

**NUTR 207: Statistical Methods for Nutrition Science and Policy  
FALL 2022**

**Class Meetings** Monday (lectures) and Wednesday (recitation): 1:30-3:00pm  
Behrakis Auditorium, Jaharis, plus online materials assigned  
DeBlois Auditorium Rm 108 on October 19<sup>th</sup>, 2022

**Instructor** Anastasia (Ana) Marshak, PhD (she/her/hers)  
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**Office Hours** Office hours are offered every weekday at varying times, as noted below. Office hours held over Zoom will not be recorded.

Day of the week	Time (EST)	Held by	Location
Monday	11am-12pm 4-5pm	Chiu Afnan	Jaharis 219
Tuesday	8-9am	Afnan	Virtual
Wednesday	12:30-1:30 3-4pm	Ana Zihan	Rm 810, 75 Kneeland St, Boston Jaharis 219
Thursday	1-2pm 2:30-3:30pm	Chiu Zihan	Virtual Virtual
Friday	12-1pm EST	Ana	Virtual

**Semester Hour Units** 3 SHU

**Prerequisites** The prerequisite to this course is a university level math course.

**Course Description** In this class we will explore statistical techniques for analyzing social science data, with specific applications to nutrition, food policy, agriculture and the environment. Although it is necessary to teach some theory, this course is meant to be practical and user oriented. The primary goal here is to learn how to analyze data in ways that will be useful in your academic and professional careers, both in conducting your own work and critically assessing the work and claims of others.

For most students, this course is the first part of a year-long sequence. This is a first semester graduate course in statistics that is required for students in the AFE, FANPP, and NICBC programs. This one-semester course will provide students with an introductory level understanding of social science statistics concepts and methodologies, and how and why they are applied. Topics will include data gathering, experimental design, probability, descriptive statistics, graphical displays,

hypothesis testing, nonparametric tests, analysis of variance, correlation, and simple linear regression. A distinctive feature of this course is its focus on methods that can be used with observational data, which frequently arise in the social sciences.

## Course Goals

By the end of this course, students will be able to:

1. Explain and evaluate statistical results presented in health and nutrition journals.
2. Recognize how study design, data type, and the distribution of the data relates to the statistics, comparison tests, and models used.
3. Explain the assumptions that need to be met to run different types of analysis.
4. Produce and select the appropriate descriptive statistics and visualizations, hypotheses, comparison and association tests for parametric and non-parametric data, and linear regression models.

## Textbooks

*Required Text:* Biostatistics for the Biological and Health Sciences by Marc M. Triola, Mario F. Triola, and Jason Roy; 2<sup>nd</sup> Edition, 2018

- Should be purchased and has online features that may be further explored by students.
- One copy available at the Hirsh Health Sciences Library Circ Desk Reserve: **WA 950 T834b 2019**

*Required Text:* Statistical Methods for the Social Sciences, 5th edition, by A. Agresti, 2018

- Copies available at the Hirsh Health Sciences Library Circ Desk Reserve: **QA 276.12 A34 2018**

*Optional Text:* Introductory Econometrics: a Modern Approach by Jeffrey Wooldridge, 2018

- This is the primary textbook for NUTR307 in the Spring and is a useful resource in the last weeks of this course
- Copies available at the Hirsh Health Sciences Library Circ Desk Reserve: **QA 276.12 A34 2018**

## Software

*Stata Software for Statistical Analysis*

The Stata statistical analysis software is required software for the NUTR 207 & 307. Tufts students have the option to obtain a free license through the University or purchase it at a greatly reduced rate. Please note that the license through the University is temporary (expected expiration after 1 year), while the purchased license does not expire. Links for both options are below.

- Please be sure to obtain Stata AND install it on your notebook computer well before the start of the semester.
- If you have problems purchasing or installing Stata, contact the Stata Software Company for support.
- Tufts students can now download Stata to their personal computer for free – but please note the free license is only valid until August 2023 (as opposed to the purchased license, which does not expire): <https://access.tufts.edu/stata>
- To purchase Stata:
  - URL: <http://www.stata.com/order/new/edu/gradplans/student-pricing/>
  - Select “**Stata/IC 16 perpetual (\$225)**” DVD or download. This version of the software is required for our courses. The license does not expire.
  - You can either purchase a DVD copy that will be mailed to you or Download. The Download option will give you an EXE file for PCs or DMG file for Macs.

*Microsoft Office software*

We will be using Microsoft Excel in the course for many of the basic calculations and homework and midterms will be turned in on Microsoft Word. Tufts students can now download Microsoft Office to their personal computer for free: <https://access.tufts.edu/office-365>

### *Canvas*

All course materials, assignments, and announcements will be on Canvas. Make sure your announcement notifications are turned on to be received immediately so that you do not miss important class information. Tufts' guidance on how to check and adjust your notification settings, and recommendations on useful settings, are available at <https://sites.tufts.edu/canvas/2017/09/08/notifications-recommendations-for-students/>

### *Zoom*

Occasionally office hours will be online and so held on Zoom. If you plan to attend any online office hours, download the **desktop app** (or **mobile app**, if you need to use your phone). The website client does not have the same functionality as the apps. If you have a personal Zoom account not affiliated with Tufts, please log in to Zoom using the single sign-on ("SSO") option and your Tufts credentials prior to joining online office hours. Additional useful guidance is available at <https://it.tufts.edu/guides/audio-and-virtual-conferencing-zoom>.

**Inclusion and Sensitive Topics** It is our intent that students from all backgrounds and perspectives be well-served by this course, that students' learning needs be addressed both in and out of class, and that the diversity that students bring to this class be viewed by all as a resource, strength and benefit. It is also our intent to present materials and activities that are respectful of diversity across gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture. Your suggestions are encouraged and appreciated. Please let us know ways to improve the effectiveness of the course for you personally or for other students or student groups. To help accomplish this:

- If you have a name and/or set of pronouns that differ from those that appear in your official Tufts records, please let us know.
- If any of our class meetings conflict with your religious events, please let us know so that we can make arrangements for you.
- If you feel like your performance in the class is being impacted by your experiences outside of class, please do not hesitate to come and talk with one of us. If you prefer to speak with someone outside of the course, Dr. Rob Mack, Associate Provost and Chief Diversity Officer, is an excellent resource, as is Snaggs Gendron, Boston Campus Student Wellness Officer.

Our approach to potentially sensitive topics in this class is to not shy away from those topics that are relevant to areas of study at the Friedman School. Such topics will necessarily include subjects such as eating behaviors and eating disorders; weight gain and loss; malnourishment, including in humanitarian disaster situations; food assistance and poverty reduction policies; alcohol consumption; diseases and health outcomes; issues of race and gender as they relate to food, nutrition and health; and more generally, ethical research methods as they relate to vulnerable populations. Our goals in covering such material are to never choose a topic deliberately to be provocative, and to ensure that students in the class are familiar with how we approach both the analysis and interpretation of data on such topics. We always strive to be sensitive and respectful in how we approach such topics, and ask that all students in the class do the same.

### **Academic Conduct**

Academic integrity, including avoiding plagiarism, is critically important. Each student is responsible for being familiar with the standards and policies outlined in the Friedman School's [Policies and Procedures](#) manual. It is the responsibility of the student to be aware of, and comply with, these policies and standards. In accordance with [Tufts University's policy on academic misconduct](#), violations of standards of academic conduct will be sanctioned by penalties ranging from grade reduction or failure on an assignment, grade reduction or failure of a course, up to dismissal from the school, depending on the nature and context of any infraction. Any plagiarism or cheating will result in my awarding a failing grade for both the assignment and the course, and all violations will be reported to the Academic Dean, Dr. Ed Saltzman.

*Classroom Conduct and Disruptions:* While in class sessions please make sure that all communication devices are silent and put away. If you would like to use a laptop to take notes, please sit in the back row to avoid distracting other students. Please do not use this time to do online shopping or go on social media. Even subtle interruptions are distractions to your classmates and instructor.

*Accommodating Disabilities:* Tufts University is committed to providing equal access and support to all students through the provision of reasonable accommodations so that each student may access their curricula and achieve their personal and academic potential. If you have a disability that requires reasonable accommodations, please contact Matthew Hast, the Friedman School Assistant Dean of Student Affairs, at [matthew.hast@tufts.edu](mailto:matthew.hast@tufts.edu) or 617-636-6719 to make arrangements for determination of appropriate accommodations. Please be aware that accommodations cannot be enacted retroactively, making timeliness a critical aspect for their provision.

*Classroom Health and Safety:* Our plan is for NUTR 207 to be an in-person course this semester unless university policy and/or public health concerns make it necessary to transition the course to a remote format. We will be following all relevant School and University guidance on ensuring health and wellness during the ongoing pandemic. Students are only allowed to participate in the course if they are in compliance with the [Tufts University student vaccination policy](#). Moreover, students are asked to remain at home if they feel unwell or are showing signs of respiratory distress. We will provide all reasonable accommodations for anyone who cannot attend class because of health concerns.

*Contacting Us:* Questions about course material should be brought to Wednesday recitation sessions, office hours, or posed on the online discussion threads available on Canvas. Answers to questions posed on Canvas will be posted for reference by all students. You are also free to ask us administrative questions that are not of general interest to your classmates over e-mail. Questions about course material should be submitted in the discussion groups, not via email, so that your classmates can learn from your questions and our responses. Dr. Marshak also holds Friday office hours at 10:00am that are reserved for administrative and general advising questions.

## Weekly class format

This is the format for most weeks, with a few exceptions.

<i>Before Monday's class</i>	Do all required reading for this week
<i>Monday class</i>	Lecture by Professor Marshak focused on theory
<i>Wednesday class</i>	Recitation by Professor Marshak with group discussions/activities and questions to practice the week's material
<i>Before Sunday 11:59pm EST</i>	Complete online quiz on Canvas for the week; turn in any assignments due that week

**Assessment and grading** A passing grade in this course is a B- or better. Course grades will be based on the following (subject to revision during the course):

A	≥ 93%
A-	90 to < 93%
B+	87 to < 90%
B	83 to < 87%
B-	80 to < 83%

Your grade in this class will be determined by problem sets, participation (attendance, in-class exercises, quizzes, engagement in lectures, completion of CITI training) and two exams (see more details below). Points will be awarded for each assignment, and an overall course score will be calculated from the weights given below.

Assignment	Grading weight
Participation	10%
Quizzes	10%
Problem sets (4 total)	40%
Midterm examination	20%
Final examination	20%
<b>Total</b>	<b>100%</b>

### *Participation*

- Attendance in lectures and recitations is a necessary (but not sufficient!) condition for mastering this material and passing the course.
- 10% of your grade will be based on course participation as well as the submission of the Research Ethics Training Certificate (CITI).
- The online human subjects research ethics training is a School-wide requirement for graduation and should be completed by the end of the fall semester. Completion of this requirement will be discussed in class and will count toward your participation grade. Please submit a copy of the completion certificate to via Canvas when you complete the training. It is in your best interest to complete the training as early as possible, but the final deadline is December 4th at 11:59pm. Most students in NUTR 207 should be completing the required "Social-Behavioral-Educational Researchers" group modules. For more information, please see <https://viceprovost.tufts.edu/sber-irb-trainings>.

### *Quizzes*

- One online quiz is given per module to review the material and to assess their understanding of the material. We will drop your lowest quiz grade and count your top 12 quizzes for your total quiz grade.

- The quizzes are "open book," which means that you can review the material and consult the books while you are taking each quiz. Quizzes have an open time limit, but you may only submit it once.
- Performance on the weekly online quizzes will constitute 10% of the final course grade.

#### *Homework*

- There will be 4 graded homework assignments, each worth 10%, for a total of 40% of your final course grade.
- The homework assignments are long, and we do not recommend that you wait until the week and especially weekend before they are due to complete them. Instead, each week focus on the problems that relate to that week's material, otherwise you might find yourself a bit overwhelmed as the due date approaches.
- We encourage that you work together on homework assignments, provided everyone submits their own work.
- The homework assignments are "open book". You can use your books, notes and online materials while working on the homework assignments.

#### *Exams*

- Two exam sets will be given in the middle and end of the semester, each worth 20%, for a total of 40% of your final course grade.
- The will midterm examination worth **20%** of the overall grade on Wednesday, October 26th during class time. The final exam will be worth **20%** of your overall grade, and will be held on Monday, December 19th from 1:30-3:30pm. Additional information on the format, grading and content of the exams will be distributed prior to each exam

#### **Timeliness**

No late assignments will be accepted, and a zero grade will be recorded for missing work. If you think you may have difficulty completing a problem set on time, please ask us for an extension as early as possible. *No extensions will be granted fewer than 48 hours before an assignment is due* except in documentable emergency circumstances. We will always try to accommodate emergency situations, but not poor planning.

#### **Communication Policy & Instructions for Submission of Assignments and Exams**

- Assignments and quizzes will be available and are to be submitted via Canvas.
- You are expected to check email and the course web page regularly to be aware of announcements and updates.
- For questions regarding course materials or extensions on assignments, please email the instructor AND cc the course TAs. We will respond within approximately 24 hours, or the following Monday if over the weekend.
- Students are encouraged to schedule and participate in group study sessions with one another via Zoom or other online meeting platform.

#### **Technical Support**

- Technical support is provided by Friedman support staff and/or IT Support. **Please do not contact faculty or TA's for technical support.**
- **Telephone:** (617) 627-3376
- **Email:** [canvas@tufts.edu](mailto:canvas@tufts.edu)
- **Hours:** 24 hours a day, seven days a week.
- When reporting a problem, please include:
  - The name and number of your course (e.g. "NUTR 207")
  - Your operating system and browser
  - A detailed description of the problem
  - If you are sending a support request via email, please use your Tufts email address.

## Course Topics and Assignment Schedule at a Glance

This schedule is subject to modification at the instructor's discretion.

### Academic Calendar – Fall 2022:

Fall 2022 Classes Begin	Tuesday, September 6, 2022
Indigenous People's Day: NO CLASSES	Monday, October 10, 2022
Thanksgiving Recess: NO CLASSES	Wednesday, November 23, 2022
Last day of classes for the semester	Monday, December 12, 2022
Final Examination period ends	Thursday, December 22, 2022

Week	Lecture Date	Material	Assignments
1	September 7 <sup>th</sup> , 2022	<p><i>Topic:</i> Introduction to the class and statistics</p> <p><i>Reading:</i></p> <ul style="list-style-type: none"> <li>○ Syllabus</li> <li>○ AA Chapter 1</li> <li>○ <a href="#">“Statistics in pursuit of social justice”</a>, <i>Significance Magazine</i> (June 2018)</li> <li>○ <a href="#">“Dealing with bias in artificial intelligence”</a>, <i>NYT</i> (January 2020)</li> </ul>	Complete quiz1 by 11:59pm EST on September 11th
2	September 12 <sup>th</sup> and 14 <sup>th</sup> , 2022	<p><i>Topic:</i> Bias, study design, and data management</p> <p><i>Reading:</i></p> <ul style="list-style-type: none"> <li>○ AA Chapter 2</li> <li>○ T&amp;T chapter 1, part 2: missing data (pg 36-38)</li> <li>○ <a href="#">“Science has been in a replication crisis for a decade. Have we learned anything?”</a>, <i>Vox</i> (October 2020)</li> <li>○ <a href="#">“Invisible Women”</a>, <i>99% Invisible</i> podcast (July 2019)</li> </ul> <p><i>Supplementary reading:</i></p> <ul style="list-style-type: none"> <li>○ T&amp;T Chapter 1</li> </ul>	Complete quiz2 by 11:59pm EST on September 18th
3	September 19 <sup>th</sup> and 21 <sup>st</sup> , 2022	<p><i>Topic:</i> Data visualization and descriptive statistics</p> <p><i>Reading:</i></p> <ul style="list-style-type: none"> <li>○ T&amp;T Chapter 2 and 3</li> <li>○ Summary Statistics Table example</li> <li>○ Watch “Descriptive Statistics” Stata video and go through do-file</li> <li>○ Watch “Generating Variables” Stata and go through do-file</li> </ul> <p><i>Supplementary reading:</i></p> <ul style="list-style-type: none"> <li>○ AA Chapter 3</li> <li>○ <a href="#">“Transgender inclusive measures of sex/gender for population surveys: mixed methods evaluation and recommendations”</a>, <i>PLOS One</i> (May 2017)</li> </ul>	Complete quiz3 by 11:59pm EST on September 26 <sup>th</sup>  <b>Problem Set 1</b> due by 11:59pm EST on September 25th

4	September 26 <sup>th</sup> and 28 <sup>th</sup> , 2022	<p><i>Topic:</i> Introduction to probability, odds, and risks</p> <p><i>Reading:</i></p> <ul style="list-style-type: none"> <li>○ T&amp;T Chapter 4</li> <li>○ <a href="#">“Odds Ratio, Relative Risk, Absolute Risk Reduction, and the Number Needed to Treat – Which of these should we use?”</a>, <i>Value in Health</i> (October 2002)</li> <li>○ <a href="#">“Beyond COVID-19 deaths during the COVID-19 pandemic in the United States”</a>, <i>Health Care Management Science</i> (June 2021)</li> </ul>	Complete quiz4 by 11:59pm EST on October 2 <sup>nd</sup>
5	October 3 <sup>rd</sup> and 5 <sup>th</sup> , 2022	<p><i>Topic:</i> Probability distributions and central limit theorem (Guest Lecture: Sean Cash)</p> <p><i>Reading:</i></p> <ul style="list-style-type: none"> <li>○ T&amp;T Chapter 5 &amp; 6</li> <li>○ <a href="#">“Chapter 2: Use of Percentiles and Z-scores in Anthropometry”</a>, <i>Handbook of Anthropometry: Physical Measures of Human Form in Health and Disease</i> (2012)</li> <li>○ Review do-file: testing for normality</li> </ul> <p><i>Supplementary reading:</i></p> <ul style="list-style-type: none"> <li>○ AA Chapter 4</li> </ul>	Complete quiz5 by 11:59pm EST on October 9th
6	October 12 <sup>th</sup> , 2022  No classes on Monday, October 10 <sup>th</sup> , 2022	<p><i>Topic:</i> Statistical inference: estimation</p> <p><i>Reading:</i></p> <ul style="list-style-type: none"> <li>○ AA Chapter 5</li> <li>○ <a href="#">“In Fallout Over Polls Margin of Error Gets New Scrutiny”</a>, <i>Undark</i> (November 2020)</li> <li>○ Stata PPT and do-file on z-distributions, t-distributions, and CIs</li> </ul> <p><i>Supplementary reading:</i></p> <ul style="list-style-type: none"> <li>○ T&amp;T Chapter 7</li> <li>○ <a href="#">“Disentangling Bias and Variance in Election Polls”</a>, <i>Journal of American Statistical Association</i>, (June 2016)</li> </ul>	Complete quiz6 by 11:59pm EST on October 16 <sup>th</sup>
7	October 17 <sup>th</sup> and 19 <sup>th</sup> , 2022  On October 19 <sup>th</sup> we will be meeting at the DeBlois Auditorium, Rm 108	<p><i>Topic:</i> Statistical inference: significance</p> <p><i>Reading:</i></p> <ul style="list-style-type: none"> <li>○ AA Chapter 6</li> <li>○ <a href="#">“800 scientists say it’s time to abandon statistical significance”</a>, <i>Vox</i> (March 2019)</li> </ul> <p><i>Supplementary reading:</i></p> <ul style="list-style-type: none"> <li>○ T&amp;T Chapter 8</li> </ul>	Complete quiz7 by 11:59pm EST on October 23 <sup>rd</sup>  Problem Set 2 due by 11:59pm EST on October 22nd
8	October 24 <sup>th</sup> and 26 <sup>th</sup> , 2022	<i>Topic:</i> Review and Midterm	

9	October 31 <sup>st</sup> and November 2 <sup>nd</sup> , 2022	<p><i>Topic:</i> Inferences from two samples</p> <p><i>Reading:</i></p> <ul style="list-style-type: none"> <li>○ AA Chapter 7</li> <li>○ <a href="#">“Optimizing college health promotion in the digital age: Comparing perceived well-being, health behaviors, health education needs and preferences between college students enrolled in fully online versus campus-based programs”, Health Promotion Perspectives (October 2019)</a></li> </ul> <p><i>Supplementary reading:</i></p> <ul style="list-style-type: none"> <li>○ T&amp;T Chapter 9</li> </ul>	Complete quiz9 by 11:59pm EST on October 30th
10	November 7 <sup>th</sup> and 9 <sup>th</sup> , 2022	<p><i>Topic:</i> Goodness of fit and contingency tables</p> <p><i>Reading:</i></p> <ul style="list-style-type: none"> <li>○ T&amp;T Chapter 11</li> <li>○ Campbell Swinscow Chapter 8</li> </ul> <p><i>Supplementary reading:</i></p> <ul style="list-style-type: none"> <li>○ AA Chapter 8.1-8.4</li> </ul>	Complete quiz10 by 11:59pm EST on November 13th
11	November 14 <sup>th</sup> and 16 <sup>th</sup> , 2022	<p><i>Topic:</i> Analysis of variance</p> <p><i>Reading:</i></p> <ul style="list-style-type: none"> <li>○ T&amp;T Chapter 12</li> <li>○ <a href="#">“Vitamin C Plasma Levels Associated with Inflammatory Biomarkers, CRP and RDW: Results from the NHANES 2003–2006 Surveys”, Nutrients (March 2022)</a></li> </ul> <p><i>Supplementary reading:</i></p> <ul style="list-style-type: none"> <li>○ AA Chapter 12.1-12.3</li> </ul>	Complete quiz11 by 11:59pm EST on November 20 <sup>th</sup>  <b>Problem Set 3</b> due by 11:59pm EST on November 20 <sup>th</sup>
12	November 21 <sup>st</sup> , 2022  No classes on November 23 <sup>rd</sup> , 2022	<p><i>Topic:</i> Non-parametric tests and summary of comparison tests</p> <p><i>Reading:</i></p> <ul style="list-style-type: none"> <li>○ T&amp;T Chapter 13</li> <li>○ <a href="#">“Choosing statistical tests”, Deutsches Arzteblatt International (May 2010)</a></li> </ul> <p><i>Supplementary reading:</i></p> <ul style="list-style-type: none"> <li>○ <a href="#">Dallal, G.E. Nonparametric Statistics. The Little Handbook of Statistical Practice</a></li> <li>○ AA Chapter 12</li> </ul>	Complete quiz12 by 11:59pm EST on November 27 <sup>th</sup>
13	November 28 <sup>th</sup> and 30 <sup>th</sup> , 2022	<p><i>Topic:</i> Covariance and correlation</p> <p><i>Reading:</i></p> <ul style="list-style-type: none"> <li>○ T&amp;T 10.1 and 13.6</li> </ul>	Complete quiz13 by 11:59pm EST on December 4 <sup>th</sup>

		<ul style="list-style-type: none"> <li>○ <a href="#">“Statistical notes for clinical researchers: covariance and correlation”</a>, Restorative Dentistry and Endodontics (February 2018)</li> <li>○ <a href="#">“How do different indicators of household food security compare?”</a>, Feinstein International Center (April 2013)</li> <li>○ Review do-file on correlation</li> </ul> <p><i>Supplementary reading:</i></p> <ul style="list-style-type: none"> <li>○ AA Chapter 9.4</li> <li>○ Woolridge Chapter 2</li> </ul>	CITI certificate due by 11:59pm EST on December 4th
14	December 5 <sup>th</sup> and 7 <sup>th</sup> , 2022	<p><i>Topic:</i> Simple Linear Regression</p> <p><i>Reading:</i></p> <ul style="list-style-type: none"> <li>○ AA Chapter 9</li> <li>○ Review do-file on linear regression</li> <li>○ <a href="#">UCLA guide on Stata linear regression output</a></li> </ul> <p><i>Supplementary reading:</i></p> <ul style="list-style-type: none"> <li>○ T&amp;T 10.2-10.3</li> <li>○ Woolridge Chapter 2</li> </ul>	Complete quiz14 by 11:59pm EST on December 11 <sup>th</sup>  Problem Set 4 due by 11:59pm EST on December 11th
15	December 12 <sup>th</sup> , 2022	<i>Topic:</i> Optional Review Session	Prepare for final exam
16	December 19 <sup>th</sup> , 2022	Final Exam	

## Detailed Description of Course Topics, Assignment Schedule, and the Learning Goals for Each Class Session

### Module 1: Introduction to the class and statistics

Learning objectives:

- Summarize course structure and explain expectations.
- Describe the difference between descriptive and inferential analysis.
- Describe the difference between a sample and a population.
- Describe the difference between a statistic and a parameter.
- Recognize that data and statistics are people, but are also designed, collected, and analyzed by people

### Module 2: Bias, study design, and data management

Learning objectives:

- Recognize the different types of bias in sample data and how it might affect the data
- Identify different types of missingness and how it affects the analysis
- Identify and recognize different types of study design and sampling strategy
- Identify different types of variables
- Identify basic steps for conducting research
- Produce basic Stata data management and commands describing the data

### Module 3: Data visualization and descriptive statistics

Learning objectives:

- Identify different measures for describing data and their properties
- Calculate mean, median, mode, range, standard deviation, and variance of a dataset

- Distinguish between appropriate measure of center depending on distribution and objective
- Distinguish between population parameters and sample statistics
- Identify approaches for measures of relative standing
- Calculate z-scores
- Calculate outliers

#### **Module 4: Introduction to probability, odds, and risks**

Learning objectives:

- Recognize key principles, rules, and notation for measures of probability and odds
- Interpret probability, absolute risk, relative risk, odds, and odds ratios
- Calculate probability, absolute risk, relative risk, odds, and odds ratios

#### **Module 5: Probability distributions and Central Limit Theorem**

Learning objectives:

- Define key principles, rules and notation for probability distributions
- Calculate mean, standard deviation, and variance of binomial and Poisson discrete probability distributions
- Transform a normal distribution into a standard normal distribution
- Calculate z-scores from probabilities and probabilities from z-scores in a standard normal distribution
- Describe the properties of a sampling distribution of a statistic
- Describe the key elements of the central limit theorem and its applications

#### **Module 6: Statistical inference: estimation**

Learning objectives:

- Derive point estimates of a population proportion, mean, and variance
- Calculate and interpret confidence interval estimates
- Understand what Margin of Error really means in polling
- Discern sample size requirements and appropriate calculation methods

#### **Module 7: Statistical inference: significance**

Learning objectives:

- Define, identify and interpret p-values.
- Draw appropriate conclusions from a significance test.
- Describe the difference between Type I and Type II error.
- Summarize the difference between a one-sided and two-sided hypothesis test.
- Conduct the 5 parts of a significance test for a one sample test of a proportion.
- Conduct the 5 parts of a significance test for a one sample test of the mean.

#### **Module 8: Midterm review and exam**

#### **Module 9: Statistical inference: two samples**

Learning objectives:

- Construct inferences for proportions, means, and variation in two samples (independent or dependent)
- Apply confidence intervals and sample size to estimations of difference between two samples

#### **Module 10: Goodness-of-fit and contingency tables**

Learning objectives:

- Assess goodness of fit, independence, homogeneity, and testing matched pairs
- Create and assess contingency tables to test claims of association between two variables

### **Module 11: Analysis of Variance**

Learning objectives:

- Critically evaluate analysis of variance
- Construct one way and two-way ANOVA
- List and explain issues of multiple comparisons, and compare various methods to mitigate

### **Module 12: Non-parametric tests and summary of comparison tests**

Learning objectives:

- Differentiate between non-parametric vs parametric tests, advantages and disadvantages, and when they should be applied
- Data manipulation to suit the data or testing strategy
- Conduct and interpret non-parametric tests

### **Module 13: Covariance and correlation**

Learning objectives:

- Identify the most appropriate correlation coefficient to use based on the data
- Recognize and test for key assumptions required to use the appropriate correlation coefficient
- Calculate the coefficient correlation by hand and in Stata
- Generate hypothesis testing to determine significance of correlation
- Explain the relationship between correlation and linear regression

### **Module 14: Simple linear regression**

Learning objectives:

- Describe the difference between correlation and simple linear regression
- Calculate slope, the constant, residuals, residual sum of squares, model sum of squares, total sum of squares, standard error, the test statistic for hypothesis testing, and confidence intervals for simple linear regression by hand and in Stata
- Formulate a hypothesis test for simple linear regression
- Recognize and test for key assumptions required to use run a simple linear regression

### **Module 15 and 16: Final review and exam**