MATH 362/662: Multivariate Statistics, Fall 2016

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Office Hours: Wednesday 3:15 - 4PM, Thursday 3:30-5PM, and by appointment
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1. **Location and Time:** 10:00-10:50 MWF, Manchester 121

2. **Book:** An Introduction to Applied Mutivariate Analysis with R (2011), by Everitt and Hothorn

3. **Prerequisites:** MTH 121 or 205 or 206 (i.e. some type of linear algebra) and MTH 256/656 Statistical Models, or POI. Previous experience with linear algebra (vector and matrix algebra, matrix inverses, orthogonality, etc.) is important; prior exposure with statistical models is important, but gaps can be overcome. While calculus is not a pre-requisite and will not be used on exams or assignments, some familiarity with functions of one variable is helpful. No previous computer programming experience is needed.

4. **Outline:** This course covers the visualization and analysis of datasets with multiple variables. The techniques we will study are designed to uncover hidden patterns within very large datasets. Unlike regression which you may have studied in MTH 256, MTH 367 or a similar course, in multivariate statistics we don't designate a particular variable as a *response* variable, modelled based on designated *explanatory variables* which are assumed to be measured without error. Instead, we take the point of view that we simply have large datasets, all variables are of equal interest, and all are measured with error. If you've ever heard phrases like "big data" or "looking for a needle in a haystack" both apply nicely to MTH 362 topics.

   Specifically, we will cover the basics of multivariate analysis and high dimensional data visualization (chapters 1-2), principal components (chapter 3), scaling (chapter 4), clustering (chapter 6), and a few associated topics such as factor analysis or missing data. Throughtout the course we will make extensive use of the statistical software program `R`, but no previous computer programming experience is assumed.

5. **What is Assigned:**

   - **Assignments:** (18%) We will have weekly homework assignments, generally due on Fridays. You may discuss problems with classmates, and indeed you are encouraged to do so, but everything you write must be your own work. In particular, you must entirely code your computer programs to analyze data. If you need to miss class, you may place your assignment in my mailbox at Manchester 131 anytime before class. Unless you have advance permission, homework up to 24 hours late is counted at 50%, and not accepted after 24 hours.
   - **Exams:** (25% each) There will be two in-class exams, on **Wednesday, October 12** and **Wednesday, November 16**. Specific topics and details on the exams

will be announced in advance of each exam. Exams are closed-book and closed-notes, but you may use any simple calculator (you'll need $\sqrt{x}$, e^x, $\log(x)$). You may not use any device with WiFi access as your calculator.

- **Final Exam:** (32%) Our comprehensive final exam will be held **9AM on Monday December 12**.

6. **Software:** We will use `R`, a free statistical software program which can be found here: (`http://cran.us.r-project.org/`). In particular, we will use RStudio as a convenient framework for programming. Students must write their own computer programs from scratch, but no previous computer programming experience is needed.

7. **Grading:** Grades follow the standard scale, with cutoffs: 93 A, 90 A-, 87 B+, 83 B, 80 B-, 77 C+, 73 C, 70 C-, 67 D+, 63 D, 60 D-, and below 60 is F. Modest curving of grades *may* be used, but only at the end of the semester. Graduate students enrolled in MTH 662 will have some additional questions on homework assignments and exams.

8. **Honesty and Courtesy:** Academic dishonesty of any sort will not be tolerated, and could result in an immediate grade of F. Refer to `http://services.studentlife.wfu.edu/judicial-affairs/honor/`. Phones, laptops, and other electronic devices are distractions when used for non-academic work in class. There is a mountain of research that shows we do lower quality work when distracted by electronic devices. Additionally, I find it extremely disheartening when I see students distracted by electronic devices during class. Surely you can last 50 minutes disconnected.

9. **Getting Help:** Come to my office hours, or e-mail me and set up an appointment. Please contact the Learning Assistance Center (758-5929) within the first two weeks of class if you require accommodations for taking this course due to a disability.