Course Description

In collaboration with the Faculty Teaching Excellence Program (FTEP), Psych 5541 (Topics in Psychology: Programming in $R$) will be held 2009 Spring semester, Wed mornings from 9 a.m. to noon. My main goal is for you to understand the logic of the $R$ language and how to learn specific topics on your own. By the end of class, my hope is that you will be comfortable enough with $R$ to use it as your preferred statistical package. No prior experience with $R$ is required. This is not primarily a statistics course, but obviously we'll be covering statistical procedures and approaches, and so a firm grasp of graduate-level statistics is assumed.

Classes will be a mix of lecture and working on homework. You probably will not have time to finish homework in class and so they will be due by the following week. I don't anticipate that the homework will take you a large amount of time outside of class (perhaps 2-4 hours per week), but the more time you spend working with $R$, the more you will get out of this course. The first three classes will serve as a self-contained broad intro to the $R$ statistical language and later classes will get much more in depth into topics.

I strongly encourage collaborative work. Getting together with fellow students and working together on homework and your final projects is one of the best ways to learn $R$. In this vein, I strongly encourage attending the weekly office hours, to be held in the faculty lunchroom of Muen (E224). While working together on final exams is also OK, please show proper judgment in helping classmates (i.e., act like an instructor would rather than how a cheater would). In no case should two students turn in identical homeworks, projects, or take-home finals. Also note that there is a point at which asking for too much help from fellow students takes away from your own learning of the material. If you find that you have trouble using $R$ on your own, that is a good indication that you need to do $R$ by yourself more!

Assessment and Grading

Final grades are based on equal weightings of homework, a project, and a take-home final. These are explained below:

1) Homework. Homework assigned from the previous week is due the following Monday at noon. They should be submitted on the course website. Homework should be in the form of an *.R script file that I can run in $R$ and that will produce all necessary graphs and results. Short descriptions of the results (as well as notes to yourself) should be placed in this file in the form of comments (using the “#” comment character). Homework is graded pass/fail.
2) **Final Project.** (Due May 3). On the sixth class, you will give me a short proposal of a How-To Manual you would like to write on a topic you want to master using R (e.g., interactions in linear regression; hierarchical linear models, etc…). Please include enough detail so that I can understand why you have chosen this topic and what you want to accomplish in your manual. I will work with you to make sure the topic is appropriate. These topics do not necessarily need to be on statistical analysis (importing stock prices from online databases, writing LATEX reports within R, using BioConductor, etc…), but please try to choose topics that are likely to be something you are currently using or will use in the future. I strongly suggest choosing a topic that you are already familiar with and that you have mastered using another statistical package – this allows you to concentrate on learning R rather than a new statistical technique, and allows you to compare your R results with those from an independent statistical package.

Your job is to write a beginner’s “How To” manual (posted on the class wiki) on your chosen topic. It needs to include a brief and cogent explanation of the analysis and when it would be used. Using a dataset that is either publicly available or that is simulated within your syntax, walk the readers through an example analysis (complete with syntax and written explanations). Make sure to cover issues such as assumption checking, graphing, manipulation of data, analysis, and interpretation of results. Assuming I have your permission, I will eventually publish the best of these guides on the official R-wiki site, making them available to the general public as guides to analysis.

3) **Take home final** (Due May 3). The take home final will be like a homework on steroids. It will hopefully prove challenging and fun.

### Tentative Course Schedule

**PART 1 – BASIC R FOR STATISTICS**

<table>
<thead>
<tr>
<th>Jan</th>
<th>14</th>
<th>Introduction to R</th>
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<tbody>
<tr>
<td></td>
<td>21</td>
<td>Reading, writing, and manipulating data</td>
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<tr>
<td></td>
<td>28</td>
<td>Graphing and statistics for GLM</td>
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**Feb  | 4  | Graphing and statistics for ANOVA |
|      | 11 | Review of material from first part of course |

**PART 2 – ADVANCED R PROGRAMMING**

<table>
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<th>Mar</th>
<th>4</th>
<th>Controlling your computer from within R</th>
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<tbody>
<tr>
<td></td>
<td>11</td>
<td>Advanced data manipulation I</td>
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<tr>
<td></td>
<td>18</td>
<td>Programming &amp; Looping in R Choose topic for Final Project</td>
</tr>
<tr>
<td></td>
<td>25</td>
<td>Writing your own functions in R</td>
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</table>
18 Advanced data manipulation II
25 **Spring Break** **no class**

Apr  1 High level graphing
     8 Low level graphing
     15 Bootstrapping and permutation testing in R

PART 3 – TAKE HOME FINAL & HOW-TO MANUALS

22 Work on take-home final or How-To Manual in class
29 Work on take-home final or How-To Manual in class

May  3 Take home final due (email document to matthew.c.keller@gmail.com)
     “How To” Manual due

Important Information:

Disabilities, Learning Difficulties, and Related Problems
The flexible structure and small size of this course makes it easy to accommodate a wide range of learning-related difficulties. Please send me an email or talk to me in office hours about any special problems you may have.

Religious and Other Absences
Similarly, the flexible structure and small size of this course makes it easy to accommodate absences for religious observances or similar needs. Please send me email or talk to me in office hours about any absences you will need and we will make arrangements.

Students are expected to know and comply with University policies described by these links:
http://www.colorado.edu/policies/cnr/
http://www.colorado.edu/policies/classbehavior.html
http://www.colorado.edu/policies/honor.html
http://www.colorado.edu/policies/index.html