

# Applied Statistics (INTR 202-04)

Fall 2022

TR 9:45-11:15 am, *Huntley 323*

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Huntley Hall 210

Office Hours: Tuesday 1:30-3:30 pm & Wednesday 10:30-11:30 am

## Course Description

An examination of the principal applications of statistics to allow students to develop a working knowledge and understanding of applied statistics. Topics include descriptive statistics, probability, estimation, hypothesis testing, and regression analysis.

We are surrounded by data. Statistics is what allows us to retrieve information from data. Without statistics, data would just be numbers and words in a spreadsheet. In this course, you will develop skills in learning from data as well as drawing conclusions and critically evaluating results based on data. Students will learn the basic concepts of statistics and probability and comprehend the methods needed to analyze and critically evaluate statistical arguments.

We will discuss the complexities of research design, including operationalizing concepts and measuring them as well as the challenges and limitations of gathering good data. A very important emphasis of this course will be to critically evaluate the conclusions that we draw from data in class and in life (research by analysts, reporters, politicians, and policy advocates). Society, media, business, government, and culture are becoming increasingly data-oriented, placing a high value on basic statistical literacy.

We will employ an inverted teaching format, with most of the time spent “doing statistics” by means of online and in-class lab exercises.

## Course Objectives

- Demonstrate understanding of the process by which statistical analysis provides evidence to answer questions, including the basic ideas of statistical inference.
- Convey basic information about data using descriptive statistics and present this information using meaningful graphical techniques.
- Interpret and critically evaluate statistical results in different applied examples.
- Develop a basic understanding of the common pitfalls of data collection and sampling.
- Translate general research questions into testable hypotheses with dependent and independent variables.
- Critically examine numerical and graphical statistical arguments appearing in mass media.

## Course Requirements

The course will meet twice a week. The requirements for the course are first and foremost regular class attendance, reading of the assigned materials, and completion of tests, labs, and quizzes. Since the majority of our class sessions will be spent “doing statistics,” you will need to **bring your laptop to every session**. We will be working with our online courseware and software all the time. If you do not have access to a laptop, let me know and we will facilitate one. If you lack proficiency with computers, please let me know and I will work with you.

Students are **required** to have all course-related files saved on an **online drive** of their preference (i.e., Dropbox, Google Drive, or others).

**Attendance** is mandatory. Classes missed immediately before and after holidays are particularly noticed and are not excused. If you need to miss class, please send me a quick note *ahead of* the class session you must miss. I expect everyone to **arrive on time**. Late arrivals are disruptive and distracting. I appreciate your cooperation.

Contact me if you have questions or concerns. If you have any kind of problem with the course or with life, please **communicate** with me (no need to give me any specific details regarding the situation you are going through). Let me know if my office hours are not at a convenient time for you and we will set an appointment. Do not let missed classes and assignments get out of hand. I am willing to work with you to help you succeed, but I cannot do so retroactively at the end of the semester.

The following are some guidelines to help you get started:

- **Speak up!** Ask the second you have a question or a comment. It is very possible that others may have the same concerns you do.
- **Respect** one another.
- **No cellphones in class.**

## Course Evaluation

Checkpoints (quizzes)	15%
Labs	25%
Midterm exam	20%
Participation + presentation	10%
Final exam	30%

## Grade Assessment

**I do not discuss grades via email.** Please take 24 hours to review the initial feedback. Then, bring to my office a written note explaining the error that you think I have made.

If you have concerns about your grade in the course, please come talk to me as soon as possible about strategies to improve your performance. Grades reflect the following assessment of your work in this course:

*A: Excellent performance* (90-100). Exceptional grasp of the material and a deep analytic understanding of the subject.

*B: Good performance (80-89).* Mastering the material, understanding the subject well, and showing some originality of thought and/or considerable effort.

*C: Fair performance (70-79).* Acceptable understanding of the material but failing in translating this understanding into consistently creative or original work.

*D: Poor performance (60-69).* Some understanding of the material but exhibiting significant deficiency in comprehension and/or effort.

*F: Fail (59 and below).* Failing to complete assignments or comprehend the basics of the material.

Minus grades at each increment are below 63, 73, 83, and 93, and plus grades above 67.9, 77.9, and 87.9. I do not round up .5 grades. In other words, 87.5 is not a B+, and 89.5 is not an A-.

### **Checkpoints**

The weekly open book online "Checkpoints" consist of multiple-choice questions, via our online courseware. You will complete **two required attempts** for each checkpoint, with the **score** of your **best attempt** being your graded score. If you fail to complete the second attempt, that will count as zero and average with the grade you receive on your first attempt. The graded checkpoints have specific due dates. If you miss a deadline, you must request my approval to complete the checkpoint late and will only receive 50% of the credit.

These quizzes are designed to encourage you to study the course material throughout the semester rather than waiting until the midterm or final exams.

### **Labs**

You will have a set of weekly graded online labs consisting of cases, problems, and questions to assess your statistical capabilities and comprehension of the assigned material. **See the complete schedule of assignments and due dates on pages 6-7.**

### **Exams**

The midterm exam and final exam will consist of problems and questions to assess your comprehension of the material. The **midterm** exam will be posted on Canvas on **Thursday, October 20<sup>th</sup>** at 9 am and it will be available until 9 pm. You will have up to three hours to take the exam. No books, notes, or sources may be used. Extensions for the exam will only be offered in cases of emergencies and must be arranged *at least a week prior* to the exam date. There will be no exceptions to this policy.

The **final** exam will take place during finals week (December 11-17). It will be self-timed and will be posted on Canvas.

### **Participation & Presentation**

Participation is key for this course. Forget about the percentage of your overall grade it counts towards, the actual value of participation is much greater than this because it will help you to do better on all the assignments and exams in this course.

**Students are expected to read the assigned materials prior to each class and participate actively** during class meetings. Participation performance is not based on the number of times you speak up during class but on the **quality** of your input. By no means, this should be understood as having to "be right" every time. Any comment or question that contributes to

our analysis of course content is highly regarded. Questions are an excellent way to participate. They show your interest in the course and your ability for critical thought.

Each of you will choose one class throughout the term to find statistics used in a piece of popular press about a current event. You will prepare a brief **presentation** of the current event you chose and describe the statistics used in it. Addressing how an understanding of statistics made the information more valuable and allowed you to consider it critically will be **key components** of the small presentation (5 minutes). You may work in pairs for this assignment (8 minutes total).

For all coursework, the [Honor System](#) applies.

### **Disability Accommodations**

Washington and Lee University makes reasonable academic accommodations for qualified students with disabilities. All accommodations must be approved through the Office of the Dean of the College. Students requesting accommodations for this course should present an official accommodation letter within the first two weeks of the term and schedule a meeting outside of class time to discuss accommodations. It is the student's responsibility to present this paperwork in a timely fashion and to follow up about accommodation arrangements.

### **Diversity Statement**

Washington and Lee affirms that diverse perspectives and backgrounds enhance our community. We are committed to the recruitment, enrichment, and retention of students, faculty, and staff who embody many experiences, cultures, points of view, interests, and identities. As engaged citizens in a global and diverse society, we seek to advance a positive learning and working environment for all through open and substantive dialogue. Please read the [Politics Department Statement on Diversity and Inclusion](#).

### **[Policy on Prohibited Discrimination](#)**

The University prohibits and this policy addresses discrimination, including harassment, on the basis of race, color, religion, national or ethnic origin, age, disability, veteran's status, and genetic information in its educational programs and activities and with regard to employment. Additionally, the University prohibits retaliation against any individual who brings a good faith complaint under this policy or is involved in the complaint process. Students, faculty, and staff found to have violated this policy will be disciplined appropriately, up to and including termination from employment or dismissal from the University.

### **[Sexual Discrimination & Misconduct Policy](#)**

W&L prohibits all forms of sexual misconduct-which includes sexual harassment, non-consensual sexual intercourse, non-consensual sexual contact, sexual exploitation, domestic and dating violence, and stalking-and retaliation. This policy provides guidance to assist those who have experienced or been affected by sexual misconduct, whether as a complainant, a respondent, or a third party. It includes detailed information about what conduct is prohibited, confidential and reporting resources, and resolution procedures.

## Course Materials

1) Online courseware application from Carnegie Mellon University (CMU) as our **textbook**. Access card available at the W&L Store.

2) The online software package **StatCrunch**. Access code available at <https://www.statcrunch.com/register/student>

Payment, registration, and login are required to access both materials.

**Additional** (free) materials: [Statistics Glossary](#). If you insist on a traditional textbook, then *Even You Can Learn Statistics and Analytics: An Easy to Understand Guide to Statistics and Analytics*, 3rd ed (2014) is available through the Library.

## Course Schedule

Note that I reserve the right to make changes to the course schedule, including assignments due dates and test dates, when unforeseen circumstances occur.

### Sept. 8 to Oct. 20

Learning Strategies & Big Picture

Exploratory Data Analysis

Examining Distributions (Descriptive Stats)

Examining Relationships

Producing Data

Sampling

Designing Studies

Probability

Introduction

Random Variables

Sampling Distributions

October 18: Midterm Review

### **October 20: Midterm Exam**

### Oct. 25 to Dec. 8

Inference

Estimation

Hypothesis Testing (also called Significance Testing)

Inference for Relationships

Data Science – Introduction and Initial Applications

December 8: Final Review

**December 10-16: Final Exam**

## List of Assignments and Due Dates – INTR202-04 F2022, Ponce de Leon

The assigned readings must be done **before** class.

<b>Date</b>	<b>Assignments</b>
Tuesday, Sept 13	Read M3 & M4 Examining Distributions (omit p.23) Start Practice Lab
Wednesday, Sept 14	Checkpoints 1 & 2 due
Thursday, Sept 15	Read M5 Examining Relationships
Friday, Sept 16	Checkpoints 3 & 4 due
Saturday, Sept 17	Practice Lab due
Tuesday, Sept 20	Start Lab 1
Thursday, Sept 22	Read U3 Producing Data
Friday, Sept 23	Checkpoints 5, 6 & 7 due
Saturday, Sept 24	Lab 1 due
Tuesday, Sept 27	Start Lab 2
Thursday, Sept 29	Read M8 & M9 Probability & Random Variables
Friday, Sept 30	Checkpoints 8 & 9 due
Saturday, Oct 1	Lab 2 due
Tuesday, Oct 4	Start Lab 3
Thursday, Oct 6	Read M10 Sampling Distributions
Friday, Oct 7	Checkpoints 10 & 11 due
Saturday, Oct 8	Lab 3 due
Tuesday, Oct 11	Checkpoints & Lab Feedback
Tuesday, Oct 18	Midterm Review
<b>Thursday, Oct 20</b>	<b>Midterm Exam (available 9 am - 9 pm) – No Class</b>
Tuesday, Oct 25	Read M11 & 12 Inference & Estimation, Start Lab 4
Wednesday, Oct 26	Checkpoint 12 due
Thursday, Oct 27	Continue Lab 4, due that day
Tuesday, Nov 1	Read M13 Hypothesis Testing I (p.146-174)
Wednesday, Nov 2	Checkpoints 13, 14 & 15 due

Thursday, Nov 3	Start Lab 5
Saturday, Nov 5	Lab 5 due
Tuesday, Nov 8	Read M13 Hypothesis Testing II (p.175-177), Start Lab 6
Wednesday, Nov 9	Checkpoints 16 & 17 due
Thursday, Nov 10	Continue Lab 6, due that day
Tuesday, Nov 15	Read M14 Inference for Relationships I (p.178-196)
Wednesday, Nov 16	Checkpoint 18 & 19 due
Thursday, Nov 17	Start Lab7
Saturday, Nov 19	Lab 7 due
Tuesday, Nov 29	Read M14 Inference for Relationships II (p.197-203), Start Lab 8
Wednesday, Nov 30	Checkpoint 20 due
Thursday, Dec 1	Continue Lab 8
Saturday, Dec 3	Lab 8 due
Tuesday, Dec 6	Intro to Data Science, Readings TBD
Thursday, Dec 8	Final Review

**Checkpoints:**

- 1 & 2: Examining Distributions Checkpoints 1 & 2
- 3 & 4: Examining Relationships Checkpoints 1 & 2
- 5, 6 & 7: Sampling 1, Designing Studies Checkpoints 1 & 2
- 8 & 9: Introduction to Probability Checkpoint & Random Variables Checkpoint
- 10 & 11: Sampling Distributions Checkpoints 1 & 2
- 12: Estimation Checkpoint
- 13, 14 & 15: Overview Checkpoint, Hypothesis Testing for a Population Proportion Checkpoint & Hypothesis Testing for a Population Mean Checkpoint
- 16 & 17: Hypothesis Testing Checkpoint & Type I and Type II Checkpoint
- 18 & 19: Two Independent Samples Checkpoint & Matched Pairs Checkpoint
- 20: ANOVA Checkpoint