

**Statistical Methods for Research**

MATH 835.01 CRN 10973

**Instructor:** Ernst Linder, Kingsbury N321B  
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**Time and Room:** M/W 11:10 – 12:30 Kingsbury S320, or live on-line.

**Format:** This is a synchronous online course for which you have the choice to either attend the classes “old-style” in person in the classroom, or to attend remotely via a computer. See below for details about the on-line course delivery.

**Textbook:** **REVISED !** For this course we use  
1) the free on-line text: **OpenIntro Statistics**, edition 4. By Diez, D. Cetinkaya-Rundel, M. and Barr, C. See the website:  
[https://www.openintro.org/stat/textbook.php?stat\\_book=os](https://www.openintro.org/stat/textbook.php?stat_book=os)

2) We might occasionally use the freely available on-line interactive e-book and related course tools which are posted at <http://onlinestatbook.com>

In addition, some course notes in PDF format will be provided during the semester. Students are expected to read the notes and any assigned reading of the e-books and are responsible for the content.

**Purpose:** This is the first course of a two semester sequence in statistical methods. Math 835 provides a first course and/or refresher course in statistics plus coverage of popular statistical methods. See the Course Topics list given below for the coverage provided in this course.

The second semester Math 836 is Advanced Statistical Methods for Research. Information on Math 836 will be indicated during the semester. There are numerous other graduate level statistics courses offered for which this course serves as a prerequisite. (MATH 837, MATH 838, MATH 839, MATH 840, MATH 841, MATH 843, MATH 844, MATH 855, MATH 941, MATH 944)

**Learning Objectives:** To introduce students to the discipline of statistics as a science of understanding and analyzing data. Throughout the semester, students learn how to effectively make use of data in the face of uncertainty: how to collect data, how to analyze data, and how to use data to draw inferences and conclusions about real world phenomena.

**Some Learning Goals:**

- Recognize the importance of data collection, identify limitations in data collection methods and other sources of statistical bias, and determine their implications and how they affect the scope of drawing conclusions.
- Use statistical software to summarize data numerically and visually, and to perform data analysis.
- Have a conceptual understanding of the unified nature of statistical inference.
- Apply estimation and testing methods to analyze single variables or the relationship between two variables in order to understand natural phenomena and make data-based decisions.
- Model numerical response variables using a single explanatory variable or multiple explanatory variables in order to investigate relationships between variables.
- Interpret results correctly, effectively, and in context without relying on statistical jargon.
- Critique data-based claims and evaluate data-based decisions.

**Computer Usage:**

**JMP 14.0 Pro** statistical software will be integrated into the course. The software is installed on the computer clusters and can be downloaded for use on individual computers at: <https://www.unh.edu/it/kb/article/unh-academic-software-applications.html>

**R:** The open source software system R may also be used on occasion. I recommend you take the 1-credit introduction to R (MATH 859) which is offered every semester and also during J term and during summer session.

**Quizzes:** During the semester quizzes will be assigned and should be completed through **Canvas** (Mycourses). These are given to encourage students to stay engaged in the course. The **quizzes are to be done individually** and students **are not to collaborate** in completing them.

**Homework:** Homework will be assigned regularly to assess class learning and motivate class participation. Some homework will be assigned for submission, and some will be assigned for discussion in class. Participation in homework discussions will be observed and recorded for grade calculation. There will be a final comprehensive homework (takehome).

**Submitting Homework:** Your solutions for the homework are to be submitted electronically via Canvas; simply upload your completed assignment through the link of the original assignment. Electronic submittals for regular homework **must be in .docx or .pdf format**.

**Course Delivery:** This course is delivered *synchronously* on-line using **ZOOM**. Try it by going to <http://zoom.unh.edu> ; join a “meeting” and play with the software. Try to set up your audio (microphone and loudspeakers) functions. Make sure that you are not producing echoes and extraneous noises when you have both, mic and loudspeakers on at the same time. Sometimes we recommend an earphone or a headset. Links to our class meetings should be posted on Canvas (myCourses.unh.edu) and class materials, including recordings will also be posted there.

ZOOM provides a fully interactive platform for course delivery and student participation. It is therefore expected that students attend the class either in person in the classroom, or, virtually from a computer **during the scheduled class time**. While the classes are recorded for replay at a later point in time, it is not acceptable for students to never attend class when it is scheduled and simply peruse the recording later. The recordings are to be used for replay in cases where parts of the lecture were not clearly understood the first time. Students who anticipate having time conflicts with the scheduled classes need to inform the instructor of their planned absences from the live class.

It is also expected that students who attend the class from a distance have the necessary equipment that allows them to fully participate in the course, in particular a microphone (a laptop mic tends to be sufficient).

**Discussion Forums:** During the semester you will be asked to read assigned, important papers related to topics in statistics, or sections of the on-line textbook. You are to complete these readings and participate in related discussion forums where you collaborate with your fellow students in commenting on the papers and topics related to the papers. I consider this an important part of the course in order for students to gain proper perspective on statistics and its methodologies, strengths and weaknesses, and its utility in scientific investigations.

**Team Work:** Some assignments will be as team work (this may also depend on class size). This will be quite informal. Take advantage of your peers’ knowledge and insight by participating to the fullest possible.

**Final Grade:** The final grade will be calculated as follows:  
homework: 45%, final homework: 25%, quizzes: 20%, participation: 10%  
(Participation in discussion forums and in-class discussions of “discussion homework” and of general discussion).

**Tentative Course Topics (Book Chapters)**

1. Introduction to data. Data structures, variables, and basic data collection techniques.
2. Summarizing data. Data summaries, graphics, and a teaser of inference using randomization.
3. Probability. Basic principles of probability.
4. Distributions of random variables. The normal model and other key distributions.
5. Foundations for inference. General ideas for statistical inference in the context of estimating the population proportion.
6. Inference for categorical data. Inference for proportions and tables using the normal and chi-square distributions.
7. Inference for numerical data. Inference for one or two sample means using the t-distribution, statistical power for comparing two groups, and also comparisons of many means using ANOVA.
8. Introduction to linear regression. Regression for a numerical outcome with one predictor variable. Most of this chapter could be covered after Chapter 1.
9. Multiple and logistic regression. Regression for numerical and categorical data using many predictors.

**Tentative Schedule**

Aug 26 M		Chap 1: Intro to Data
28 W		
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(Sept 2 no classes)		
Sept 4 W		
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9 M		Chap 2: Summarizing Data
11 W		
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16 M		Chap 3: Probability
18 W		
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23 M		Chap 4: Distributions
25 W		
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30 M		
Oct 2 W		
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7 M		Chap 5: Foundations of Inference
9 W		
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15 T	Monday class schedule	
16 W		Chap 6: Inference for Categorical Var's
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21 M		Chap 7: Inference for measurement Var's
23 W		
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28 M		
30 W		
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Nov 4 M		Chap 8: Linear Regression / ANOVA
6 W		
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11 M	<i>NO Classe (Veteran's Day)</i>	
14 W		
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18 M		Chap 9: Multiple Regr and Logist. Regr.
20 W		
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25 M		
27 W	No classes (before Thanksgiv)	
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Dec 2 M		
4 W		
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9 M		
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