

# Applied Statistics

## Interdepartmental 202-03, Fall 2019

1:30-3 pm Tuesday & Thursday  
EarlyFl 109

Professor Zoila Ponce de Leon

Office Hours: Wednesday 9-10 am, Thursday 3:15-6:15 pm

Office: Huntley Hall 210

E-mail: [zponcedeleon@wlu.edu](mailto:zponcedeleon@wlu.edu)

### Course Description

This course provides an examination of the principal applications of statistics and is designed to allow the 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 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.

### 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 in plenary session. The requirements for the course are first and foremost regular class attendance, reading of the assigned materials, and completion of tests, labs, and quizzes.

The majority of the time spent during our class sessions will be “doing statistics” by means of online problems and in-class lab exercises. Moreover, the text and related interactive materials are provided online. Therefore, you will need to **bring your laptop to every session** since we will be working with our online courseware and software all the time. If you do not have access to a laptop, just let me know and we will facilitate one. If you lack proficiency with computers, please let me know as soon as possible and I will be happy to work with you.

**Attendance** is obligatory. Classes missed immediately before and after holidays are particularly noticed. I expect everyone to **arrive on time**. I understand that life is complicated but late arrivals are disruptive and distracting. I appreciate your cooperation.

Please come to office hours or contact me by e-mail if you have questions or concerns. If you have any kind of problem with the course or with life, please **communicate** with me. 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 cell-phones in class.**

## Course Materials

We will use an online courseware application from Carnegie Mellon University (CMU) as our **textbook**. The Statistical Reasoning courseware is available via access card purchased at the WLU Bookstore.

The online software package called **StatCrunch** is available via access card purchased at the WLU Bookstore. Payment, registration and login are required to access both materials.

**Additional** (free) materials:

Statistics Glossary found at <http://www.statsoft.com/Textbook/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 Leyburn Library’s license at <http://proquest.safaribooksonline.com>

## Course Evaluation

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

### Checkpoints

There will be weekly graded online "Checkpoints" consisting of multiple-choice questions, via our online courseware. You will have two required attempts for each one, with the **average of both attempts being your graded score**. The graded checkpoints will have specific due dates. There will also be many additional ungraded practice activities for additional edification.

These quizzes are designed to encourage you to study the course material throughout the semester instead of waiting for an examination.

### Labs

There will be a set of graded online labs consisting of cases, problems, and questions to assess your statistical capabilities and comprehension of the assigned material. The labs will be equally weighed in determining your grade. There will also be ungraded practice labs. A complete schedule of assignments and due dates will be provided by the instructor.

### Exams

There will be one midterm exam and a final exam consisting of problems and questions to assess comprehension of the material.

You will have up to three hours to take the **midterm** exam on **Thursday, October 17<sup>th</sup>**. You can start anytime between 8:30 am and 8:00 pm. No books, notes, or sources may be used. Extensions for the exam will only be offered in cases of medical or family emergencies and must be arranged prior to the exam date. There will be no exceptions to this policy.

The **final** exam will take place during finals week (December 7-13). It will be a self-timed and will be posted on Canvas.

### Participation

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 contents 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 be assigned 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 mention 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. You may work in pairs for this assignment.

### **Honor Code**

For all course work, the Honor System applies. The student's signature on her/his work confirms that the Honor System rules were respected. Familiarize yourself with the System at [www.wlu.edu/executive-committee/the-honor-system/the-white-book#The\\_Honor\\_System](http://www.wlu.edu/executive-committee/the-honor-system/the-white-book#The_Honor_System)

### **Grade Assessment**

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 not succeeding 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 to 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.

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.

**Re-grading:** 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. When I review the assignment again, your grade may go either up or down in order to more accurately assess your performance.

## **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.

## **Course Schedule**

Please 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. 5 to Oct. 8

Learning Strategies and Big Picture

Exploratory Data Analysis

Examining Distributions (Descriptive Stats)

Examining Relationships

Producing Data

Sampling

Designing Studies

Probability

Introduction

Random Variables

Sampling Distributions

October 10: Reading Day – No Class

**October 17: Midterm Exam**

Oct. 22 to Dec. 3

Inference

    Estimation

    Hypothesis Testing (also called Significance Testing)

    Inference for Relationships

Data Science – Introduction and Initial Applications

December 5: Final Review

## List of Assignments and Due Dates – INTR202-03 F2019, Ponce de Leon

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

<b>Date</b>	<b>Assignments</b>
Tuesday, Sept 10	Read M3 & M4 Examining Distributions, Start Practice Lab
Wednesday, Sept 11	Checkpoints 1 & 2 due before 10 pm
Thursday, Sept 12	Read M5 Examining Relationships
Friday, Sept 13	Checkpoints 3 & 4 due before 10 pm
Saturday, Sept 14	Practice Lab due before 10 pm
Tuesday, Sept 17	Start Lab 1
Thursday, Sept 19	Read U3 Producing Data
Friday, Sept 20	Checkpoints 5, 6 & 7 due before 10 pm
Saturday, Sept 21	Lab 1 due before 10 pm
Tuesday, Sept 24	Start Lab 2
Thursday, Sept 26	Read M8 & M9 Probability & Random Variables
Friday, Sept 27	Checkpoints 8 & 9 due before 10 pm
Saturday, Sept 28	Lab 2 due before 10 pm
Tuesday, Oct 1	Start Lab 3
Thursday, Oct 3	Read M10 Sampling Distributions
Friday, Oct 4	Checkpoints 10 & 11 due before 10 pm
Saturday, Oct 5	Lab 3 due before 10 pm
Tuesday, Oct 8	Checkpoints & Lab Feedback
Tuesday, Oct 15	Midterm Review
<b>Thursday, Oct 17</b>	<b>Midterm Exam (available from 8:30 am - 8 pm) – No Class</b>
Tuesday, Oct 22	Read M11 & 12 Inference & Estimation, Start Lab 4
Wednesday, Oct 23	Checkpoint 12 due before 10 pm
Thursday, Oct 24	Continue Lab 4, due before 10 pm
Tuesday, Oct 29	Read M13 Hypothesis Testing I (p.146-174), Start Lab 5
Wednesday, Oct 30	Checkpoints 13, 14 & 15 due before 10 pm

Thursday, Oct 31	Continue Lab 5, due before 10 pm
Tuesday, Nov 5	Read M13 Hypothesis Testing II (p.175-177), Start Lab 6
Wednesday, Nov 6	Checkpoints 16 & 17 due before 10 pm
Thursday, Nov 7	Continue Lab 6, due before 10 pm
Tuesday, Nov 12	Read M14 Inference for Relationships I (p.178-196)
Wednesday, Nov 13	Checkpoint 18 & 19 due before 10 pm
Thursday, Nov 14	Start Lab7
Saturday, Nov 16	Lab 7 due before 10 pm
Tuesday, Nov 19	Read M14 Inference for Relationships II (p.197-203)
Wednesday, Nov 20	Checkpoint 20 due before 10 pm
Thursday, Nov 21	Start Lab 8
Saturday, Nov 23	Lab 8 due before 10 pm
Tuesday, Dec 3	Intro to Data Science, Readings TBD
Thursday, Dec 5	Final Review

**Checkpoints:**

1 & 2: Examining Distributions Checkpoint 1 & 2

3 & 4: Examining Relationships Checkpoint 1 & 2

5, 6 & 7: Sampling 1, Designing Studies 1 & 2

8 & 9: Introduction to Probability Checkpoint & Random Variables Checkpoint

10 & 11: Sampling Distributions Checkpoint 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