**KINE 8970: Biostatistics II**

**Lectures**: TH 3:30-4:45pm in KINE 112

**FINAL EXAM:** None

**Instructor**: Keith Lohse, PhD

**|Office**: KINES 279  **|Office Hours**: Tuesday 1-3pm

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**Goals of the course:**

1. To give students a detailed understanding of more advanced topics in inferential statistics such as general linear modelling procedures for complicated experimental designs and different types of data.
2. To provide an introduction to non-parametric statistics, the chi-squared distribution, and logistic regression.
3. To give students mastery of common statistical tests, their assumptions, and how to use these tests in research.
4. To provide students with knowledge, but also a digital library of scripts, data-sets, and readings that will allow them to take on progressively more challenging courses in statistics.

**Course Philosophy:**

I love to teach statistics—for several reasons. For instance, I absolutely believe that statistics is one of most important classes you can take, even if you do not go on to a career in research. Statistics are a set of tools—the best and often only ones we have—to learn about complex real world problems. Nearly everything you learn in your past, current, and future classes has used the types of statistical tools that we are going to explore. Also, statistics is an empowering class; it gives you the tools to understand experimental research, but also to do your ownexperimental research. Finally, statistics is challenging, it forces you to think analytically (reducing problems to their essential components), but also creatively (e.g., given a particular problem, how can we test the question we are interested in).

**Required Materials:**

***R:*** <http://www.r-project.org/>

***R Studio:*** <http://www.rstudio.com/products/rstudio/>

***Keith’s Biostatistics webpage:*** <https://sites.google.com/site/lohsekr/biostatistics>

***Textbook:*** *Data Analysis a Model Comparison Approach (2nd Ed.)* by McClelland, Judd, and Ryan. <http://www.dataanalysisbook.com/>

**Grading and Assessment:**

As you will see, this course treats learning biostatistics like a game. "Biostatistics" is an unknown world that the student must explore. Hence, we pay homage to one of my favorite games by reminding students that, "***It's dangerous to go alone.***" If you are not familiar with the Legend of Zelda, in the beginning of the game the protagonist, Link, is given a sword to start his journey and told, “It’s dangerous to go alone! Take this.” and the old man gives him a sword.

Over the course of his adventures, Link not only learns how to use this sword more effectively, but learns to use a host of other weapons as well. Similarly, we start with learning some very basic statistics and how to implement them in the "base" package of R. As our skills grow, however, we will start to learn to use other packages to deal with different types of data and particularly difficult analyses.

***The course begins with all students having zero experience points (XP)***. There will be no tests on which you lose points during the course, but you can gain points in three different ways: (1) Earning ***experience*** by taking quizzes on the recorded lectures, (2) gaining ***skills and specialties*** by completing the in-lab assignments, and (3) completing ***quests*** (rhymes with tests) that require practical application of the knowledge you have gained in other areas of the course.

***To earn XP***, you can complete daily quizzes that will be given at the beginning of each class. You can also gain XP through completing lab assignments and completing quests.

The lab assignments are designed ***to help you gain skills***. These assignments are to be done in lab with the instructor. These skills will prepare you for the quests in the course and (hopefully) for the application of statistics in your own research. Sometimes lab assignments will be worth XP as well… but we never know when… so it’s important for you to attend class as often as possible (otherwise you might miss out on that sweet XP!).

***To complete a quest***, you will need to complete the practical module that goes with that quest with at least 80% accuracy. If you fail to complete a quest, or if you would simply like to score higher on the module, you are welcome to retake it. On your second attempt, you can earn up to 80% of the original xp (e.g., if you get 0% the first time and then 100% on the second attempt, you will finish with 80% on that module and beat the quest). There are four quests available in Biostatistics II and you need to complete all of the quests in order to pass the class.

To start a quest (more information will be given in class), you can download the .pdf with all of the questions for that module and begin working through the questions in R. You can complete the module at home in the allotted time frame (usually over the weekend, Friday morning to Tuesday morning) using any of the materials from the course, ***but all students must work individually***.

**Accommodations**

Students who need accommodations are asked to electronically submit their approved accommodations through AU Access and to arrange a meeting during office hours to discuss your accommodations. If you have a conflict with my office hours, an alternate time can be arranged. To set up this meeting, please contact me by e-mail. If you have not established accommodations through the Office of Accessibility, but need accommodations, make an appointment with the Office of Accessibility, 1228 Haley Center, 844-2096 (V/TT).

**Fall 2016| Biostatistics I.**

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| **Date: 2016/** | **Online**  | **Readings****(J, M, & R)** | **In-Class Topics:** |
| 01/12 | Module 200Module 201 | Chapter 6 | Syllabus and refresher. |
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| 01/17 | Module 210 | Chapter 8 | Codes multiple groups |
| 01/19 | Module 211 |  | Omnibus tests and false-positive rates. |
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| 01/24 | Module 212 | Chapter 9 | Models with Multiple Categorical Predictors (ANOVA) |
| 01/26 | Module 213 |  | Post-hoc tests and false-positive rates. |
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| 01/31 | Module 214 | Chapter 10 | Combining categorical and continuous predictors (ANCOVA). |
| 02/02 | Module 215 |  | Colinearity and baseline differences. |
|  |  |  | **Quest**: **“Throne of Eternity”** *Covers everything up to module 223. Due 02/07.* |
| 02/07 | Module 220 | Chapter 11 | Models for statistically dependent observations (RM ANOVA) |
| 02/09 | Module 221 |  | Multiple crossed independent variables. |
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| 02/14 | Module 222 | Chapter 11 | Non-Independence in Mixed Designs. |
| 02/16 | Module 223 |  | More on mixed designs. |
|  |  |  |  |
| 02/21 | Module 224 |  | Continuous predictors with non-independent observations. |
| 02/23 | Module 225 |  | Multilevel regression examples.***Virtual Meeting only, Dr. Lohse is out of town.*** |
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| 02/28 | Module 226 |  | Outliers and statistical assumptions. |
| 03/02 |  |  | Flex day for Review. |
|  |  |  | **Quest*: “Legacy of the Adept”*** *Covers everything up to module 032. Due 03/07.* |
| 03/07 | Module 230 |  | Introduction to non-parametric statistics |
| 03/09 | Module 231 |  | The Chi-Square Distribution |
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| 03/14 |  |  | ***No Class – Spring Break*** |
| 03/16 |  |  | ***No Class – Spring Break*** |
|  |  |  |  |
| 03/21 | Module 045 |  | The Chi-Square Test. |
| 03/23 | Module 046 |  | The Mann-Whitney U Test. |
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| 03/28 | Module 047 |  | The Wilcoxon Signed-Rank Test. |
| 03/30 | Module 048 |  | McNemar’s Test. |
|  |  |  | **Quest**: ***“The Stormbringer’s Canticle.***” *Covers everything up to module TBD. Due 04/04.* |
| 04/04 | Module 050 |  | Odds, log odds, and odds-ratios. |
| 04/06 | Module 051 |  | Link functions and logistic regression.  |
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| 04/11 | Module 052 |  | Continuous predictors in logistic regression. |
| 04/13 | Module 053 |  |  |
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| 04/18 | Module 054 |  | Categorical predictors in logistic regression. |
| 04/20 | Module 055 |  |  |
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| 04/25 |  |  |  |
| 04/27 |  |  |  |
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|  |  |  | **Quest**: ***“Malleus Discipulorum.*”** *Covers everything up to module TBD. Due 05/02.* |
| 05/02 |  |  | Final exam period, no class. |
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