

**BIS 315: UNDERSTANDING STATISTICS**

Instructor: **Joseph J. Ferrare**, Ph.D.

Fall 2019, Room UW1-120

Office: UW2-212

Office Hours: T 10:45am-11:45am & TR 2:15pm - 3:15pm (or by appointment)

[Canvas](#)

[Quantitative Skills Center](#)

Course Website: [www.josephferrare.com/bis-315](http://www.josephferrare.com/bis-315)

**OVERVIEW**

The use of statistics has become a ubiquitous feature of modern life. From the most mundane of daily activities to consequential decisions about our lives, there is a strong probability that statistics are somehow involved. For instance, apps such as Yelp use statistics to *describe* the experiences that some patrons have at restaurants. Political pollsters use statistics to make *inferences* about who voters are likely to elect. Insurance companies use statistics to *predict* the likelihood that certain types of people are going to file a claim. In short, statistics are used to tell stories about the world and our experiences in it. In this sense, the use of statistical analysis is very similar to writing an essay or even a complex novel. The difference is in the tools that get used to tell the story; novelists use techniques such as dramatic irony and statistical analysts use regression. Both are storytellers.

This course surveys some of the basic statistical tools that are widely used to describe, infer, and predict qualities about our everyday lives, matters of policy, and scientific investigation. As we engage with these storytelling tools, a strong emphasis will be placed on developing a critical statistical literacy. “Critical” in this context does not mean dismissive or contemptuous. To the contrary, to develop a critical statistical literacy is to practice patterns of thinking that allow for the generation of insight about how statistics are used and the stories being told in the process. This means that we will spend a significant amount of time raising questions about the assumptions of statistical tools and looking at how these assumptions play out in practical applications across different communities of practice.
OBJECTIVES

Students who successfully complete the requirements of this course will be able to:

1. use basic tools of statistical analysis as used across a wide variety of practical and disciplinary domains;
2. understand the basic principles of sampling, data collection, and data cleaning;
3. use SPSS software to conduct basic statistical procedures and to visualize the results;
4. critically read and interpret reports, papers, and media content that use statistical analysis.

FORMAT

The format for our class meetings will consist of interactive lectures, small group work, and individual exercises. The lectures are designed to provide an introduction to key concepts in statistics, and to offer examples of these concepts as they apply to a variety of situations and disciplinary domains. Please note that “interactive” lecture means that during this time I will pose questions to students with the intent of generating discussion. Finally, the small group and individual exercises will give you opportunities to practice thinking about, articulating, and working through problems associated with statistical analysis and interpretation. Much of the small group work and individual exercises will take place alongside the use of SPSS software, which will be available at each computer in the classroom.

EMAIL CORRESPONDENCE

I expect you to use your UW e-mail account regularly so that I can communicate with each of you electronically via Canvas between classes. If you wish to use another e-mail address as your primary account, set up your UW account to forward to your other address.

Please email me via Canvas. If you send me an email, you can expect to hear back from me within 24 hours during the week, and by Monday if you email me over the weekend. I will let you know if I anticipate being unavailable due to travel or other circumstances.

I do not take attendance, so there is not need to email me if you are going to be absent.

EXPECTATIONS REGARDING ENGAGEMENT

I expect that everyone will be present during class. By present, I do not simply mean that you will be physically in attendance. Rather, my expectation is that you will engage with intention during lectures, discussions, and labs as they happen in real time. I acknowledge that this is a required course for many students and that you may not be enrolled otherwise. Yet, here we are together for the next ten weeks.
with a collective opportunity to interrogate a way of understanding the world that has saturated our common sense. I expect you to take advantage of the situation, even if you are convinced that this is a waste of time. At the very least, give me a chance to convince you otherwise.

Note regarding use of phones, tablets, and computers during class. I understand that many of you are juggling multiple commitments while enrolled in school, and that these commitments sometimes require that you send/read a text or email during class. Whatever the reason, if this situation arises please leave the room even if it is to send a quick message. Similarly, please leave the room if you need to surf the web or engage with content that is not related to the course. If you notice a classmate texting or surfing during class, it is entirely appropriate (and encouraged) to ask them to leave the room for that purpose. I will make similar requests but won’t always be in a position to notice.

Please see below for additional considerations concerning classroom conduct, academic integrity, and other related issues.

TEXTS & TOOLS

The following serves as the primary text for the course:


This is a free textbook that is available online, as an e-book, mobile book, or in PDF. Additional reading assignments will be available in PDF on this website.

We will use SPSS software to conduct statistical analysis and visualize the results. SPSS will be available on each computer in our classroom. We will spend time in class learning how to use this tool. In addition, the Quantitative Skills Center has an SPSS Getting Started guide as well as SPSS Videos for Beginners.

Throughout the course, we will use datasets to practice the foundational statistical tools covered during class. Many of the datasets that we will use can be found here.

REQUIREMENTS AND GRADING

IN-CLASS QUIZZES (20%), DUE DATE: ROLLING
There will be six (6) in-class quizzes designed to assess your understanding of the basic ideas and concepts from the course. The quizzes will not be announced ahead of time, but you will be able to use all notes, readings, and other resources. I will only count your five best scores toward your final grade (i.e., your lowest score will automatically be dropped).

**DISCUSSION BOARD POSTS (15%), DUE DATE: MONDAYS @ 5PM OF THE WEEK ASSIGNED (SEE BELOW)**

Every other week (beginning in Week 3), you will be responsible for posting to the Canvas Discussion Board an example of statistics being used “in the wild.” This can come from a news source, think tank report, YouTube commercial, academic article, or virtually any other source that has some relevance to your life. Your assignment is to post a link to the source and reflect on the way statistics are used in this example. What story (or stories) are the statistics conveying? What are the assumptions being made? What are the possible sources of error? How might the story be misleading? What do you find confusing? What would you like to learn more about? You do not have to answer all of these questions for each post, nor are these questions exhaustive of the types of questions you can address. Rather, they are meant to give you some examples of how you might think critically about statistics in everyday life. I expect your reflection will be 1 - 2 paragraphs (~5 - 10 sentences).

Each student will be assigned to either Group 1 or Group 2, and each group will alternate posting during Week 3 - Week 10. Thus, Group 1 will be responsible for posting Week 3, Group 2 will post Week 4, Group 1 Week 5, and so on. This will result in a total of four posts per student across the quarter. The posts are due by Monday at 5pm for the week you are assigned to upload a link and narrative. For example, Group 1’s post for Week 3 is due on the Canvas Discussion Board by 5pm on Monday October 7, and Group 2’s post for Week 4 is due on Monday October 15 at 5pm.

Each post is worth five points. You will receive full credit if you post a link and provide a 1 - 2 paragraph (or longer if you desire) narrative that represents a meaningful attempt to reflect on the example. Half credit (i.e., 2.5 points) will be given to those who simply post a link without a narrative, or those whose narrative lacks any meaningful reflection. My standard for what constitutes “meaningful” will increase as the quarter progresses, as I will be looking for growth in the depth with which you are able to critically reflect on the use of statistics in society.

Each week, I will read all of the posts and pick out interesting examples to share with the class. I will not publicly criticize your narrative or even display it to the class (although these will be available to all class members on Canvas). Instead, I will use the example to engage the entire class in a broader
discussion about the use of statistics in society so that we can collectively develop a more nuanced statistical literacy.

**Due Dates for posts (all at 5pm):**

- Group 1: Oct 7, Oct 21, Nov 4, Nov 18
- Group 2: Oct 14, Oct 28, Nov 11, Nov 25

**DESCRIPTIVE STATISTICS LAB (20%), DUE DATE: OCT. 24 @ 6PM (GROUP ASSIGNMENT)**

The objective of this lab is to practice the craft of describing data using graphs, tables, and descriptive measures such as location and dispersion. The majority of the work for this lab will take place during class on **October 17th** to facilitate group interaction and so that I can be available to answer questions in real-time. In addition, each group will be expected to write a short (~3-4 pages) summary that describes and critically reflects upon the results. If you are not in class on the day(s) of the lab work, you will be assigned to a group with others who were not in attendance (or you will work alone in the event that you are the only one not in attendance).

Since this is a group assignment, we will spend some time in class discussing group expectations and developing formal agreements that will be used to hold each other accountable.

**HYPOTHESIS TESTING LAB (20%), DUE DATE: NOV. 21 @ 6PM (GROUP ASSIGNMENT)**

The objective of this lab is to form groups and work with data to test hypotheses about basic patterns of intergenerational education mobility (i.e., the education level attained given parental levels of education). The majority of the work will take place during class on **November 14th**. Once again, each group will be expected to write a short (~3-4 pages) summary that describes and critically reflects upon the results. If you are not in class on the day(s) of the lab work, you will be assigned to a group with others who were not in attendance (or you will work alone in the event that you are the only one not in attendance).

See note above regarding group assignments.

**FINAL EXAM (25%), DATE: DEC. 10**

This is a cumulative final exam that will assess your command of the concepts we have covered during the quarter. Much like the entire course, the final exam will emphasize questions that require you to
critically engage with issues related to statistical concepts and research designs that make use of statistical tools. This means that the exam will place greater weight on your ability to evaluate statistical tools in context than simply calculating measures by hand or calculator. The final week of the course will be dedicated to reviewing concepts and preparing for this exam.

**GRADING**

Use the following steps to figure out your course GPA:

1. Determine the percentage of total correct points across the quarter: this can be found on Canvas or by simply taking the total number of points correct for each assignment/quiz/exam, dividing by the total number of possible points, and multiplying that proportion by 100.

2. Subtract 55 from the total percentage

3. Divide by 10

For example, if your cumulative percentage for the course is 75%, then your corresponding GPA for the course would be calculated as follows:

\[(75 - 55) / 10 = 2.0\]

For more information, please refer to UWB's policies on undergraduate grading.

**Late Work:** I will accept late work. However, I will impose a 0.5 GPA penalty for each day the assignment is late and you will receive very limited feedback from me (if any).

**ESTIMATED COURSE OUTLINE**

*Please note that this outline is only an estimate of what (and when) we will cover. You are responsible for all materials, updates and announcements covered during class sessions. The course calendar will most likely change over time due to unforeseen circumstances; please be sure you are using the most recent version.*

**Unless otherwise noted, the reading assignments listed below are to be completed prior to the class meeting under which they are listed.**

**WEEKS 1-2: BASIC CONCEPTS**

**9-26 NO CLASS MEETING**
10-1 UNDERSTANDING STATISTICS: A PRIMER

- Read the entire syllabus

10-3 VARIABLES AND MEASUREMENT

- Read online text:
  - Variables
  - Levels of Measurement
  - Distributions
- Skim the Quantitative Skills Center’s SPSS Getting Started guide

WEEK 3: DESCRIBING DATA (GROUP 1 POSTS DUE OCT 7 @ 5PM)

10-8 TABLES AND GRAPHS

- Read online text:
  - Graphing
    - Stem & Leaf Plots
    - Histograms
    - Frequency Polygons
    - Box Plots
    - Bar Charts
    - Line Charts
    - Dot Plots

10-10 MEASURES OF LOCATION

- Read online text:
  - Measures of Central Tendency
    - What is Central Tendency?
- **Measures of Central Tendency**
- **Median and Mean**
  - Other Measures of Location
- **Percentiles**
- In-class resource (not a reading assignment): [Moving to Opportunity Atlas](#)

**WEEK 4: DESCRIBING DATA (GROUP 2 POSTS DUE OCT 14 @ 5PM)**

10-15  MEASURES OF DISPERSION AND SHAPE

- Read online text:
  - Variability
  - Shape

10-17  IN-CLASS DESCRIPTIVE STATISTICS LAB

**WEEK 5: PROBABILITY DISTRIBUTIONS (GROUP 1 POSTS DUE OCT 21 @ 5PM)**

10-22  BASIC IDEAS IN PROBABILITY

- Read online text:
  - Introduction to Probability
  - Basic Concepts
  - Permutations and Combinations

10-24  PROBABILITY DISTRIBUTIONS

- Descriptive Statistics Lab Due by 6pm (Upload to Canvas)
- Read online text:
  - Binomial Distribution
  - Normal Distribution
- Introduction
History
Areas of Normal Distributions
Standard Normal Distribution
Normal Approximation to the Binomial

WEEKS 6-7: STATISTICAL INERENCE

(GROUP 2 POSTS DUE OCT 28 @ 5PM)

10-29 SAMPLING & SAMPLING DISTRIBUTIONS

- Read online text:
  - Inferential Statistics
  - Sampling Distribution

- Introduction
- Sampling Distribution of the Mean
- Difference Between Means

10-31 STATISTICAL INERENCE: ESTIMATION

- Read online text:
  - Estimation

- Introduction
- Degrees of Freedom
- Characteristics of Estimators
- Confidence Intervals
- Confidence Interval for the Mean
- t Distribution
- Difference Between Means
- Proportions

(GROUP 1 POSTS DUE NOV 4 @ 5PM)
11-5 STATISTICAL INERENCE: SIGNIFICANCE TESTS

- Read online text:
  - Significance Tests
    - Introduction
    - Significance Testing
    - Type I and II Errors
    - One- and Two-Tailed Tests
    - Significance Results
    - Non-Significant Results
    - Steps in Hypothesis Testing
    - Confidence Intervals
    - Misconceptions

11-7 NO CLASS MEETING

WEEK 8: COMPARING TWO GROUPS (GROUP 2 POSTS DUE NOV 11 @ 5PM)

11-12 MEANS & PROPORTIONS

- Read online text:
  - Test of Means
    - Single Mean
    - Two Means
    - Pairwise Comparisons
    - Specific Comparisons
    - Correlated Pairs
    - Comparisons for Correlated Pairs
    - Pairwise Comparisons for Correlated Observations
**11-14 CHI-SQUARE TEST OF INDEPENDENCE & IN-CLASS HYPOTHESIS TESTING LAB**

- Read online text:
  - Chi Square Distribution
  - One-Way Tables
  - Contingency Tables

**WEEK 9: CORRELATION AND REGRESSION (GROUP 1 POSTS DUE NOV 18 @ 5PM)**

**11-19 CORRELATION**

- Read online text:
  - Introduction to Bivariate Data
  - Values of the Pearson Correlation
  - Properties of Pearson's $r$
  - Computing $r$

**11-21 REGRESSION**

- Hypothesis Testing Lab Due by 6pm (Upload to Canvas)

- Read online text:
  - Introduction to Linear Regression
  - Partitioning Sum of Squares
  - Standard Error of the Estimate
  - Inferential Statistics for $b$ and $r$
  - Influential Observations
  - Regression Toward the Mean
  - Introduction to Multiple Regression

**WEEK 10: REGRESSION & DESIGN (GROUP 2 POSTS DUE NOV 25 @ 5PM)**
11-26 REGRESSION

- Read online text:
  - Statistical Power
  - Effect Size
    - Proportions
    - Two Means

11-28 NO CLASS MEETING

WEEK 11: REVIEW

12-3 REVIEW AND SYNTHESIS

12-5 REVIEW AND SYNTHESIS

FINAL EXAM WEEK

12-10 FINAL EXAM

ADDITIONAL RESOURCES & CONSIDERATIONS

IAS PORTFOLIO

Students majoring in degrees offered by IAS begin the process of creating a Google Drive archive in “BIS 300: Interdisciplinary Inquiry” and conclude it by creating a Capstone Portfolio in BIS 499. IAS students should maintain an archive of all of the work they have done in (or in relation to) their undergraduate education. To get started with UW Google Apps (including Google Drive), students may consult UW IT's web page at https://itconnect.uw.edu/connect/email/google-apps/ (scroll down to UW Google Apps Support Online Help Center).

For more information about the IAS portfolio, visit the IAS webpage: http://www.uwb.edu/ias/iasdegreeportfolio. For help on the technical development of your IAS portfolio Learning Technologies (learningtech@uwb.edu) or http://www.uwb.edu/learningtech/eportfolios). You can also get help from a student tutor in the campus's Open Learning Lab in UW2-140.

ACADEMIC INTEGRITY
Please see the UWB General Catalog, the documents you signed upon admission to IAS, and these policy statements for crucial information regarding academic integrity. The library also has useful resources for you to explore. You are responsible for knowing what constitutes a violation of the University of Washington Student Code regardless of your intent. Make sure you know how to properly cite any ideas or words you have taken from outside sources.

Work of any kind (including written, video, audio, performance, artistic, etc.) produced outside of this course may not be submitted for credit without first discussing it with your instructor. In most circumstances, work produced for one course may not be submitted for another course.

Please see the Student’s Guide to Academic Integrity for more information and resources.

INCOMPLETES

University rules state that “an incomplete is given only when the student has been in attendance and has done satisfactory work until within two weeks at the end of the quarter and has furnished proof satisfactory to the instructor that the work cannot be completed because of illness or other circumstances beyond the student’s control.” IAS strongly discourages incompletes.

RESPECT FOR DIVERSITY

Diverse backgrounds, embodiments and experiences are essential to the critical thinking endeavor at the heart of university education. In IAS and at UW Bothell, students are expected to:

- respect individual differences which may include, but are not limited to: age, cultural background, disability, ethnicity, family status, gender presentation, immigration status, national origin, race, religion, sex, sexual orientation, socioeconomic status, and veteran status.

- engage respectfully in discussion of diverse worldviews and ideologies embedded in course readings, presentations, and artifacts, including those course materials that are at odds with personal beliefs and values.

Students seeking support around these issues can find more information and resources here.

ACCESS AND ACCOMMODATIONS

Your experience in this class is important to me. If you have already established accommodations with Disability Resources for Students (DRS), please communicate your approved accommodations to me at your earliest convenience so we can discuss your needs in this course.
If you have not yet established services through DRS, but have a temporary health condition or permanent disability that requires accommodations (conditions include but not limited to; mental health, attention-related, learning, vision, hearing, physical or health impacts), you are welcome to contact DRS at 425.352.5307 or rosal@uw.edu.

DRS offers resources and coordinates reasonable accommodations for students with disabilities and/or temporary health conditions. Reasonable accommodations are established through an interactive process between you, your instructor(s) and DRS. It is the policy and practice of the University of Washington to create inclusive and accessible learning environments consistent with federal and state law.

**VETERENS**

Welcome! We at UW Bothell understand that the transition into civilian life can be challenging for our veteran students and we have many resources for any who may want to reach out for guidance or assistance. This includes our Vet Corp Navigator through the WDVA and our Student Veterans Association (SVA). Please contact Veteran Services at 425.352.5307 or rosal@uw.edu. For those of you needing more URGENT support, please call The Suicide Prevention Hotline 1.800.273.8258 or connect with the UWB CARE Team.

**INCLEMENT WEATHER**

Please check if the campus may be closed due to weather. Information on suspension of operations will be made public and available through the media. Students can learn of campus operations status from the website or by calling the Campus Information Hotline 425.352.3333. You may also sign up with an alert system that will contact you via email or text message if classes are canceled. For more information on the alert process, please see this. Class activities will be rescheduled as needed.

**GENDER NEUTRAL BATHROOMS (ARC, DISCOVERY HALL, BEARDSLEE BUILDING, HUSKY VILLAGE)**

For students who prefer to use an inclusive, gender neutral bathroom, these can be found in the following: ARC– one on each level of the building, one (1) LL restroom room with shower; Discovery Hall – LL, off of ramp connecting DISC to UW2; UWBB – second floor, with shower.

**REFLECTION ROOM INFORMATION (UW1-007)**
This room is an open use space for all members of UWB who seek quiet time for meditation, reflection and prayer. No reservations are needed to utilize this space. Please follow the guidelines listed in the room about the expectations of the space.

**LACTATION AND BABY CHANGING LOCATIONS**

Lactation stations can be found in UW1-128, UW2-336, Husky Hall 1419, and Beardslee Crossing 102 U. These stations are available from 8am-5pm and can be reserved online at uwb.edu/admin/services/lactation-station. Baby changing stations are located in Discovery Hall LL 050, UW2-L2 washrooms, UW1-L1 washrooms, LB1 and LB2-L1 washrooms.

**OTHER PARENTING STUDENT RESOURCES**

Parenting Students are encouraged to take advantage of the resources provided on campus, which include the Parent Union at UWB, the Child Care Assistance Program, priority access at Bright Horizons Bothell and Bothell KinderCare, back-up/sick care at Bright Horizons, and lactation rooms and baby changing stations on campus. For more information, please visit the Parent Resources website, or contact the Parent Union on Facebook.

**UNIVERSITY OF WASHINGTON RELIGIOUS ACCOMMODATION POLICY**

Washington state law requires that UW develop a policy for accommodation of student absences or significant hardship due to reasons of faith or conscience, or for organized religious activities. The UW's policy, including more information about how to request an accommodation, is available at Faculty Syllabus Guidelines and Resources. Accommodations must be requested within the first two weeks of this course using the Religious Accommodations Request form available at: https://registrar.washington.edu/students/religious-accommodations-request/