STA 210 037-042
Making Sense of Uncertainty
An Introduction to Statistical Reasoning

Instructor: Dr. Bill Rayens
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Office Hours: TR 9-9:50
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Lecture: TR 11-11:50 (Whitehall Classroom Building 102)

Rec 037:	M 9-9:50 (MDS335)	Rec 040:	R 3:30-4:20 (MDS335)
Rec 038:	F 9-9:50 (MDS335)	Rec 041:	M 4-4:50 (MDS335)
Rec 039:	T 8-8:50 (MDS335)	Rec 042:	R 2:30-3:20 (MDS335)

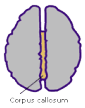
Textbooks

The workbook Making Sense of Uncertainty: An Introduction to Statistical Reasoning is **required.** It is not a traditional textbook, but more like a workbook. You will need to have it with you every class and every recitation. **Only original materials turned in from your own workbook will be counted.** No exceptions. We will explain more about the book and how it will be used later. Only turn in your papers; not anyone else's.

Overview

This course is STA's new course in the "statistical inferential reasoning" (SIR) category that addresses "Learning Outcome III" of the new UK Core (http://www.uky.edu/UKCore/outcomes.html). You will receive credit for the STA 200 part of the USP inference requirement if you need that credit and are still under USP. Broadly speaking, the goal of this course is to help you develop your expertise at consuming the kinds of inferential arguments we either encounter, or construct, as part of our daily lives. Most of our daily encounters with statistical inference arise either formally from polls, surveys, social and medical experiments; or informally, from "human inferences" associated with simple statistical constructs like tables and graphs. Accordingly, this course is divided into three modules that reflect these sources:

I. Slippery Evidence (Jan. 12, 17, 19, 24, 27, 31; Feb 2, 7; First Exam on February 9th)



The primary intent of this module is to help students begin to absorb common statistical information appropriately and to form associated human inferences carefully. The focus will be on tables, charts and summaries in the media, but some time will be spent on the psychology of inference as well.

II. MOE's Lineage (Feb. 14, 16, 21, 23, 28; Mar. 1, 6, 8; Second Exam on March 20th)

The primary intent of this module is to develop a deeper sense of what statistical confidence means and doesn't mean by exploring sampling variability and encountering some of the important theory behind repeated sampling. The focus will be largely on polls and social surveys.

III. No Ho Hum HO HA (Mar. 23, 27, 29; Apr. 3, 5, 10, 12, 17, 19, 24, 26; Third Exam May 3rd 1-3 p.m. in CB 102)

The primary intent of this module is to encounter the concepts and language of hypothesis testing by way of the more common ideas of sensitivity and specificity. Discussion will revolve around field sobriety tests and home pregnancy tests.

Each module has its own set of learning outcomes and these are described below. In addition to the materials in our workbook, referenced above, I may create other resources for you with articles from journals, the internet, newspapers, etc. This is a course where we think, read, and experience, more often than we calculate. In the end, we want you to be better equipped to intelligently consume statistical information, particularly inferential information. You will also be challenged to increase your information literacy, both through the articles you have to read that I provide, or the ones that you have to find yourselves to read.

Policy on academic accommodations due to disability

If you have a documented disability that requires academic accommodations, please see me as soon as possible during scheduled office hours. In order to receive accommodations in this course, you must provide me with a Letter of Accommodation from the Disability Resource Center (Room 2, Alumni Gym, 257-2754, email address jkarnes@email.uky.edu) for coordination of campus disability services available to students with disabilities.

Grading

Your grades in this course will come from the following sources:

- Working Beyond the Numbers (Class Work) 20%
- Practice Makes Perfect (Recitations) 10%
- Working Beyond the Classroom (Small Projects) 25%
- Tests (3 – one for each module; first one is 10%, second 15%, third is 20%) 45%

Team

Dr. Rayens will be assisted by a great team, consisting of Ms. Meng Qi and Mr. Joel Perry. Meng and Joel will assist me in the classroom activities, run the recitations, and help with the grading. Dr. Rayens designs the activities and directs them, creates all the assessments, grades most of the open response, and fields all questions about exams and the deeper conceptual material as it is encountered.

Beyond the Numbers

This is a broad category, but *most* of these exercises will be pages from your workbook and will be torn out and handed it. We may not use all of the ones in the workbook, but we will use most of them and add a some on top of that. This category counts 20%. Think of that as 2 letter grades.

Practice Makes Perfect

The recitations will feature exercises and discussions that are designed to allow you to practice basic skills that we need you to have in order to better appreciate and absorb deeper concepts. Each recitation is worth 10 points and you will get the full 10 if you come and participate. This category counts 10%. Think of this as a free letter grade. Low cost grade insurance. Make sure your get yours.

Beyond the Classroom

This is what will keep us focused on the overarching goal of our course, and keep us connected with the world around us. We'll make these connections in a variety of ways. We will likely use the five in our workbook but we may substitute a new one for one of those if it seems right. At 25% this is like 3 letter grades, so this category is clearly one we value.

Three Exams

These exams will be administered in our regular classroom. Note the dates of the exams are given above. The last exam will be held during our final exam slot and it will not be cumulative. Exams have variable worth: first exam is worth 10%, second exam worth 15%, and third exam is worth 20%. Need to stay focused all semester.

Your percent correct in each of these four categories is weighted as noted above to determine your letter grade:

The following standard scale to determine the course letter grade:

- 90 or above A
- 80 to 89 B
- 70 to 79 C
- 60 to 69 D
- 59 or below E

Please be advised that midterm grades will be reported and at-risk students will be identified.

Classroom Decorum

We try to have an interesting, active classroom so sometimes things get noisy. We like "good noisy." But when Dr. Rayens or the Team is addressing the class you are expected to be quiet or you may receive a penalty on the classroom assignment. Cell phones, lap tops and all electronic devices are expected to be off at all times unless part of a classroom activity. You can survive 50 minutes without Facebook! The Team reserves the right to confiscate items and/or assign a penalty for the classroom assignment in the event of noncompliance.

Attendance Policies

- Classroom: Of course you need to be there. This is when we do the Beyond the Numbers activities! These activities cannot be turned in late without an official University excuse. Once we get to know each other better we may be able to make some classroom attendance optional. But we won't be discussing that until at least after midterm.

- Exams: Attendance at exams is a specific course requirement. Make-up exams will only be offered in the case of an "excused" absence. An unexcused absence from an exam will result in a grade of zero (0) for that particular exam.

- Recitations: Attendance at recitations is a specific course requirement. A make-up for a recitation activity will only be offered in the case of an "excused" absence. Please understand: coming and participating in the recitation counts for a letter grades. This is very valuable, very affordable insurance and you would be well advised to take advantage of it.

Excused Absences

Students need to notify the professor of absences prior to class when possible. S.R. 5.2.4.2 defines the following as acceptable reasons for excused absences: (a) serious illness, (b) illness or death of family member, (c) University-related trips, (d) major religious holidays, and (e) other circumstances found to fit "reasonable cause for nonattendance" by the professor.

Students anticipating an absence for a major religious holiday are responsible for notifying the instructor in writing of anticipated absences due to their observance of such holidays no later than the last day in the semester to add a class. Information regarding dates of major religious holidays may be obtained through the religious liaison, Mr. Jake Karnes (859-257-2754).

Students are expected to withdraw from the class if more than 20% of the classes scheduled for the semester are missed (excused or unexcused) per university policy.

Make-Up Policies

In the event of an excused absence from an exam, recitation, or in-class assignment you have the right to make up the work. The following conditions apply to making up the work due to an excused absence.

- For a missed exam, you must present documentation of the absence to me as soon as you return to school. Dates on excuse must match the interval of time you are absent. A makeup will be scheduled.

- For a missed recitation, you must present documentation of the absence to your TA as soon as you return to school. Dates on excuse must match the interval of time you are absent. With appropriate documentation, you will be marked "exempt" from the recitation. This means the recitation points will not appear in the numerator or the denominator of your recitation average.

- For missed daily work, no matter what form that takes, you must present documentation of the absence to Dr. Rayens as soon as you return to school. You will then be asked to complete the same or a similar activity in a manner Dr. Rayens decides. In some cases and exemption will be the best way to handle the absence. The choice to offer a makeup or record an exemption resides with Dr. Rayens.

Failure to make up missed assignments, that are excused, in accordance with the conditions specified above will result in a grade of zero (0). The excuse presented **MUST** include the actual dates for which you were absent.

Verification of Absences

Students may be asked to verify their absences in order for them to be considered excused. Senate Rule 5.2.4.2 states that faculty have the right to request "appropriate verification" when students claim an excused absence because of illness or death in the family. Appropriate notification of absences due to university-related trips is required prior to the absence.

Academic Integrity

Per university policy, students shall not plagiarize, cheat, or falsify or misuse academic records. Students are expected to adhere to University policy on cheating and plagiarism in all courses. The minimum penalty for a first offense is a zero on the assignment on which the offense occurred. If the offense is considered severe or the student has other academic offenses on their record, more serious penalties, up to suspension from the university may be imposed.

Plagiarism and cheating are serious breaches of academic conduct. Each student is advised to become familiar with the various forms of academic dishonesty as explained in the Code of Student Rights and Responsibilities. Complete information can be found at the following website: http://www.uky.edu/Ombud. A plea of ignorance is not acceptable as a defense against the charge of academic dishonesty. It is important that you review this information as all ideas borrowed from others need to be properly credited.

Part II of Student Rights and Responsibilities (available online http://www.uky.edu/StudentAffairs/Code/part2.html) states that all academic work, written or otherwise, submitted by students to their instructors or other academic supervisors, is expected to be the result of their own thought, research, or self-expression. In cases where students feel unsure about the question of plagiarism involving their own work, they are obliged to consult their instructors on the matter before submission.

When students submit work purporting to be their own, but which in any way borrows ideas, organization, wording or anything else from another source without appropriate acknowledgement of the fact, the students are guilty of plagiarism. Plagiarism includes reproducing someone else's work, whether it be a published article, chapter of a book, a paper from a friend or some file, or something similar to this. Plagiarism also includes the practice of employing or allowing another person to alter or revise the work which a student submits as his/her own, whoever that other person may be.

Students may discuss assignments among themselves or with an instructor or tutor, but when the actual work is done, it must be done by the student, and the student alone. When a student's assignment involves research in outside sources of information, the student must carefully acknowledge exactly what, where and how he/she employed them. If the words of someone else are used, the student must put quotation marks around the passage in question and add an appropriate indication of its origin. Making simple changes while leaving the organization, content and phraseology intact is plagiaristic. However, nothing in these Rules shall apply to those ideas which are so generally and freely circulated as to be a part of the public domain (Section 6.3.1).

Please note: Never turn in an assignment for someone else in this class w/o prior permission from Dr. Rayens.

Appendix – Description of Modules

Module 1 – Slippery Evidence

Overarching Goal

The primary intent of this module is to help students begin to absorb common statistical information appropriately and to form associated human inferences carefully.

Learning Outcomes

Students who successfully complete this module should be able to:

1. Identify categorically good or bad statistical summaries, charts and graphs and explain the reasons they are so categorized;
2. Identify categorically good or bad statistical arguments based on statistical summaries, charts, and graphs, and explain the reasons they are so categorized;
3. Distinguish the concepts of correlation and causation and explain how they offer different types of evidence;
4. Identify hidden or confounding variables in studies reported by the media or in the literature;
5. Explain if and how hidden or confounding variables can or did affect the associated common-sense inferences;
6. Define what is meant by Simpson's Paradox;
7. Explain how a misinterpretation of randomness leads to poor human inferences;
8. Explain how not having enough or the right information leads to poor human inferences;
9. Present examples relevant to each of Outcomes 5., 6., 7, and 8;
10. Identify and present at least one argument from psychology or neuroscience that supports the contention that poor human inferences are common.

Duration – minimum of 4 weeks

Module 2 – MOE's Lineage

Overarching Goal

The primary intent of this module is to develop an evolved sense of what statistical confidence means and doesn't mean by involving students in real surveys that they will enjoy discussing.

Learning Outcomes

Students who successfully complete this module should be able to:

1. Identify categorically good or bad surveys and explain the reasons they are so categorized;
2. Identify a push poll from the news and explain the reasons such a poll is likely not a source of useful information;
3. Explain the difference between sampling variability and non-sampling variability;
4. Identify strategies for understanding non-sampling variability;
5. Identify a margin of error that is in the news, but not discussed in class, form the associated confidence interval and use the language of the module to explain the sort confidence that is being offered, and the type of risk that is being quantified;
6. Compare and contrast the information contained in a Cosmopolitan on-line poll, a CBS Evening News call-in poll, a Gallup random-dialing poll, and a door-to-door political campaign poll.
7. Define sampling variability and explain the role it plays in the construction of a confidence interval;
8. Define sampling distribution and demonstrate the Central Limit Theorem by hands-on repeated sampling;
9. Produce a non-95% confidence interval for a proportion or mean, based on data from a simple random sample;
10. Explain what happens to a confidence interval as the confidence level changes and/or the sample size changes

Duration: minimum of 4 weeks

Module 3 – No Ho Hum HO HA

Overarching Goal

The primary intent of this module is to juxtapose the concepts and language of hypothesis testing with the more easily accessible ideas of sensitivity and specificity in an effort to demystify these more difficult ideas and facilitate a discussion of the related statistical issues.

Learning Outcomes

Students who successfully complete this module should be able to:

1. Define sensitivity and specificity;
2. Read about a dichotomous decision process that is in the news, not discussed in class, and explain the roles for sensitivity and specificity in assessing the integrity of that process;
3. Identify the structure of a test of hypothesis and explain the purpose of the null and the alternative, and the way in which the evidence that is gathered is used;
4. Define significance and power, and explain the roles each play in assessing the integrity of the dichotomous significance test;
5. Read about a test of significance associated with an experiment that is in the news, but not discussed in class, and use the language of the module to explain and evaluate the nature of the evidence that is presented;
6. Explain the role of modeled error in a simple test of hypothesis for a simple experimental design.
7. Define the Prosecutor's Fallacy;
8. Explain the importance of the Prosecutor's Fallacy to interpreting specificity and sensitivity;
9. Explain the importance of the Prosecutor's Fallacy to describing the results of null hypothesis testing;
10. Read a news story and identify and demonstrate the difference between various conditional events and unconditional events discussed in that story.

Duration: Minimum of 4 weeks