CRM 7008 Data Analysis for Coastal Resources Management Students ****

**CRM 7008 Syllabus Spring 2015**

|  |  |  |  |
| --- | --- | --- | --- |
| Classroom | 9 AM - 12:00 PM | We | Flanagan 00378 |
|  |  |  |  |

**Your head analyst: Joe Luczkovich** [**luczkovichj@ecu.edu**](mailto:luczkovichj@ecu.edu) **Office:** 383 Flanagan

Guest lecturers: Hans Vogelsong, Dave Kimmel, Tom Allen, David Griffith, Ramon Lopez-Rosado

**Phone:** 252-328-9402 **Skype:** drluczkovich  **Webpage:** http://core.ecu.edu/BIOL/luczkovichj/

**Textbooks:** Dalgaard, Peter. 2008. Introductory Statistics with R. Second Edition. Springer, 364 p. ISBN 978-0-387-79053-4 (required, on reserve and soon available as e-book at Joyner Library; for now, you can purchase an electronic book via Springer’s website or rent or buy the hard copy at the ECU bookstore). <http://link.springer.com/book/10.1007%2F978-0-387-79054-1>

Wickham, Hadley. 2009. ggplot2. Elegant Graphics for Data Analysis. Springer, 213 p. ISBN 978-0-387-98140-6 (optional)

**Official course comic strips:**

PhD Comics. Life in grad school has never been funnier. <http://www.phdcomics.com/comics.php>

xkcd is also pretty funny, it is math-based humor, so you may not always get the joke. But if you do, then this is the strip for you!<http://xkcd.com/1155>

**Course Objectives:** At the end of this course, the student will be able to analyze any kind of data collected in support of coastal management decision-making, following standard procedures developed by coastal scientists and statisticians. The student will have already taken a basic graduate level statistics class and at least one other coastal science class (in ecology, geology, social science). Students will be given data, learn to read it in, and then asked to analyze it each week in a hands-on computer-intensive approach using the software introduced below. This course is an introduction to all kinds of data analyses used in coastal science and not intended to be a replacement for other higher level courses in a specific data analysis technique. The student will learn to:

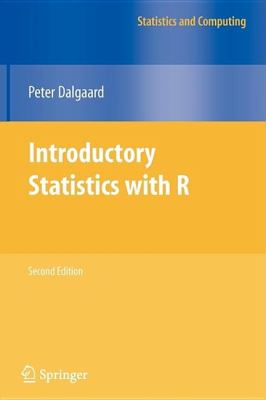
* Compare strengths, weaknesses and complementarities of quantitative, qualitative, modeling and geospatial data analysis techniques.
* Generate data analyses using selected data analysis techniques.
* Appraise and explain the capacity of different data analysis techniques to address problems in coastal resource management.

**Data Analysis Tools we will consider this semester:**

* ANOVA and Non-parametric Alternatives
* Correlation
* Regression Analysis
* Multiple Regression Analysis
* Factor Analysis/Principle Components Analysis
* Discriminant Function Analysis
* Cluster Analysis
* Geostatistics: GIS/remote sensing/image analysis
* Network Analysis
* Qualitative methods
* Visualizations of data

**Software we will use this semester:**

* **R (this is free! Others will cost money for a license, so we will learn this one!!!)**
* Excel (with Data Analysis Add-In Pak)
* Systat (and others like SPSS and SAS, but they all do the same things, so use what you know)
* UCInet/Netdraw
* ArcGIS – GIS software (ECU site license)
* SeaDAS – free remote sensing software: http://seadas.gsfc.nasa.gov/
* Other software as appropriate



**Dalgaard 2nd Edition Table of contents**

**1. Basics 11. Multiple regression**

**2. The R environment 12. Linear models**

**3. Probability and statistics 13. Logistic regression**

**4. Descriptive statistics and graphics 14. Survival analysis**

**5. One and two sample tests 15. Rates and Poisson regression**

**6. Regression and correlation 16. Nonlinear curve-fitting**

**7. ANOVA and Kruskal-Wallis A. Obtaining and installing R and the ISwR package**

**8. Tabular data B. Data sets in the ISwR package**

**9. Power and the computation of sample size C. Compendium**

**10. Advanced data handling D. Answers to exercises**

**Lecture/ Lab Schedule:**

|  |  |  |  |
| --- | --- | --- | --- |
| **Dates** | **Topic** | **Lecturer** | **Homework**  **(worth 5% each)** |
| 14 Jan | **Snow day 1** |  |  |
| 21 Jan | Introduction. Exploratory Data Analysis Visualizations of data; normality, matrix notation and R, bar plots, scatter plots. | Luczkovich |  |
| 28 Jan | One sample and two sample comparisons  T-tests, Wilcoxon tests | Luczkovich | HW 1 due |
| 4 Feb | ANOVA and Non-parametric Alternatives; Kruskal-Wallis | Luczkovich | HW 2 due |
| 11 Feb | Two-Way and Repeated Measures ANOVA | Luczkovich | HW 3 due |
| 18 Feb | **Snow Day 2** |  |  |
| 25 Feb | **Snow Day 3** |  |  |
| 3 Mar | **Make up day 1** Correlation and Regression, Multiple Regression Analysis | Luczkovich | HW 4 assigned |
| 4 Mar | Social Surveys and statistical analysis | Hans Vogelsong | Take home exam distributed |
| 11 Mar | **Data Analysis Take- Home Exam (20%)**  **Spring Break – No classes** |  | Take home exam |
| 17 Mar | **Make up day 2** Multivariate Analysis MANOVA, Clustering | Luczkovich | Take-home Exam due |
| 18 Mar | Discriminant Function Analysis, Correspondence analysis | Luczkovich | HW 5 due |
| 24 Mar | **Make up Day 3** Logistic Regression | Luczkovich | HW 6 due |
| 25 Mar | Factor Analysis/Principal Component Analysis | David Kimmel |  |
| 31 Mar | **Make up day 4** Multi-dimensional scaling MDS, ANOSIM | Luczkovich |  |
| 1 Apr | Time Series Analysis | Luczkovich | HW 7 due |
| 8 Apr | Geostatistics II: Remote sensing  Geostatistics II: Remote sensing lab | Ramón López-Rosado | HW 8 due |
| 15 Apr | Geostatistics I: GIS/kriging/spline  Geostatistics: GIS maps and mosquitos[[1]](#footnote-1) | Tom Allen | HW 9 due |
| 22 April, | Qualitative Data Analysis  Qualitative methods, participant observer | David Griffith | HW 10 due |
| 29 April | Network Analysis; 2 mode and square matrix Bayesian Analysis | Luczkovich |  |
| 4 May  8:00 AM | **Final Exam take-home assignment (30%) presentations in class and written report due** |  |  |

**References and Texts to consult when stuck:**

Becker, Richard A., William S. Cleveland and Allan R. Wilks. 1987. **Dynamic Graphics for Data Analysis.** *Statistical Science.* Vol. 2, No. 4 (Nov., 1987), pp. 355-383  <http://www.jstor.org/stable/2245523>

Bernhardsen, T. 2002. Geographic Information Systems: An Introduction. New York: Wiley.

Cleveland, W. S. 1985. The Elements of Graphing Data. Monterey, CA: Wadsworth.

Cresswell, J. 2008. Research Design: Qualitative, Quantitative, and Mixed Methods Approaches. Thousand Oaks, CA: Sage.

Hollander, Myles and Douglas A. Wolfe. 1973. Nonparametric Statistical Methods. John Wiley and Sons.

[Johnson](http://www.amazon.com/s/ref=ntt_athr_dp_sr_1?_encoding=UTF8&sort=relevancerank&search-alias=books&field-author=Richard%20A.%20Johnson), Richard A. and [Dean W. Wichern](http://www.amazon.com/s/ref=ntt_athr_dp_sr_2?_encoding=UTF8&sort=relevancerank&search-alias=books&field-author=Dean%20W.%20Wichern). 2007. Applied Multivariate Statistical Analysis (6th Edition). Prentice Hall. ISBN: 978-0131877153.

[Kleinman](http://www.amazon.com/Ken-Kleinman/e/B001HCY52Y/ref=ntt_athr_dp_pel_1), Ken and [Nicholas J Horton](http://www.amazon.com/Nicholas-J-Horton/e/B002IPB6SK/ref=ntt_athr_dp_pel_2). 2009. SAS and R: Data Management, Statistical Analysis, and Graphics. Chapman and Hall. ISBN: 978-1420070576.

Manly, B. 2005. Multivariate Statistical Methods: A Primer. Boca Raton: Chapman & Hall.

[Muenchen](http://www.amazon.com/Robert-A.-Muenchen/e/B002S9J2U0/ref=ntt_athr_dp_pel_1), Robert A. R for SAS and SPSS Users (Statistics and Computing). Springer. ISBN: 978-0387094175

Snedacor, G. W. and W. G. Cochran. 1985. Statistical Methods. 8th Edition. Iowa State University Press. ISBN: 978-0813815619.

Sokal, Robert and James Rolhf. 1994. [Biometry: The Principles and Practices of Statistics in Biological Research](http://www.amazon.com/Biometry-Principles-Practices-Statistics-Biological/dp/0716724111/ref=sr_1_1?ie=UTF8&qid=1294768536&sr=8-1). W. H. Freeman; Third Edition. ISBN: 978-0716724117

Tufte, Edward R. 1983. The visual display of quantitative information. Cheshire, CT: Graphics Press.

[Velten](http://www.amazon.com/exec/obidos/search-handle-url/ref=ntt_athr_dp_sr_1?%5Fencoding=UTF8&sort=relevancerank&search-type=ss&index=books&field-author=Kai%20Velten), K. 2009. Mathematical Modeling and Simulation: Introduction for Scientists and Engineers. New York: Wiley.

Zar , [Jerrold H.](http://www.amazon.com/Jerrold-H.-Zar/e/B000APRCY2/ref=ntt_athr_dp_pel_1) 2009. Biostatistical Analysis (5th Edition). Prentice Hall. ISBN: 978-0131008465

1. Meets in Brewster C201 GIS lab 9 – 11 AM [↑](#footnote-ref-1)