov Goodness of Fit Test Run Test and Test for Randomness

### **Theory of Statistical Inference**

Power of a Statistical Test Best Critical Regions Likelihood Ratio Tests  
Maximum Likelihood Methods  
Sufficiency  
Optimal Tests of Hypotheses

### **Nonparametric and Robust Statistics**

### **The Normal Linear Model**

### **Appendixes: A Review of Selected Mathematical Techniques**

Algebra of Sets Mathematical; Tools for the Hypergeometric Distribution; Limits; Infinite Series; Integration; Multivariate Calculus

## **Rice Honor Code**

Before enrolling in a Rice University program, you must understand and agree to abide by the Honor System in place at Rice which protects the academic integrity of all coursework. Proper citation and use of the Honor Pledge on examinations will normally be required. All students (including graduate students) at Rice are bound by the Rice Honor Code. New students should familiarize themselves with the Honor Code before starting classes. The Honor Code is a unique feature at Rice, one that is valued highly, and is of profound importance. Honor Code violations are very serious, and can lead to dismissal from the University. Suspected violations will be processed in accordance with applicable procedures <http://honor.rice.edu>.

Examinations, if held, are conducted under pledged conditions. Improper recitation and use of the Honor Pledge on examinations will normally be penalized at 5% of the exam grade.

Homework and group assignments/projects may be worked on with other class members but each student must submit their own work for credit. Homeworks should be submitted by each person, but you should indicate with whom you worked when applicable. No direct copying is allowed. Specific group projects and assignments may be submitted by the group.

## **Disabilities**

Any student with a documented disability needing academic adjustments or accommodations is requested to speak with the instructor during the first two weeks of class. All discussions will remain confidential. Students with disabilities should also contact Disability Support Services in the Ley Student Center. Further information is available at <http://dss.rice.edu/>.

Revised 9/7/17