**QUANTITATIVE METHODS I: Inferential Statistics and ANOVA**

**CRN: 10122 Credits: 3**

**Course Information:**

**Class:** Tuesdays and Thursdays 10:30-11:45am in PHRM 316

**Instructor Contact Information:**

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| **Professor:** Kristine Marceau**Office:** 225 Hanley Hall**Phone:** 494-9410**Email:** KristineMarceau@purdue.edu**Student hours:** by appointment or drop-in. Please email me and I’m happy to jump on a virtual call if I’m available, or to set something up virtually or in person if I’m not. | **TA:** Kirsten Anderson**Office: HNLY 326****Email:** ande1123@purdue.edu**TA:** Jerod White**Office: PSYC 2190****Email:** white755@purdue.edu**Student hours:** Jerod will be available from 9-10am on Tuesdays in his office. Kirstin and Jerod will both be available by appointment. |

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# Course Description and Objectives:

This course provides a basic understanding of foundational concepts and tools used in statistical analysis and inference in the behavioral sciences, including data preparation, sample description, hypothesis testing, univariate and bivariate statistics, and ANOVA. Emphasis is placed on the conceptual and interpretive understanding of statistical methods. Prerequisite: Undergraduate coursework in Statistics.

**What can** **you expect this class to be like?**

**In Class.** Each class will start with some lecture, and will move back and forth between lecture, practice data preparation and analysis using R software, in class assignments/discussions, and demonstrations on the whiteboard. You might find it useful to bring markers/colored pens to take notes, since I tend to color code on the board. Class attendance is highly recommended, as without class attendance, it will be much more difficult to master the material (and I may not have as good a read on how you’re doing!).

**Data.** If you have your own data, I highly encourage you use it for class- adapt the course scripts to your own data. If you don’t have your own data, I do have data available, and may be able to help you locate data that are suitable and on a topic that is more interesting to you than the data I will use in class. All classes will occur in the lab.

**Outside of Class.** In the first week, I want to meet with each of you in order to get to know you and your research interests and goals. I will, for example, tailor readings and examples to try and cover the interests of the class. The TA’s and I are happy to meet to go over assignments, materials, and preparations for your final presentation whenever you’d like. We are happy to meet in person or via zoom, depending on your preference. If you’re struggling with content or code (especially the unique data problems that will crop up when using your own data), please go to the TA’s first. If they can’t troubleshoot the problem, then it will escalate to me.

**Learning Resources, Technology & Texts**

**Class Website:** <https://purdue.brightspace.com/d2l/le/home/603648>

The course webpage is hosted by Brightspace. When you login to Brightspace you should automatically have access to the webpage. The webpage will contain: PowerPoints from presentations given in lecture, R scripts and data sets, homework assignments, supplemental readings, and other resources. I will also provide updates to the class through Brightspace.

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# Required Text:

Howell, D. C. (2013). Statistical Methods for Psychology (8th edition). Belmont, CA: Thomson Wadsworth.

Textbook webpage: <http://www.uvm.edu/~dhowell/methods8/>

# Useful Supplemental Resources:

We will be growing a list of resources throughout the semester, available on Brightspace. These will include textbooks, readings, and video tutorials. Links relevant to each week will be posted in that week’s module.

# Communication:

In addition to posting announcements on Brightspace, I am likely to use email to communicate with the class. If you have any questions for me specifically, I prefer that you email me. You can also feel free to use the discussion boards on Brightspace to ask general questions that may be of interest to all students. From me, anything on Brightspace will be an “FYI” or reminder-style communication.

*A note on how I read/respond to emails*… To me, emails fall in the “semi-urgent” category. **If I don’t respond within 48h please follow-up/email me again**. I have two kids - Korra is 4 (in preschool) and Jakob is 6 (in 1st grade), and so I may not communicate after 3:30pm (if it’s my day to get Jakob from the bus) and you may see relatively early emails from me (they wake up super early, sigh). I do not expect you to email/respond ‘after hours’, and I ask that you be patient if you email me outside of the hours of 9-3:30. I am happy to receive emails after hours if that’s what’s best for you – I just may not respond to them until the next day.

I don’t think you’ll need to contact me ‘urgently’, but if you do, you may reach me on my cell phone (414-940-7380). It is probably safer to text me and include your name so I know you’re not spam.

**Learning objectives:**

The first half of the course covers a broad range of topics most of which is review for the typical incoming graduate student. These topics include, for example, probability, central tendency, variability, the normal distribution, sampling and sampling distributions, estimation, hypothesis testing, association, regression & correlation, experimental designs, and reliability & validity. The second half of the course is focused on ANOVA modeling and introduction to multiple regression.

While theoretical and mathematical basics of statistical methods will be covered, **emphasis is placed on the application of the methods, including a conceptual and interpretive understanding of the methods**. The primary goal is for students to develop an ability to apply these statistical methods using a statistical software package to their substantive research questions and to understand and communicate their meaning.

Learning outcomes:

* Understand the basics of probability, sampling, and inferential theory underlying statistical methods
* Understand univariate and bivariate statistics and ANOVA modeling methods
* Properly interpret the statistical estimates and tests covered in the course
* Formulate testable hypotheses
* Apply proper statistical tests to evaluate hypotheses
* Analyze data using univariate and bivariate statistics and ANOVA and Stata statistical software
* Use statistical methods to test your research questions using empirical data
* Produce written communication of analytic methods and interpretation of results

# Course Components:

**Readings**: Reading assignments include the required text as well as optional supplemented course readings which will be provided on Brightspace. Reading assignments may be updated during class and on Brightspace. Completing the readings will greatly aid with your understanding of the material presented in class. Therefore, I encourage you to keep up with the reading as best you can. It is good practice to read statistics in shorter sections rather than reading through entire chapters in one sitting.

**Statistical Software:** We will learn how to analyze and visualize data using R and SAS statistical software. R/Rstudio is free, and SAS is available in all ITaP instructional labs across campus as well as through software remote: <https://engineering.purdue.edu/ECN/Support/KB/Docs/UsingITaPGoRemotesof>

Other software: SAS 9.4 (for your personal computer) is also available for immediate download by placing a free order on Purdue’s Community Hub: <https://communityhub.purdue.edu/storefront/browse/statistical>. Please contact the TA for additional information about downloading SAS for your personal computer. Note: SAS does not make a Mac version for their software. If you have a Mac, remote access is best.

Additionally, we will be providing scripts for the analyses in STATA as well, though this will not be primarily taught this semester. If you prefer to use the STATA scripts for homework just let me know.

**Practice Sets:** There will be 13 small practice sets (see schedule below), intended to solidify the key aspects of that week’s content. Each assignment will be released on a Tuesday and due 1 week later, on the following Tuesday by the time of the class period unless otherwise specified. Sometimes class time will be used to work on the practice sets. Practice sets will represent 50% of your final grade. Your lowest 3 scores will be dropped. The other 10 will each be worth 5% of your grade. For each question on the practice set, it will be graded:

 2pts – correct and complete

 1pt – partially correct or incomplete but on the right track

 0 pts – not completed or completely incorrect

**Paper Prep Assignments:** There will be 2 larger assignments over the course of the semester that should help build you up to your final paper. The first (10% of your grade) will be a proposal for your final project. The second will be a data documentation exercise (10% of your grade) making decisions and completing specific analytic tasks related to your own proposal and learning to write them up. You will be given examples and the grading rubrics for each, along with the homework, at least 2 weeks before the due date.

**Final Paper**: A final paper will be 30% of your grade. This is not meant to be completely independent work – you can and should get help from other students, the TAs, and myself. The specific instructions and grading rubric will be released prior to Thanksgiving break.

**Grading:**

Your grade will be weighted based on the following course component percentages:

|  |  |
| --- | --- |
| Homework: | 50% |
| Paper Prep Assignments: | 20% |
| Final Paper: | 30% |
|  |  |

Final grades will be assigned according to the following scale:

|  |  |  |
| --- | --- | --- |
| A+: |  > | 98% |
| A: | 92% - | 97.9% |
| A-: | 90% - | 91.9% |
| B+: | 88% > | 89.9% |
| B: | 82% - | 87.9% |
| B-: | 80% - | 81.9% |
| C+: | 78% > | 79.9% |
| C: | 72% - | 77.9% |
| C-: | 70% - | 71.9% |
| D+: | 68% > | 69.9% |
| D: | 62% - | 67.9% |
| D-: | 60% - | 61.9% |
| F: | < | 60% |

# Attendance:

# There is no formal attendance policy. You are all graduate students with competing demands on your time and it is important to learn how to balance your priorities. I trust that you can weigh the importance of attending this class as is best for you. However, I really think you’ll get the most out of class by coming. Please do let me know if you will be absent ahead of time, as it is courteous and so I don’t wait for you to start class.

**Holiday Schedule:**

Students will not be expected to do course-related work on university-recognized holidays. If other significant holidays or observances related to your background, identity, and/or religious practices overlap with assignment due dates, please contact me and/or the TAs and we can make a plan to work around your observances.

**Academic Guidance in the Event a Student is Quarantined/Isolated**

# As noted above, if you are quarantined/isolated, let us know. You will still be responsible for all course materials for that week/those weeks, but we can work on a case-by-case basis on timing or mode of completion depending on your situation while isolated (i.e., connectivity, illness).

# Classroom Guidance Regarding Protect Purdue

Students are expected to keep up to date with and comply with Protect Purdue Protocols. (I’m not providing specific guidance here, as they are subject to change over time).

Any student who has substantial reason to believe that another person is threatening the safety of others by not complying with Protect Purdue protocols is encouraged to report the behavior to and discuss the next steps with their instructor. Students also have the option of reporting the behavior to the [Office of the Student Rights and Responsibilities](https://www.purdue.edu/odos/osrr/). See also [Purdue University Bill of Student Rights](https://catalog.purdue.edu/content.php?catoid=7&navoid=2852#purdue-university-bill-of-student-rights) and the Violent Behavior Policy under University Resources in Brightspace.

# Course Policies:

**Accommodations:** Our goal is for everyone to participate fully in this course. If you have a physical, psychological, medical, or learning disability that may impact your course work, please make an appointment to speak with me in order to discuss any needed adjustments. In addition, you should notify the Disability Resource Center of an impairment/condition that may require accommodations/documentation. <http://www.purdue.edu/drc>

# Academic Integrity: Students are advised to familiarize themselves with the University’s regulations regarding student conduct in academic endeavors. This information is located at the following website: <http://www.purdue.edu/univregs/pages/stu_conduct/stu_regulations.html.> Students who are suspected to be in violation of the University’s regulations regarding academic dishonesty, including but not limited to plagiarism and cheating, will be dealt with in accordance with University policy. This may result in a referral to the Office of the Dean of Students and penalties for the assignment(s) in question.

**Honor Pledge:**

***As a boilermaker pursuing academic excellence, I pledge to be honest and true in all that I do. Accountable together - we are Purdue.***

Please refer to [*Purdue’s Honor Pledge*](https://www.purdue.edu/provost/teachinglearning/honor-pledge.html) for more details.

**Nondiscrimination Statement:** We are a diverse group this semester, and that diversity makes the learning environment richer. You will have different perspectives and questions that will help your peers think about the topics in new and different ways. Please be sensitive to the fact that your fellow classmates belong to many different departments, come from many walks of life, and may face discrimination that you are unaware of. Specific to this course, some students are more or less confident in their statistical abilities. Particularly in methods courses like this one, students learn very differently, and each of you will struggle with different topics. You will really understand or really be lost when I explain aspects of the course in different ways (i.e., some will be visual and some will latch onto the equations). I try my best to present the material a few different ways, but this class works best when students are kind and understanding, and open to being helpful to each other – you can help explain things to each other and figure things out together leveraging your respective strengths. Please be kind, respectful, and inclusive in these efforts.

Purdue University is committed to maintaining a community which recognizes and values the inherent worth and dignity of every person; fosters tolerance, sensitivity, understanding, and mutual respect among its members; and encourages each individual to strive to reach his or her potential. In pursuit of its goal of academic excellence, the University seeks to develop and nurture diversity. The University believes that diversity among its many members strengthens the institution, stimulates creativity, promotes the exchange of ideas, and enriches campus life. Please see Purdue’s [Nondiscrimination Policy Statement](https://www.purdue.edu/purdue/ea_eou_statement.php) (also in the Brightspace template under University Policies) for more information.

# Campus Emergencies:

In the event of a major campus emergency, course requirements, deadlines and grading percentages are subject to changes that may be necessitated by a revised semester calendar or other circumstances beyond the instructor’s control. Relevant changes to this course will be posted onto the course website or can be obtained by contacting the instructors or TAs via email or phone. You are expected to read your @purdue.edu email on a frequent basis.

Emergency information and updates will be posted on Purdue's homepage at [http://www.purdue.edu.](http://www.purdue.edu/) Students should sign up for emergency text messages here: [http://www.purdue.edu/securepurdue/.](http://www.purdue.edu/securepurdue/) Also, the following webpage details university policies and procedures during various emergency events: [https://www.purdue.edu/emergency\_preparedness/flipchart/index.html.](https://www.purdue.edu/emergency_preparedness/flipchart/index.html)

# Basic Needs:

Any student who faces challenges securing their food or housing and believes this may affect their performance in the course is urged to contact the Dean of Students for support. There is no appointment needed and Student Support Services is available to serve students 8 a.m.-5 p.m. Monday through Friday. Considering the significant disruptions caused by the current global crisis as it related to COVID-19, students may submit requests for emergency assistance from the [Critical Needs Fund](https://www.purdue.edu/odos/resources/critical-need-fund.html).

# Mental Health/Wellness:

If you find yourself beginning to feel some stress, anxiety and/or feeling slightly overwhelmed, try [WellTrack](https://purdue.welltrack.com/). Sign in and find information and tools at your fingertips, available to you at any time.

If you need support and information about options and resources, please contact or see the [Office of the Dean of Students](http://www.purdue.edu/odos). Call 765-494-1747. Hours of operation are M-F, 8 am- 5 pm.

If you find yourself struggling to find a healthy balance between academics, social life, stress, etc. sign up for free one-on-one virtual or in-person sessions with a [Purdue Wellness Coach at RecWell](https://www.purdue.edu/recwell/fitness-wellness/wellness/one-on-one-coaching/wellness-coaching.php). Student coaches can help you navigate through barriers and challenges toward your goals throughout the semester. Sign up is completely free and can be done on BoilerConnect. If you have any questions, please contact Purdue Wellness at evans240@purdue.edu.

# If you’re struggling and need mental health services: Purdue University is committed to advancing the mental health and well-being of its students. If you or someone you know is feeling overwhelmed, depressed, and/or in need of mental health support, services are available. For help, such individuals should contact [Counseling and Psychological Services (CAPS)](https://www.purdue.edu/caps/) at 765-494-6995 during and after hours, on weekends and holidays, or by going to the CAPS office on the second floor of the Purdue University Student Health Center (PUSH) during business hours.

# Tentative Schedule:

The tentative schedule of topics and readings is provided below. **There will inevitably be changes to this schedule and specific readings during the semester.** I will provide updated schedules as we move through the course topics. Additional readings may be added.

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| **Dates** | **Topics Covered** | **Readings** |
| Aug 23& 25 | Course overview, basic concepts | Howell Chapter 1 |
| Aug 30 & Sep 1 | Statistics, Eugenics, and Racism, and how to move forward; Data Documentation | No required readings, but suggested readings are posted on Brightspace.  |
| Sept 6 & 8K | Describing and Exploring Data | Howell Chapter 2 |
| Sept 13 & 15 | The Normal Distribution | Howell Chapter 3 |
| Sept 20 & 22 | Sampling Distributions and Hypothesis Testing | Howell Chapter 4 |
| Sept 27 & 29 | Probability Concepts | Howell Chapter 5 |
| Oct 4 & 6 | Categorical Data & the Chi Square | Howell Chapter 6 |
| Oct 11 | **No Class** (Fall break) |  |
| Oct 13 | Hypothesis Tests Applied to Means | Howell Chapter 7  |
| Oct 18 & 20 | Statistical Power and Effect Size | Howell Chapter 8 |
| Oct 25 & 27 | Correlation and Regression | Howell Chapter 9 |
| Nov 1 & 3 | Simple ANOVA & Multiple Comparisons | Howell Chapter 11 & 12 |
| Nov 8 & 10 | Factorial ANOVA | Howell Chapter 13 |
| Nov 15 & 17 | Repeated Measures ANOVA | Howell Chapter 14 |
| Nov 22 | Multiple Regression and ANCOVA | Howell Chapter 15 & 16 |
| Nov 25 | **No Class** (Thanksgiving break) |
| Nov 30K | Research Article Critiques |
| Dec 1 | Ethical data documentation reminder, help with final paper data documentation |
| Dec 6 & 8 | **No Class Meetings Individual help with Final Papers** |

KKristine travelling, TA will run class.