**W203 Statistics, Ryan Kappedal, Tuesday 4pm, Fall 2018**

**Week 1-2 | Descriptive Statistics and Exploratory Data Analysis (2 lectures) (9/1-9/11)**

* Measurement
* Types of variables
* Operationalization of constructs
* Descriptive statistics
* Measures of location
* Measures of dispersion
* Tools for visualizing Data
* Guidelines for exploratory analysis

 Required readings:

**(Week 1: due 9/4)**

* Devore, J. L. (2015). Probability and statistics for engineering and the sciences. **Chapter 1**.
* The following readings are provided to you via Study.net.

Fox, J., & Weisberg, S. (2011). An R companion to applied regression. **Chapters 1.1, 1.4, 2.1, 2.2, and 2.3**

**(Week 2: 9/4-9/10)**

* The following readings are provided to you via Study.net.

Fox, J., & Weisberg, S. (2011). An R companion to applied regression. **Chapters 3.1.1, 3.1.4, 3.2.1.**

***Note****: When reading the chapters from Fox, don't worry if you come across statistical terms you don't understand. Simply ignore them and move on.*

Additional readings:

* The RStudio R markdown lessons - read from the introduction through the section titled Output Formats <http://rmarkdown.rstudio.com/lesson-1.html>
* The R Markdown Cheatsheet <https://www.rstudio.com/wp-content/uploads/2015/02/rmarkdown-cheatsheet.pdf>

**Week 3-6 | Probability Theory and Mathematical Statistics (4 lectures) (9/11-10/1)**

* Axioms of probability
* Random variables
* Probability density and cumulative probability functions
* Joint distributions
* Unconditional and conditional expectation
* Variance and covariance
* Sampling
* The Central Limit Theorem

 Required readings:

**(Week 3: 9/11-9/17)**

* Devore, J. L. (2015) Probability and statistics for engineering and the sciences. **Chapter 2**.
* The ShareLatex primer on subscripts and superscripts in the Latex language <https://www.sharelatex.com/learn/Subscripts_and_superscripts>

**(Week 4: 9/18-9/24)**

* Devore, J. L. (2015). Probability and statistics for engineering and the sciences. **Chapters 3–3.4, 4–4.3, 4.6**.
* **Optional**: Chapters 3.5, 3.6, 4.4, and 4.5.

***Note to students****: Out of all the probability distributions in chapters 3 and 4, the most important ones to know are the Bernoulli, binomial, uniform, and normal. Students who plan to take more advanced statistics courses will benefit from reading about all of the other distributions in the chapters. On the other hand, if you are feeling overwhelmed by the math, it is acceptable to skip these sections for now and come back to them when you actually need them.*

**(Week 5: 9/18-9/24)**

* Devore, J. L. (2015). Probability and statistics for engineering and the sciences. **Chapters 5.1 and 5.2**.

**(Week 6: 9/25-10/1)**

* Devore, J. L. (2015). Probability and statistics for engineering and the sciences. **Chapters 5.3, 5.4, and 5.5**.

**Week 7-9 | Estimation and Hypothesis Testing (3 lectures) (10/2-10/22)**

* Desirable properties of estimators
* Maximum likelihood estimators
* Method of moments estimators
* Confidence intervals
* The Frequentist approach to statistical inference
* z -tests and t-tests for one sample
* Parametric tests for comparing means
* The reproducibility crisis
* p-hacking
* p-value corrections
* Publication bias
* Strategies for improving reproducibility

 Required readings:

**(Week 7: 10/2-10/8)**

* Devore, J. L. (2015). Probability and statistics for engineering and the sciences. **Chapters 6, 7.1, 7.2, and 7.3**.

***Note****: In 7.2, the subsections titled "A Confidence Interval for a Population Proportion" and "One-Sided Confidence Intervals (Confidence Bounds)" are optional. In 7.3, the sections titled "A Prediction Interval for a Single Future Value" and "Tolerance Intervals" are optional.*

**(Week 8: 10/9-10/15)**

**QUIZ 1 Due 10/22**

* Devore, J. L. (2015). Probability and statistics for engineering and the sciences. **Chapters 8–8.3, 8.5**.

***Note****: Within 8.5, you are only responsible for reading "Statistical Versus Practical Significance" and "The Relationship Between Confidence Intervals and Hypothesis Tests."*

**(Week 9: 10/16-10/22)**

* Devore, J. L. (2015). Probability and statistics for engineering and the sciences. **Chapters 9–9.3**.
* Wagenmakers, E., Wetzels, R., Borsboom, D., & van der Maas, H. (2011, March). Why psychologists must change the way they analyze their data: The case of psi: Comment on Bem. Journal of Personality and Social Psychology, Vol 100(3), 426–432.

*For the article above, read up to and including the subsection entitled "Problem 1: Exploration Instead of Confirmation." This article can be accessed through the university library. First, make sure you are logged into Calnet (*[*https://calcentral.berkeley.edu/*](https://calcentral.berkeley.edu/)*), then use the following*[*link*](https://search.proquest.com/docview/849701737?accountid=14496)*.*

* [Why Most Published Research Findings Are False](http://journals.plos.org/plosmedicine/article?id=10.1371/journal.pmed.0020124)
* The following readings are provided to you via Study.net.

Dienes, Z. (2008). Understanding psychology as a science. New York, NY: Palgrave. Chapter 3.

**Week 10-14 | Classical Linear Regression (5 Lectures) (10/23-12/11)**

* Bivariate estimation
* Multivariate estimation
* Rubin’s Causal Model
* Omitted variable bias
* Factors that influence standard errors
* The classical linear model assumptions
* Key assumptions for large sample sizes
* The use of variable transformations, polynomials, indicator variables, and interaction terms
* Regression Diagnostics and formal statistical assumption testing
* True experiments

 Required readings:

**Week 10: 10/23-10/29**

* Wooldridge, J. (2015). Introductory econometrics: A modern approach, 6th ed. **Chapter 2**.

**10/30-11/5: NO CLASS THIS WEEK**

**Week 11: 11/6-11/12**

* Wooldridge, J. (2015). Introductory econometrics: A modern approach, 6th ed. **Chapters 3–3c, 5.1**.
* Optional Reading: Students that want to deeply understand the matrix derivation of OLS might find the following article useful. It provides some nice intuition for taking derivatives with respect to vectors. <http://michael.orlitzky.com/articles/the_derivative_of_a_quadratic_form.xhtml>

**11/13-11/19: NO CLASS THIS WEEK**

**Week 12: 11/20-11/26**

* Wooldridge, J. (2015). Introductory econometrics: A modern approach 6th ed. **Chapters 3.4 through the end of Chapter 3, 4 through 4.3, and 5.2**.

**Week 13: 11/27-12/3**

**QUIZ 1 Due 12/4**

* Wooldridge, J. (2015). Introductory econometrics: A modern approach, 6th ed. **4.4 through the end of Chapter 4, 6 through 6.2, 7 through 7.4**.

**Week 14: 12/4-12/10**

* No reading