# PSY-PC-2110-02: Introduction to Statistical Analysis

S. Mason Garrison

November 29, 2018

Class Hours: TR 4:00p-5:15p                    Class Room: Payne Building 109

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## Course Description

This introductory course is designed to help students develop the conceptual background and practical skills necessary to evaluate the statistics encountered in their coursework and in everyday life. It emphasizes selection, application, and interpretation. Topics to be covered include statistical inference, probability distributions, sampling, hypothesis testing, and correlation. The goal will be to go beyond rote memorization of abstract formulas and for students to develop an appreciation for the critical role that statistics plays in psychological science.

To do well in the course, you should read the assigned material before class and re-read previously assigned material as the course progresses. By reading the text before class you will be better prepared to ask questions and integrate the content of lectures with what was presented in the text. Also be sure to attend all lectures and arrive on time. Each topic builds directly on the previous one. Thus, if you miss one lecture, you run the risk of being completely lost in the next lecture.

**Selected Course Objectives:**

- To understand the selection, computation, and interpretation of descriptive and inferential statistics

- To learn how to use and interpret R (R Core Team 2018).

## Materials

### Texts

*Required*

[1] D. S. Moore, W. Notz and M. A. Fligner. *The basic practice of statistics*. Eighth. W. H. Freeman, 2017. ISBN: 1319042570.

**How to use the required text:** The text (Moore, Notz, and Fligner 2017) is intended to supplement the lectures. The lectures don't follow the order of chapters in the text and the text covers some material that won't be covered in the lectures, i.e., not all the information in each chapter is perfectly pertinent to the course requirements.

*Endorsed*

[1] D. Huff. *How to Lie with Statistics*. New York: W. W. Norton & Company, 1954. <URL: https://books.google.com/books?id=5oSU5PepogEC>.

[2] W. Strunk and E. B. White. *The Elements of Style*. MacMillan, 1959. ISBN: 9788578110796. <URL: https://books.google.com/books?id=3Yw6AQAAMAAJ>.

## Software

R is a free software environment for statistical computing and graphics. It compiles and runs on a wide variety of UNIX platforms, Windows and MacOS.

[1] R Core Team. *R: A Language and Environment for Statistical Computing*. Vienna, Austria: R Foundation for Statistical Computing, 2018. <URL: https://www.R-project.org/>.

# Course Policies

I will detail the policies for this course below.

## Grading Policy

Typically an A- is defined as 90% of the highest point total in the class, B- as 78% of that total, C- as 68 and D- as 58%. I may shift these values down to provide a better fit to the actual point distribution. By scaling to a % of the highest point total in the class, each student has a much better chance of receiving higher grades than if no re-scaling were done.

- 300 points of your grade will be determined by three (3) tests during normal class hours.
- 100 points of your grade will be determined by one (1) cumulative exam.
- 50 points of your grade will be determined by your attendance and participation in class. Generally, ask questions and answer them.

*Extra Credit*

Students can earn up to 25 points of extra credit in this class by completing a data visualization project, using R. The project is due on the Friday December 7th at 7pm. The parameters for this project are intentionally vague. But, each submission must include the following three elements:

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1. A data visualization
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2. Source Code (I should be able to reproduce your visualization)
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3. A written description of the project (Less than 1 page).
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Examples of data visualizations include:

- https://www.reddit.com/r/dataisbeautiful/top/

- https://www.census.gov/dataviz/

- https://fivethirtyeight.com/tag/data-visualization/
- http://flowingdata.com/tag/best-of/

## Attendance Policy

*Showing up is 80 percent of life* – Woody Allen, via Marshall Brickman

Students should be wary of skipping class. There is a strong positive correlation between the percentage of classes a student has attended in the course and the student's final grade for the semester (Crede, Roch, and Kieszczynka 2010; Chen and Lin 2008), even after controlling for motivation and ability (Latif and Miles 2013).

I deduct *all* participation points for a class after five unexcused absences and this can have important implications for a student's overall grade in the class.

The student who misses a class meeting is responsible for any assignments and/or announcements made. The stated attendance policy of Peabody College applied to this course:

> Students are expected to attend all scheduled meetings of classes in which they are enrolled; they have an obligation to contribute by full participation in the work of each class... Students who must miss a class due to illness, personal reasons, or other reasons should notify the course instructor (prior to the class meeting if possible). In case of serious illness or personal emergency causing an absence from campus, the student may request that the Peabody Office of Student Affairs notify instructors. The Office of Student Affairs does not "excuse" a student from class; it will simply notify instructors of the student's absence.

*Excused absences*

I recognize that occasions arise during the academic year that merit the excused absence of a student from a scheduled class or laboratory during which an examination, quiz, or other graded exercise is given. Examples include participation in sponsored university activities (e.g., debate team, varsity sports), observance of officially designated religious holidays, serious personal problems (e.g., serious illness, death of a member of the student's family), and matters relating to the student's academic training (e.g., graduate or professional school interviews). Conflicts arising from personal travel plans or social obligations do not qualify as excused absences.

Except in the case of true emergencies, a possible excused absence should be discussed with me as far in advance as possible - you should not assume that an excused absence will automatically be granted. This discussion should occur via email. If you also discuss your situation verbally, please send a summary of the discussion via email to me. An unexcused absence will result in a zero for any graded work that should have been performed for or during the missed class.

## Academic Dishonesty Policy

All work submitted for credit must be the student's own and is subject to the provisions of the Vanderbilt Honor Code. Details can be found at the Honor Council web site http://studentorgs.vanderbilt.edu/HonorCouncil/.

## Accommodations Policy

If you are (or become) learning, sensory, or physically disabled, and need special course accommodations in class, reading, or any other work in this course, please contact me to discuss your

specific needs as soon as possible. Students who need reasonable accommodations for disabilities also should contact the Access Center (https://www.vanderbilt.edu/student-access/disability/).

## Classroom Climate

I would like to create a learning environment for my students that supports a diversity of thoughts, perspectives and experiences, and honors your identities (including race, gender, class, sexuality, religion, ability, etc.) To help accomplish this:

- If you have a name and/or set of pronouns that differ from those that appear in your official Vanderbilt records, please let me know!

- If you feel like your performance in the class is being impacted by your experiences outside of class, please don't hesitate to come and talk with me. I want to be a resource for you. Remember that you can also submit anonymous feedback (which will lead to me making a general announcement to the class, if necessary to address your concerns). If you prefer to speak with someone outside of the course, Tina Smith, Interim Vice Chancellor for Equity, Diversity and Inclusion, is an excellent resource.

- I (like many people) am still in the process of learning about diverse perspectives and identities. If something was said in class (by anyone) that made you feel uncomfortable, please talk to me about it. (Again, anonymous feedback is always an option).

## Tentative Class Schedule

This syllabus is intended to give the student guidance in what may be covered during the semester and will be followed as closely as possible. However, I reserve the right to modify, supplement and make changes as the course needs arise.

### Week 01, 08/20 - 08/24: Introduction

- Tuesday: (No Class)
- Thursday: First Day of Class

### Week 02, 08/27 - 08/31: Getting Ready to Do Statistical Analysis

- Tuesday: Research Design (Chapter 9)

- Thursday: Sampling Theory (Chapter 8) / Measurement in the Social/Behavioral Sciences

### Week 03, 09/03 - 09/07: Describing Data with R

- Tuesday: Describing Data Graphically with R

- Wednesday (Sep 05, 2018)

    - Last day to drop a class (with a paper drop form) with no entry on the record
    - Last day to add a class & register for pass/fail status using paper forms

- Thursday: Describing Data Numerically with R

### Week 04, 09/10 - 09/14: Univariate Distributions

- Tuesday: Univariate Distributions (Chapter 1/2)

- Thursday: Standardization, z-scores, and the normal distribution (Chapter 3)

### Week 05, 09/17 - 09/21: Test 1

- Tuesday: Test 1 Review

- Thursday: Test 1

### Week 06, 09/24 - 09/28: Bivariate Distributions

- Tuesday: Bivariate Distributions (Chapter 4)

- Thursday: Correlation (Chapter 5)

### Week 07, 10/01 - 10/05: Probability Theory

- Thursday: Probability Theory (Chapter 12)

### Week 08, 10/08 - 10/12: Binomials and other sampling distributions

- Tuesday: More Probability Theory (Chapter 13)

- Thursday: Review

## Week 09, 10/15 - 10/19: Test/Fall Break

- Tuesday: Test 2

- Thursday No Class (Fall Break Oct 18-19)

- Friday (Oct 19, 2018)

    - Last day undergraduate students may withdraw from fall semester classes
    - Last day to change from pass/fail to graded status in a fall semester class

## Week 10, 10/22 - 10/26: Hypothesis Testing

- Tuesday: The Logic of Hypothesis Testing Hypotheses, Errors (Chapters 16-19)

- Thursday: t-tests

## Week 11, 10/29 - 11/02: Inferences about means

- Tuesday: Applying t-tests and ANOVA (Chapters 20 & 21)

- Thursday: More Analysis of Variance (Chapters 24 & 27)

## Week 12, 11/05 - 11/09: Special Topics

- Tuesday: Subverting the Research Process

- Thursday: Causal Inference

## Week 13, 11/12 - 11/16: Test 3

- Tuesday: Review

- Wednesday: Alternative Test Date

- Thursday: Test 3

## Week 14, 11/19 - 11/23: Thanksgiving

- Thanksgiving Break (Nov 17-25)

## Week 15, 11/26 - 11/30: Applications in R

- Tuesday: Translating Research Questions into R

- Thursday: Addressing Statistical Questions in R

## Week 16, 12/03 - 12/07: Applications in R

- Tuesday: Addressing Statistical Questions in R
- Thursday: Last Day of Class
- Friday: Extra Credit Due at 7pm

**Final Exam**

- The Final Exam will be take home.
    - Open Notes, Open Book, Open Internet, Open Computer
    - However, you can't get help from other people.
    - But you can ask me questions.
        * I will have extended office hours.
- The exam will be made available on Friday December 7th at 5pm (through brightspace)
- It will be due on brightspace on Saturday December 15th at 7:00 pm.

# References

Chen, Jennjou, and Tsui-Fang Lin. 2008. "Class attendance and exam performance: A randomized experiment." *The Journal of Economic Education* 39 (3). Taylor & Francis: 213–27.

Crede, M., S. G. Roch, and U. M. Kieszczynka. 2010. "Class Attendance in College: A Meta-Analytic Review of the Relationship of Class Attendance With Grades and Student Characteristics." *Review of Educational Research* 80 (2): 272–95. doi:10.3102/0034654310362998.

Latif, Ehsan, and Stan Miles. 2013. "Class Attendance and Academic Performance: A Panel Data Analysis." *Economic Papers: A Journal of Applied Economics and Policy* 32 (4): 470–76. doi:10.1111/1759-3441.12054.

Moore, David S., William Notz, and Michael A. Fligner. 2017. *The basic practice of statistics*. Eighth. W. H. Freeman.

R Core Team. 2018. "R: A Language and Environment for Statistical Computing." Vienna, Austria: R Foundation for Statistical Computing. https://www.R-project.org/.