Short Course Description

This course provides a brief overview of the basics of probability and statistics. Students will review basic probability concepts and probability distributions, the Central Limit Theorem and hypothesis testing, and linear and logistic regression. Throughout this course, students should develop and reinforce proper statistical intuition. This includes knowing how to identify a sample and a population and applying appropriate statistical methods such as hypothesis testing, as well being able to identify different types of data and using the proper methods for each type of data. By the end of the course, students should have a strong foundation in statistics with which they can start their graduate coursework.

Course Objectives

By the end of the course, students will...
- Understand sample and population and know how to apply statistical methods appropriately
- Be able to apply basic probability
- Know basic probability distributions and how to apply them
- Perform hypothesis tests and construct confidence intervals
- Regression analysis, including multiple regression and logistic regression.

Prerequisites

No prerequisites.

Class Structure and Course Concept

This is an online course, using a flipped classroom design. It covers the same material and content as an on-site course but runs differently. In this course, you are responsible for watching video-recorded lectures and reading the required literature for each unit prior to participating in mandatory weekly one-hour online meetings where students have the chance to discuss the materials from a unit with the instructor. Just like in an on-site
course, homework will be assigned and graded and there will be a final exam at the end of the course.

Although this is an online course where students have more freedom in when they engage with the course materials, students are expected to spend the same amount of time overall on all activities in the course – including preparatory activities (readings, studying), in-class-activities (watching videos, participating in online meetings), and follow-up activities (working on assignments and exams) – as in an on-site course. As a rule of thumb, you can expect to spend approximately 3h/week on in-class-activities and 9 hours per week on out-of-class activities (preparing for class, readings, assignments, projects, studying for quizzes and exams). Therefore, the workload in all courses will be approximately 12h/week. This is a 3-credit/6-ECTS course that runs for 12 weeks. Please note that the actual workload will depend on your personal knowledge.

**Mandatory Weekly Online Meetings**

*Wednesday, 01:00 PM EDT/7:00 PM CEST, starting June 3*

Meetings will be held online through Zoom. Follow the link to the meeting sessions on the course website on mannheim.instructure.com. If video participation via Internet is not possible, arrangements can be made for students to dial in and join the meetings via telephone.

In preparation for the weekly online meetings, students are expected to watch the lecture videos and read the assigned literature before the start of the meeting. In addition, students are encouraged to post questions about the materials covered in the videos and readings of the week in the forum before the meetings (deadline for posting questions is Wednesday, 10:00 AM EDT/4:00 PM CEST).

Students have the opportunity to use the Zoom meeting room set up for this course to connect with peers outside the scheduled weekly online meetings (e.g., for study groups). Students are encouraged to post the times that they will be using the room to the course website forum to avoid scheduling conflicts. Students are not required to use Zoom and can use other online meeting platforms, such as Google Hangout or Skype.

**Grading**

Grading will be based on:
- 11 homework assignments (60% of grade total, lowest homework dropped)
- Participation in online meetings and submission of questions demonstrating understanding of readings (10% of grade)
- Online Final Exam (30% of grade)

Students must get a 70% or higher in order to pass the class.
A+  100 - 97
A   96 - 93
A-  92 - 90
B+  89 - 87
B   86 - 83
B-  82 - 80
Etc.

The grading scale is a base scale recommended by the MDM. Variations for grading on a scale are at the discretion of the instructor.

Dates of when assignments will be due are indicated in the syllabus. Extensions will be granted sparingly and are at the instructors’ discretion.

Technical Equipment Needs

The learning experience in this course will mainly rely on the online interaction between the students and the instructors during the weekly online meetings. Therefore, we encourage all students in this course to use a web camera and a headset. Decent quality headsets and web cams are available for less than $20 each. We ask students to refrain from using built-in web cams and speakers on their desktops or laptops. We know from our experience in previous online courses that this will reduce the quality of video and audio transmission and therefore will decrease the overall learning experience for all students in the course. In addition, we suggest that students use a wire connection (LAN), if available, when connecting to the online meetings. Wireless connections (WLAN) are usually less stable and might be dropped.

Long Course Description

By the end of this course, students should be up to speed on statistical reasoning, hypothesis testing, and regression analysis. First, the course covers basic statistical thinking, reviewing the difference between a sample and a population as well as methods in sampling and experiments. Students will also be expected to recognize numerical and categorical data and apply proper methods throughout the course based on the type of data. This includes using the proper summaries and visualizations of the data, but also applies later on in hypothesis testing and confidence intervals.

We will cover the basics of the Central Limit Theorem, applying it in the form of confidence intervals and hypothesis tests. Students should know what conditions must be met in order to perform certain hypothesis tests, as well as be able to interpret the confidence intervals and hypothesis tests appropriately. This course will cover various types of tests, including one- and two-sample paired and unpaired t-tests, chi-squared tests, ANOVA.

This course also covers simple linear regression, multiple regression, and logistic regression. Students should know how a least-squares regression line is fit, as well as understand the assumptions that go along with it. In addition, students should be comfortable with evaluating the linear regression models and using diagnostics to
determine whether it is appropriate to use a linear regression. For logistic regression, students should also know how to properly interpret the coefficients.

**Readings**

**Primary Readings**

You can download the PDF of this textbook at openintro.org

**Required and Recommended Readings**
List of required and recommended readings for each class are provided below for each specific unit.

**Academic Conduct**

Clear definitions of the forms of academic misconduct, including cheating and plagiarism, as well as information about disciplinary sanctions for academic misconduct may be found at

https://www_president_umd.edu/sites/president/umd.edu/files/documents/policies/III-100A.pdf (University of Maryland) and


Knowledge of these rules is the responsibility of the student and ignorance of them does not excuse misconduct. The student is expected to be familiar with these guidelines before submitting any written work or taking any exams in this course. Lack of familiarity with these rules in no way constitutes an excuse for acts of misconduct. Charges of plagiarism and other forms of academic misconduct will be dealt with very seriously and may result in oral or written reprimands, a lower or failing grade on the assignment, a lower or failing grade for the course, suspension, and/or, in some cases, expulsion from the university.

**Accommodations for Students with Disabilities**

In order to receive services, students at the University of Maryland must contact the Accessibility & Disability Service (ADS) office to register in person for services. Please call the office to set up an appointment to register with an ADS counselor. Contact the ADS office at 301.314.7682; https://www.counseling.umd.edu/ads/.

Students at the University of Mannheim should contact the Commissioner and Counsellor for Disabled Students and Students with Chronic Illnesses at http://www.uni-mannheim.de/studienbueros/english/counselling/disabled_persons_and_persons_with_chronic_illnesses/
Course Evaluation

In an effort to improve the learning experience for students in our online courses, students will be invited to participate in an online course evaluation at the end of the course (in addition to the standard university evaluation survey). Participation is entirely voluntary and highly appreciated.
Sessions

Week 1: Introduction
Video lecture: available Wednesday, May 27, 2020
Online meeting: Wednesday, June 3, 2020, 01:00 PM EDT/7:00 PM CEST
Assignment 1: due Friday, June 5, 2020, 01:00 PM EDT/7:00 PM CEST
Required Readings:
Diez, Barr, and Çetinkaya-Rundel (2015) Ch 1.1-1.5

Week 2: Descriptive Statistics
Video lecture: available Wednesday, June 3, 2020
Online meeting: Wednesday, June 10, 2020, 01:00 PM EDT/7:00 PM CEST
Assignment 2: due Friday, June 12, 2020, 01:00 PM EDT/7:00 PM CEST
Required Readings:
Diez, Barr, and Çetinkaya-Rundel (2015) Ch 1.6-1.8

Week 3: Probability
Video lecture: available Wednesday, June 10, 2020
Online meeting: Wednesday, June 17, 2020, 01:00 PM EDT/7:00 PM CEST
Assignment 3: due Friday, June 19, 2020, 01:00 PM EDT/7:00 PM CEST
Required Readings:
Diez, Barr, and Çetinkaya-Rundel (2015) Ch 2

Week 4: The Normal Distribution and Z-Scores
Video lecture: available Wednesday, June 17, 2020
Online meeting: Wednesday, June 24, 2020, 01:00 PM EDT/7:00 PM CEST
Assignment 4: due Friday, June 26, 2020, 01:00 PM EDT/7:00 PM CEST
**Required Readings:**
Diez, Barr, and Çetinkaya-Rundel (2015) Ch 3.1-3.2

**Week 5: Other Probability Distributions**

Video lecture: available Wednesday, June 24, 2020

Online meeting: Wednesday, July 1, 2020, 01:00 PM EDT/7:00 PM CEST

Assignment 5: due Friday, July 3, 2020, 01:00 PM EDT/7:00 PM CEST

**Required Readings:**
Diez, Barr, and Çetinkaya-Rundel (2015) Ch 3.3 – 3.5

**Week 6: Confidence Intervals**

Video lecture: available Wednesday, July 1, 2020

Online meeting: Wednesday, July 8, 2020, 01:00 PM EDT/7:00 PM CEST

Assignment 6: due Friday, July 10, 2020, 01:00 PM EDT/7:00 PM CEST

**Required Readings:**
Diez, Barr, and Çetinkaya-Rundel (2015) Ch 4.1 – 4.2

**Week 7: Central Limit Theorem and Hypothesis Testing**

Video lecture: available Wednesday, July 8, 2020

Online meeting: Wednesday, July 15, 2020, 01:00 PM EDT/7:00 PM CEST

Assignment 7: due Friday, July 17, 2020, 01:00 PM EDT/7:00 PM CEST

**Required Readings:**
Diez, Barr, and Çetinkaya-Rundel (2015) Ch 4.3 – 4.5

**Week 8: Inference for Numerical Data**

Video lecture: available Wednesday, July 15, 2020

Online meeting: Wednesday, July 22, 2020, 01:00 PM EDT/7:00 PM CEST

Assignment 8: due Friday, July 24, 2020, 01:00 PM EDT/7:00 PM CEST
**Required Readings:**
Diez, Barr, and Çetinkaya-Rundel (2015) Ch 5.1 – 5.5

**Week 9: Inference for Categorical Data**

Video lecture: available Wednesday, July 22, 2020

Online meeting: Wednesday, July 29, 2020, 01:00 PM EDT/7:00 PM CEST

Assignment 9: due Friday, July 31, 2020, 01:00 PM EDT/7:00 PM CEST

**Required Readings:**
Diez, Barr, and Çetinkaya-Rundel (2015) Ch 6.1 – 6.6

**Week 10: Linear Regression**

Video lecture: available Wednesday, July 29, 2020

Online meeting: Wednesday, August 5, 2020, 01:00 PM EDT/7:00 PM CEST

Assignment 10: due Friday, August 7, 2020, 01:00 PM EDT/7:00 PM CEST

**Required Readings:**
Diez, Barr, and Çetinkaya-Rundel (2015) Ch 7.1 – 7.2

**Week 11: Regression Assumptions, Multiple- and Logistic Regression**

Video lecture: available Wednesday, August 5, 2020

Online meeting: Wednesday, August 12, 2020, 01:00 PM EDT/7:00 PM CEST

Assignment 11: due Friday, August 14, 2020, 01:00 PM EDT/7:00 PM CEST

**Required Readings:**
Diez, Barr, and Çetinkaya-Rundel (2015) Ch 7.3 - 7.4, 8.1 - 8.4

**Final exam**

Due: Wednesday, August 19, 2020, 01:00 PM EDT/7:00 PM CEST