

**Psych 5007: Statistics and Data Analysis in MATLAB**  
**Spring Semester 2014 (January 13, 2014 – April 25, 2014)**

*Classes:* Fridays, 2:00pm – 4:00pm, Psychology Building, Room 216B

*Instructor:* Kendrick Kay, PhD (Visiting Scholar, Psychology Department)

*Office hours:* by appointment

*E-mail:* kendrick.kay@wustl.edu

*Class web site:* <http://artsci.wustl.edu/~kkay/psych5007/>

**Overview:** The goal of this course is to (1) identify and explain basic statistical principles that are widely applicable to the analysis of neuroscience and behavioral data and (2) show how these principles can be translated into practice using MATLAB as the programming environment. Topics will include probability distributions, error bars and confidence intervals, statistical significance, regression, classification, correlation, linear and nonlinear models, cross-validation, bootstrapping, model selection, and randomization methods. We will focus on nonparametric and computational approaches to statistical problems, as opposed to classical statistical approaches involving parametric assumptions and analytic solutions.

**Target audience:** This course is intended for graduate students or postdocs who would like to gain a better understanding of statistical principles and/or learn how to program in MATLAB. Auditors are welcome.

**Prerequisites:** Students should have some familiarity with basic statistics and should have access to MATLAB. (Note: The Student Version of MATLAB is sufficient and suitable for this course.) Prior programming experience is helpful but not necessary.

**Assignments:** There will be several programming assignments. Assignments can be completed in groups of up to two people, and this is strongly encouraged. There is no final exam.

**Materials/textbook:** Course materials will be provided online. There is no textbook for this course.

**Final grade:**

Homework assignments = 100%

<i>Date</i>	<i>Topic</i>	<i>Homework</i>
Jan 17	<b>MATLAB Basics I</b> (the MATLAB environment, data types, matrices, indexing, basic operations)	HW1 due Jan 31
Jan 24	<b>MATLAB Basics II</b> (figures and plotting, flow control, writing functions)	–
Jan 31	<b>Probability distributions and error bars</b> (histograms, mean, standard deviation, median, probability distributions, the Gaussian distribution, error bars, confidence intervals, bootstrapping)	HW2 due Feb 21
Feb 7	<b>Hypothesis testing and correlation</b> (hypothesis testing, $p$ -values, $t$ -test and nonparametric alternatives, correlation ( $r$ ), independence)	–
Feb 14	<b>MATLAB examples</b>	–
Feb 21	<b>Model specification</b> (regression vs. classification, linear models, linearized models, nonlinear models)	HW3 due Mar 21
Feb 28	<b>Model fitting</b> (least-squares, error surfaces, nonlinear optimization, maximum likelihood)	–
Mar 7	<b>MATLAB examples</b>	–
Mar 14	<b>***NO CLASS (SPRING BREAK)***</b>	–
Mar 21	<b>Model accuracy</b> (coefficient of determination ( $R^2$ ), overfitting, cross-validation, model selection)	HW4 due Apr 11
Mar 28	<b>Model reliability</b> (bootstrapping, jackknifing, split-half)	–
Apr 4	<b>MATLAB examples</b>	–
Apr 11	<b>Classification</b> (logistic regression, linear discriminant analysis, support vector machines, nearest-neighbor classification)	HW5 due Apr 25
Apr 18	<b>MATLAB examples</b>	–
Apr 25	<b>Review</b>	–