

## APPLICATION FOR NEW COURSE

**1. General Information.**

- a. Submitted by the College of: Arts and Sciences Today's Date: 9/3/2010
- b. Department/Division: Statistics
- c. Contact person name: Dr. Bill Rayens Email: rayens@uky.edu Phone: 7-7061
- d. Requested Effective Date:  Semester following approval OR  Specific Term/Year<sup>1</sup>: Spring 2011

**2. Designation and Description of Proposed Course.**

- a. Prefix and Number: STA 210
- b. Full Title: Making Sense of Uncertainty: An Introduction to Statistical Reasoning
- c. Transcript Title (if full title is more than 40 characters): Intro to Statistical Reasoning
- d. To be Cross-Listed<sup>2</sup> with (Prefix and Number): N/A

e. Courses must be described by at least one of the meeting patterns below. Include number of actual contact hours<sup>3</sup> for each meeting pattern type.

2 Lecture  Laboratory<sup>1</sup> 2 Recitation  Discussion  Indep. Study  
 Clinical  Colloquium  Practicum  Research  Residency  
 Seminar  Studio  Other – Please explain: \_\_\_\_\_

- f. Identify a grading system:  Letter (A, B, C, etc.)  Pass/Fail
- g. Number of credits: 3
- h. Is this course repeatable for additional credit? YES  NO   
 If YES: Maximum number of credit hours: \_\_\_\_\_  
 If YES: Will this course allow multiple registrations during the same semester? YES  NO

i. Course Description for Bulletin: The goal of this course is to help students develop or refine their statistical literacy skills. Both the informal activity of human inference arising from statistical constructs, as well as the more formal perspectives on statistical inference found in confidence intervals and hypothesis tests are studied. Throughout, the emphasis is on understanding what distinguishes good and bad inferential reasoning in the practical world around us.

j. Prerequisites, if any: Any course in the new Quantitative Foundations area of Gen Ed. beginning Spring 2012. We propose delaying enforcement of the prerequisite until then to avoid an initial bottleneck in Fall 2011. Ideally most students will take a Foundations course in the fall and then enter into this course in the spring of their first year or fall of their second. It may be better for system if some students take this course in the fall of the 1st year and a foundations course in the spring. Otherwise the Foundations offerings may not be able to meet the demand.

- k. Will this course also be offered through Distance Learning? YES<sup>4</sup>  NO

<sup>1</sup> Courses are typically made effective for the semester following approval. No course will be made effective until all approvals are received.  
<sup>2</sup> The chair of the cross-listing department must sign off on the Signature Routing Log.  
<sup>3</sup> In general, undergraduate courses are developed on the principle that one semester hour of credit represents one hour of classroom meeting per week for a semester, exclusive of any laboratory meeting. Laboratory meeting, generally, represents at least two hours per week for a semester for one credit hour. (from SR 5.2.1)

## APPLICATION FOR NEW COURSE

1. Supplementary teaching component, if any:  Community-Based Experience  Service Learning  Both
3. Will this course be taught off campus? YES  NO
4. Frequency of Course Offering.
- a. Course will be offered (check all that apply):  Fall  Spring  Summer
- b. Will the course be offered every year? YES  NO   
If NO, explain: \_\_\_\_\_
5. Are facilities and personnel necessary for the proposed new course available? YES  NO   
If NO, explain: \_\_\_\_\_
6. What enrollment (per section per semester) may reasonably be expected? 24
7. Anticipated Student Demand.
- a. Will this course serve students primarily within the degree program? YES  NO
- b. Will it be of interest to a significant number of students outside the degree pgm? YES  NO   
If YES, explain: Course was already approved for Stat Inf Reasoning area within Gen Ed last academic year; may be 4000 students per year, depending on alternative offerings in the same area.
8. Check the category most applicable to this course:
- Traditional – Offered in Corresponding Departments at Universities Elsewhere
- Relatively New – Now Being Widely Established
- Not Yet Found in Many (or Any) Other Universities
9. Course Relationship to Program(s).
- a. Is this course part of a proposed new program? YES  NO   
If YES, name the proposed new program: General Education, SIR Area
- b. Will this course be a new requirement<sup>5</sup> for ANY program? YES  NO   
If YES<sup>5</sup>, list affected programs: Most programs currently requiring STA 200, which will be phased out, will likely decide to require this course instead. Those decisions are yet to be made though.
10. Information to be Placed on Syllabus.
- a. Is the course 400G or 500? YES  NO   
If YES, the *differentiation for undergraduate and graduate students must be included* in the information required in **10.b**. You must include: (i) identification of additional assignments by the graduate students; and/or (ii) establishment of different grading criteria in the course for graduate students. (See SR 3.1.4.)
- b.  The syllabus, including course description, student learning outcomes, and grading policies (and 400G-/500-level grading differentiation if applicable, from **10.a** above) are attached.

<sup>4</sup> You must *also* submit the Distance Learning Form in order for the proposed course to be considered for DL delivery.

<sup>5</sup> In order to change a program, a program change form must also be submitted.

## SIGNATURE ROUTING LOG

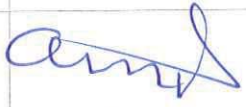




### General Information:

Proposal Type: Course  Program  Other   
 Proposal Name<sup>1</sup> (course prefix & number, pgm major & degree, etc.): STA 210: Intro Stat Reasoning *(new)*  
 Proposal Contact Person Name: W. Rayens Phone: 7-7061 Email: rayens@uky.edu

### INSTRUCTIONS:

Identify the groups or individuals reviewing the proposal; note the date of approval; offer a contact person for each entry; and obtain signature of person authorized to report approval.

### Internal College Approvals and Course Cross-listing Approvals:

Reviewing Group	Date Approved	Contact Person (name/phone/email)	Signature
Department of Statistics Dus	02/10/09 10/15/10	A. Stromberg / 7-6115 / stromberg@uky.edu	
Statistics, Chair	10/15/10	W. Rayens/7-7061/rayens@uky.edu A. Stromberg / 7-6115 / stromberg@uky.edu	 
		/ /	
		/ /	
A&S Ed. Policy Cmte. A&S Dean	<i>10/19/10</i> <i>10/19/10</i>	G. Murthy, Nat. Sci. / 7-4729 / ganpathy.murthy@uky.edu Anna Bosch, Associate Dean / 7-6689 / bosch@uky.edu	 

*see also  
10/12/10*

### External-to-College Approvals:

Council	Date Approved	Signature	Approval of Revision <sup>2</sup>
Undergraduate Council	11/09/2010	Sharon Gill <small>Digitally signed by Sharon Gill DN: cn=Sharon Gill, ou=Undergraduate Education, o=Undergraduate Council, email=sgill@uky.edu, c=US Date: 2010.11.11 10:22:32 -0500</small>	
Graduate Council			
Health Care Colleges Council			
Senate Council Approval		University Senate Approval	

### Comments:

<sup>1</sup> Proposal name used here must match name entered on corresponding course or program form.

<sup>2</sup> Councils use this space to indicate approval of revisions made subsequent to that council's approval, if deemed necessary by the revising council.



## Distance Learning Form

This form must accompany every submission of a new/change course form that requests distance learning delivery. This form may be required when changing a course already approved for DL delivery. **All fields are required!**

**Introduction/Definition:** For the purposes of the Commission on Colleges Southern Association of Colleges and Schools accreditation review, *distance learning* is defined as a formal educational process in which the majority of the instruction (interaction between students and instructors and among students) in a course occurs when students and instructors are not in the same place. Instruction may be synchronous or asynchronous. A distance learning (DL) course may employ correspondence study, or audio, video, or computer technologies.

A number of specific requirements are listed for DL courses. **The department proposing the change in delivery method is responsible for ensuring that the requirements below are satisfied at the individual course level.** It is the responsibility of the instructor to have read and understood the university-level assurances regarding an equivalent experience for students utilizing DL (available at <http://www.uky.edu/USC/New/forms.htm>).

Course Number and Prefix: STA 210	Date: 10/15/2010
Instructor Name: W. Rayens	Instructor Email: rayens@uky.edu
Check the method below that best reflects how the majority of course of the course content will be delivered.	
Internet/Web-based <input type="checkbox"/>	Interactive Video <input type="checkbox"/>
Hybrid <input checked="" type="checkbox"/>	

<b>Curriculum and Instruction</b>	
1.	<p>How does this course provide for timely and appropriate interaction between students and faculty and among students? Does the course syllabus conform to University Senate Syllabus Guidelines, specifically the Distance Learning Considerations?</p> <p>Rayens has had extensive experience using Virtual Classroom in Blackboard and that is an option. However, unless Bb has improved this part of their product, it has not behaved very well in the past and Rayens may elect to use Adobe Connect Pro, which he as an account for, and some limited practice in using. But something akin to Connect Pro will be critical in facilitating the student/instructor/TA interactions. Rayens also plans to use BlogTalkRadio, which is wonderful, free utility that basically allows the instructor to construct her own radio show where students can call in with questions, and anyone listening can hear the answers. Rayens has played with this technology but not yet used it in his classroom-based class, but will during the fall of 2010.</p>
2.	<p>How do you ensure that the experience for a DL student is comparable to that of a classroom-based student's experience? Aspects to explore: textbooks, course goals, assessment of student learning outcomes, etc.</p> <p>The classroom-based experience (in Rayens' sections) already have all the substantive content off-loaded as videos (mp4s) that the students are assigned to watch as homework. In the classroom-based course student time with the professor is spent discussing case studies, doing discovery activities, or creating a larger view of how seemingly unrelated topics are all part of a larger picture. Recitation time is spent more on previewing and practicing procedural tasks (e.g. making arguments with percentages) that are important to larger-scale conceptual issues that will emerge later (e.g. logic of using sensitivity and specificity to evaluate the goodness of a go/no-go decision process - like a field sobriety test, or a parametric test of hypothesis).</p> <p>This can't be perfectly replicated online, but the online version can be comparable. The way the content will be handled is identical. Students will access off-loaded videos. Currently, Rayens has produced all his own videos using Camtasia, but he is working with four different publishers in an attempt to have one of them offer or create professionally produced versions that are similar. A key piece will be replicating, or approximating, the discovery. Rayens has a collection of applet demonstrations (collected and vetted as part of his Chellgren</p>



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	<p>project) that will have to substitute for many of the hands-on demonstrations, though students can still flip their own coins and find dice to roll if necessary. A certain amount of the procedural knowledge will have to be handled through "how to" videos that Rayens already uses in his classroom-based class. These are videos constructed with a combination of Camtasia and a Wacom artist's pad (Rayens has one) that create a voice over demonstration of how to do the task at hand (e.g. pulling the right percentages from a 2x2 table in order to compute sensitivity and specificity). Importantly, the TA will be available either for BlogTalk Radio questions, or on the Virtual Classroom for additional help on these procedural tasks. It is not going to be clear which works best until we do it one or two times.</p>
3.	<p>How is the integrity of student work ensured? Please speak to aspects such as password-protected course portals, proctors for exams at interactive video sites; academic offense policy; etc.</p> <p>There is not a perfect way to do this. All exams would be online, probably through Blackboard. We will explore the use of proctors. There will be an agreement that the student has to sign addressing the issue of honesty and integrity.</p>
4.	<p>Will offering this course via DL result in at least 25% or at least 50%* (based on total credit hours required for completion) of a degree program being offered via any form of DL, as defined above?</p> <p>No</p> <p>If yes, which percentage, and which program(s)?</p> <p>*As a general rule, if approval of a course for DL delivery results in 50% or more of a program being delivered through DL, the effective date of the course's DL delivery will be six months from the date of approval.</p>
5.	<p>How are students taking the course via DL assured of equivalent access to student services, similar to that of a student taking the class in a traditional classroom setting?</p> <p>As outlined in 1. and 2. above, the course is not that different than the classroom-based course. Students will still have full access to Blackboard help (as students enrolled at U.K.), for example, as well as equivalent virtual access to the Professor and the TA(s).</p>
<b><i>Library and Learning Resources</i></b>	
6.	<p>How do course requirements ensure that students make appropriate use of learning resources?</p> <p>Students will routinely be asked to find articles in their local (online) papers, or in the N.Y. Times, etc. They will also frequently be asked to find and read portions of articles appearing in more technical journals. With the current classroom-based course, only articles accessible on line (in some fashion) are assigned. Students in the online version of this course will, therefore, have the same access to learning resources.</p>
7.	<p>Please explain specifically how access is provided to laboratories, facilities, and equipment appropriate to the course or program.</p> <p>Students are only going to need access to a computer and a decent internet connection.</p>
<b><i>Student Services</i></b>	
8.	<p>How are students informed of procedures for resolving technical complaints? Does the syllabus list the entities available to offer technical help with the delivery and/or receipt of the course, such as the Teaching and Academic Support Center (<a href="http://www.uky.edu/TASC/index.php">http://www.uky.edu/TASC/index.php</a>) and the Information Technology Customer Service Center (<a href="http://www.uky.edu/UKIT/">http://www.uky.edu/UKIT/</a>)?</p> <p>Rayens has already developed a kind of trouble shooting protocol for the essential access students must have to the videos that are posted. In the room-based course problems are surfaced by way of a very first assignments that forces the student to watch a Welcome video and list problems s/he had viewing, if any. For mp4 files it is almost always a) no player - Quicktime is free and easy to install or b) something quirky in browser choice - am able solve many problems by saying "ditch I.E. and install free Mozilla."</p>

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9.	<p>Will the course be delivered via services available through the Teaching and Academic Support Center?</p> <p>Yes <input type="checkbox"/></p> <p>No <input checked="" type="checkbox"/></p> <p>If no, explain how students enrolled in DL courses are able to use the technology employed, as well as how students will be provided with assistance in using said technology.</p> <p>Access to Bb is immediate upon enrollment. To use Adobe Connect Pro as participants all they need is a url and access to a computer and the internet so they can click on it. To use BlogTalkRadio, they just need a phone.</p>
10.	<p>Does the syllabus contain all the required components, below? <input checked="" type="checkbox"/> Yes</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Instructor's <i>virtual</i> office hours, if any.</li> <li><input type="checkbox"/> The technological requirements for the course.</li> <li><input type="checkbox"/> Contact information for TASC (<a href="http://www.uky.edu/TASC/">http://www.uky.edu/TASC/</a>; 859-257-8272) and Information Technology Customer Service Center (<a href="http://www.uky.edu/UKIT/">http://www.uky.edu/UKIT/</a>; 859-257-1300).</li> <li><input type="checkbox"/> Procedure for resolving technical complaints.</li> <li><input type="checkbox"/> Preferred method for reaching instructor, e.g. email, phone, text message.</li> <li><input type="checkbox"/> Maximum timeframe for responding to student communications.</li> <li><input type="checkbox"/> Language pertaining academic accommodations:             <ul style="list-style-type: none"> <li><input type="checkbox"/> "If you have a documented disability that requires academic accommodations in this course, please make your request to the University Disability Resource Center. The Center will require current disability documentation. When accommodations are approved, the Center will provide me with a Letter of Accommodation which details the recommended accommodations. Contact the Disability Resource Center, Jake Karnes, Director at 859-257-2754 or <a href="mailto:jkarnes@email.uky.edu">jkarnes@email.uky.edu</a>."</li> </ul> </li> <li><input type="checkbox"/> Information on Distance Learning Library Services (<a href="http://www.uky.edu/Libraries/DLLS">http://www.uky.edu/Libraries/DLLS</a>)             <ul style="list-style-type: none"> <li><input type="checkbox"/> Carla Cantagallo, DL Librarian</li> <li><input type="checkbox"/> Local phone number: 859 257-0500, ext. 2171; long-distance phone number: (800) 828-0439 (option #6)</li> <li><input type="checkbox"/> Email: <a href="mailto:dllservice@email.uky.edu">dllservice@email.uky.edu</a></li> <li><input type="checkbox"/> DL Interlibrary Loan Service: <a href="http://www.uky.edu/Libraries/libpage.php?lweb_id=253&amp;llib_id=16">http://www.uky.edu/Libraries/libpage.php?lweb_id=253&amp;llib_id=16</a></li> </ul> </li> </ul>
11.	<p>I, the instructor of record, have read and understood all of the university-level statements regarding DL.</p> <p>Instructor Name: William Rayens <span style="float: right;">Instructor Signature: <i>W Rayens 2/4</i></span></p>

Distance Learning Approved by Undergraduate Council    12/07/2010

Sharon Gill

Digitally signed by Sharon Gill  
 DN: cn=Sharon Gill, o=Undergraduate Education,  
 ou=Undergraduate Council, email=sgill@uky.edu, c=US  
 Date: 2010.12.10 11:36:46 -0500



**From:** Rayens, William S  
**Sent:** Wednesday, September 08, 2010 3:31 PM  
**To:** Hanson, Roxie  
**Subject:** RE: (STA 210 New/GenEd approved Sp'10 A&S 100 pilot) New Course Application

Thanks Roxie –

It was offered Spring 2010 as A&S 100 003 004 005 and again this semester as A&S 100 007 008 009. It was approved for the Statistical Inferential Reasoning category.

Cheers, Bill

**From:** Hanson, Roxie  
**Sent:** Wednesday, September 08, 2010 3:27 PM  
**To:** Rayens, William S  
**Subject:** RE: (STA 210 New/GenEd approved Sp'10 A&S 100 pilot) New Course Application

Bill, would you please provide a few more details for me:

- 1) when the crs was offered, *i.e.* Sp'10
- 2) what the A&S 100 section # was, and
- 3) what the approved GenEd category was, *i.e.* Inquiry - Nat/Math/Phy Sci or QR - Stat?

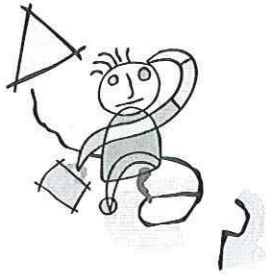
Thanks! Roxie

**From:** Rayens, William S  
**Sent:** Tuesday, September 07, 2010 3:00 PM  
**To:** Hanson, Roxie  
**Subject:** (STA 210 New/GenEd approved F'10 A&S 100 pilot) New Course Application

Hi Roxie – local issue, but still Gen Ed related. STA had a new course vetted last year for Gen Ed, under the A&S 100 title. It passed the vetting committee in late December of 2009 but a new course form was never submitted. I have attached that, along with a cover sheet explaining some of this, and a syllabus, all in one pdf file. I guess this needs to go to the EPC, and then to the UC and Senate. It does not need to go to GEOC again. Let me know if this confuses you as much as it does me. I only recently was asked to reassume my DUS duties (new DUS up and quit on the first day of classes) so I didn't know I'd be submitting this.

Thanks! Bill

William Rayens  
Professor, Department of Statistics  
Chellgren Endowed Professor for Undergraduate Excellence  
Assistant Provost for General Education



## Making Sense of Uncertainty

### An Introduction to Statistical Inferential Reasoning

*Gen Ed  
approved*

#### Important Information for Vetting Team

This syllabus was constructed in direct accordance with the course template developed by the statistical inferential reasoning subcommittee. That subcommittee clearly emphasized conceptual development of ideas and, in turn, the successful deployment of those ideas over and above computations and mathematical derivations. So that we might be sure our course was hand-in-glove with the intentions of this subcommittee we revisited the Template (divided into parts A-D) and reorganized that committee's presentation so that a mapping could be more easily constructed to a working syllabus. That mapping is appended at the end of this cover.

#### **Template Part A**

##### Conceptual Foundations

- CA1. Connect the uncertainty of sampling variability with margins of error and confidence intervals
- CA2. Demonstrate an understanding of the roles of sampling distributions, and standard scores, as well as the central limit theorem (non-mathematical treatment)
- CA3. Demonstrate an understanding that some of the other major sources of uncertainty, such as biased samples and questionnaires that are worded in a biased or misleading fashion are not addressed by margins of error or confidence intervals

##### Practical Deployment

- PA1. Evaluate common claims arising from the formal statistical inference conveyed in margins of error and confidence intervals. Students must be able to articulate the sense in which margins of error and confidence intervals address and purport to quantify risks that are of practical interest

#### **Template Part B**

##### Conceptual Foundations

- CB1. Demonstrate mastery of the basic language of statistical experimental design and null hypothesis testing, and articulate the role that statistical modeling plays in the development and interpretation of "statistical significance."
- CB2. Articulate the strengths and weaknesses of using classical null hypothesis testing as a decision tool.
- CB3. Understand the sense in which common hypothesis testing, and the associated "significance" addressed in media, is intimately related to a perspective that looks for evidence against a claim, and infers about the truth of that claim based on the weight of that evidence

##### Practical Deployment

- PB1. Evaluate common claims arising from the formal statistical inference conveyed in null hypothesis testing associated with statistically designed experiments. Students must be able to articulate the sense in which null hypothesis testing addresses and purports to quantify risks that are of practical interest
- PB2. Demonstrate a substantive understanding of "statistical significance," and the sense in which p-values and null hypothesis testing offer a useful and practical articulation of risk assessment.



### Template Part C

#### Conceptual Foundations

- CC1. Discuss the practical importance of effective conditional reasoning (e.g. false positives, Prosecutor's paradox); the importance of hidden variables and confounding (e.g. Simpson's paradox); the issue of association versus correlation and correlation and causation; the importance of having the right and/or enough information; and the problem of misinterpreting randomness.

#### Practical Deployment

- PC1. Evaluate common claims that arise from statistical constructs, like charts and graphs, tables and numerical summaries, through the important, but informal, act of human inference.
- PC2. Demonstrate an understanding of the challenges that confront informal inferences arising from these kinds of statistical entities and offer evidence that they can construct these inferences in a rational and informed manner.

### Template Part D

- D1. Independently identify and utilize appropriate information resources from a variety of sources.

Module	Module Outcomes Mapped to SIR Subcommittee Template									
	1	2	3	4	5	6	7	8	9	10
Dining at the Dichotomous Café	CB1 CB2 CB3	PB1 D1	CB3	CB1 CB3	PB1 PB2 D1	CB1	CC1	CC1	CC1	CC1
Drinks at the Survey Street Bar	CA3 PA1	CA3 PA1 D1	CA1 CA3	CA3	PA1 D1	CA3 PA1 D1	CA1 CA2	CA2	CA2	CA1 CA2
Checkup at Inference Mercy	CC1 PC1	CC1 PC1	CC1	CC1 PC2 D1	CC1 PC2	CC1	CC1	CC1 PC2	PC1 PC2 D1	PC2 D1

## Hanson, Roxie

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**From:** Rayens, William S  
**Sent:** Monday, October 25, 2010 2:26 PM  
**To:** Hanson, Roxie  
**Subject:** RE: STA 210 new crs- mtg pattern 2/2 or 2/1?

Roxie – I was just being an idiot (and worse, an idiot in a rush).

Should say 3 cr hrs ; 2 lec/ and 1 hr recitation

Sorry,

Bill

**From:** Hanson, Roxie  
**Sent:** Monday, October 25, 2010 2:21 PM  
**To:** Rayens, William S  
**Subject:** STA 210 new crs- mtg pattern 2/2 or 2/1?  
**Importance:** High

Bill, the new course form has 3 cr hrs with 2 hrs of lec and 2 hrs of recitation. Please clarify:

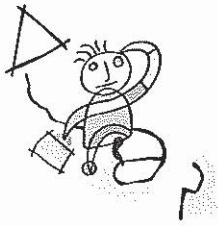
4 cr hrs: 2 lec/2 recitation or

3 cr hrs: 2 lec/2 lab or

3 cr hrs: 2 lec/1 recitation or

Other?





**STA 210**  
**Making Sense of Uncertainty**  
An Introduction to Statistical Reasoning

**Instructor:** Dr. Bill Rayens  
865 Patterson Office Tower  
Office Phone: 859 257 7061  
Email: rayens@uky.edu (preferred)

**Office Hours:** TR 8:30 - 9:30  
W 1:00 - 1:50

**Lecture:** MW 9 - 9:50 (CB 214)  
Rec 007: M 12-12:50 (CB 307)  
Rec 008: M 1 - 1:50 (CB 307)  
Rec 009: T 10-10:50 (CB 307)

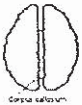
**Textbooks**

1. No primary text is required this semester. Instead you will be expected to watch a series of content videos that will be posted on our Blackboard site, as well as read supplementary material supplied by Dr. Rayens.
2. A secondary resource is required: Stat-Spotting: A Field Guide to Identifying Dubious Data, by Joel Best.

**Overview**

This course is the second iteration of a pilot course in the “statistical inferential reasoning” (SIR) category that is part of the University’s proposed new general education program. You will receive credit for the STA 200 part of the USP inference requirement. 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 (Aug. 25<sup>th</sup>, 30<sup>th</sup>; Sept. 1<sup>st</sup>, 8<sup>th</sup>, 13<sup>th</sup>, 15<sup>th</sup>, 20<sup>th</sup>; First Exam on September 22<sup>nd</sup>)**



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 (Sept. 27<sup>th</sup>, 29<sup>th</sup>, Oct. 4<sup>th</sup>, 6<sup>th</sup>, 11<sup>th</sup>, 13<sup>th</sup>, 18<sup>th</sup>; Second Exam on October 20<sup>th</sup>)**



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 (Oct. 25<sup>th</sup>, 27<sup>th</sup>; Nov. 1<sup>st</sup>, 3<sup>rd</sup>, 8<sup>th</sup>, 10<sup>th</sup>, 15<sup>th</sup>, 17<sup>th</sup>, 22<sup>nd</sup>; Dec. 1<sup>st</sup>, 6<sup>th</sup>, 8<sup>th</sup>)**



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 attached after the modules are described, below. Aside from the Joel Best book (above) there is no required textbook. I will create 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. Finally, at every turn you will 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.

### Course Policy on Classroom Civility and Decorum

The university, college and department have a commitment to respect the dignity of all and to value differences among members of our academic community. There exists the role of discussion and debate in academic discovery and the right of all to respectfully disagree from time-to-time. Students clearly have the right to take reasoned exception and to voice opinions contrary to those offered by the instructor and/or other students (S.R. 6.1.2). Equally, a faculty member has the right -- and the responsibility -- to ensure that all academic discourse occurs in a context characterized by respect and civility. Obviously, the accepted level of civility would not include attacks of a personal nature or statements denigrating another on the basis of race, sex, religion, sexual orientation, age, national/regional origin or other such irrelevant factors.)

### Grading

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

- |               |          |
|---------------|----------|
| • Homework    | 25%      |
| • Recitations | 20%      |
| • E-Portfolio | 25%      |
| • Three tests | 10% each |

The only way to effectively manage a somewhat large class such as ours is to have clear rules, insist on shared responsibility and be consistent and unwavering with policies. So please, understand NOW that **we cannot and will not give make-ups** other than those allowed by the University. **No exceptions, so please don't ask.** If you have a University excuse it must explicitly cover the dates of the missed activities to be valid.

#### **Homework – 25%**

Homework is a broad category and includes in-class questions (quizzes), short projects, web-based activities, graded recitation work, pre-class video assignments, etc. Make sure you watch the classroom Blackboard site and pay attention in class so you'll know when these assignments are made and when they are due. Indeed, much of your homework will involve previewing content for upcoming classes. This will seem a bit different to you, but we'll all catch on soon enough.

#### **Recitations – 20%**

The recitations will feature discovery exercises and discussions that are designed to allow you to practice skills or, more likely, to have meaningful encounters with difficult concepts. Each recitation is worth 10 points and you will get the full 10 if you come and participate. So, notice, you can assure 20% of your grade is perfect, just by coming to recitations and paying attention. This reflects my belief in the importance of the recitation.

#### **E-Portfolio – 25%**

About once a week you will be asked to either comment on an article in the media that I provide, or to provide one yourself. This good work will be archived as installments in a sort of "electronic portfolio" on Blackboard. This portfolio is what will keep us focused on the overarching goal of our course, and keep us connected with



the world around us. See below for a more detailed description. How and where to archive will be explained in great detail, so just stay tuned.

### Three Exams – 10% each

These exams will be given in our regular classroom. Note the dates of the first two exams are given above. The last exam will be held during our final exam slot (Friday, December 17<sup>th</sup> at 8 a.m., in CB 214). It will not be cumulative.

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.

### Attendance Policies

- Classroom: My position is that the classroom time is perhaps the most important time we have to share, so you should be there. A lot will happen in the classroom that you will not be able to get from the notes and resources we post. Although I will not pass around an attendance sheet, I plan to give a five-minute homework quiz at some point during every class. These quizzes will count as homework assignments and will typically cover either what we talked about the last class period or recitation; or they will be over special homework assignments assigned prior to class.
- Exams: Attendance at exams is a specific course requirement. Make-up exams will only be offered in the case of an "excused" absence. Excused absences are defined by the University of Kentucky Bulletin--you should consult the Bulletin for a description of what is an excused absence. An excused absence from an exam must be verified by presenting documentation to me. If you know before the excused absence is to occur that you will be absent, then present documentation to me ahead of time. Unexcused absences are any cases of absence that do not meet the University's definition. An unexcused absence from a lecture 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. (See above for definitions of "excused" and "unexcused" absences.) If you know before the excused absence is to occur that you will be absent, then present documentation to me ahead of time. Please understand: coming and participating in the recitation counts for 15% of your course grade. That amounts to 1½ letter grades. This is very valuable, very affordable insurance and you would be well advised to take advantage of it.

### 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 a missed homework assignment, no matter what form that takes, you must present documentation of the absence to me as soon as you return to school. You will then be asked to complete the same or a similar activity in a manner I will decide.

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.



## Appendix 1 – 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.

#### Academic Flexibility

The faculty instructor has complete freedom with respect to the topics and resources that are used to address the learning outcomes. A resource list is attached but only as a suggestion. What is required is the following. First, that the core instruction emerge from Joel Best's new book Stat-Spotting: A Field Guide to Identifying Dubious Data. Second, that each student produce a portfolio that contains real examples from the media, popular culture literature, or scientific literature, where incorrect human inferences have been made from simple statistical constructs. For each entry in this portfolio students should explain the error in the example and correct it

#### 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**



## Resource List

1. Psychological Perspective on frailty of human inference:
  - <http://www.amazon.com/Human-Inference-Richard-E-Nisbett/dp/0134451309>
  - <http://www.amazon.com/How-Know-What-Isnt-Fallibility/dp/0029117062>
2. Joel Best books on real examples of misinterpretation of simple statistical data presentations:
  - [http://www.amazon.com/Stat-Spotting-Field-Guide-Identifying-Dubious/dp/0520257464/ref=ntt\\_at\\_ep\\_dpt\\_2](http://www.amazon.com/Stat-Spotting-Field-Guide-Identifying-Dubious/dp/0520257464/ref=ntt_at_ep_dpt_2)
  - [http://www.amazon.com/Damned-Lies-Statistics-Untangling-Politicians/dp/0520219783/ref=ntt\\_at\\_ep\\_dpt\\_1](http://www.amazon.com/Damned-Lies-Statistics-Untangling-Politicians/dp/0520219783/ref=ntt_at_ep_dpt_1)
  - [http://www.amazon.com/More-Damned-Lies-Statistics-Numbers/dp/0520238303/ref=ntt\\_at\\_ep\\_dpt\\_3](http://www.amazon.com/More-Damned-Lies-Statistics-Numbers/dp/0520238303/ref=ntt_at_ep_dpt_3)
4. Brief on-line resource: <http://www.statisticalmisconceptions.com/MiscAndInvite01d.html>
5. An excellent listing: [http://www.cut-the-knot.org/do\\_you\\_know/misuse.shtml](http://www.cut-the-knot.org/do_you_know/misuse.shtml)
6. Miscellaneous:
  - [http://www.eric.ed.gov/ERICWebPortal/custom/portlets/recordDetails/detailmini.jsp?\\_nfpb=true&\\_ERICExtSearch\\_SearchValue\\_0=EJ796731&ERICExtSearch\\_SearchType\\_0=no&accno=EJ796731](http://www.eric.ed.gov/ERICWebPortal/custom/portlets/recordDetails/detailmini.jsp?_nfpb=true&_ERICExtSearch_SearchValue_0=EJ796731&ERICExtSearch_SearchType_0=no&accno=EJ796731)
  - <http://www.springerlink.com/content/g36h732914231721/>

## 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.

### Academic Flexibility

The faculty instructor has complete freedom with respect to the topics that are used to address the learning outcomes. A resource list is attached but only as a suggestion. What is required is that the classroom pedagogy revolves around at least one detailed encounter with a survey that students actually take and discuss. Topics, as well as a particular survey, will be assigned for TA instructors, except in very unusual circumstances.

### 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



## Resource List

1. Survey Monkey for constructing free, simple surveys with up to 10 questions  
<http://www.surveymonkey.com/>
2. Private, on-campus utility for survey construction, developed by a colleague in the College of Education (ask Professor Rayens in Statistics for details)
3. General site with some interesting on-line surveys that can be assigned. Some are socially challenging.  
<http://www.student.com/tests/>
4. Same site as above, but a link to some rather steamy sex-related questions. The on-line survey is no longer available but the questions are all still visible and the answers from the class could be compared to those who answered the on-line survey. Great opportunity to talk about voluntary response  
<http://www.student.com/tests/sexresults>
5. Surveys and/or survey results about "hooking up" from a variety of sources, biased and not
  - <http://www.studlife.com/news/students-survey-hooking-up-1.907502>
  - <http://smu.edu/univhonors/hilltopics/issues/volume3/3-21.pdf>
  - [http://www.americanvalues.org/html/a-pr\\_hooking\\_up.html](http://www.americanvalues.org/html/a-pr_hooking_up.html)
  - <http://www.questia.com/googleScholar.qst;jsessionid=KJybhJmKyvB5ynY6wr1NwMJq0n1RpGSky7pcrJ9fh27Qqn0pQ1Tp!497993468!627277496?docId=5001963386>
  - <http://s70766.gridserver.com/news/2008/11/19/hooking-up-patterns-vary-among-juniors-seniors/>
  - <http://www.chs.fsu.edu/~ffincham/papers/ASB%20Owen%20et%20al.pdf>
6. Surveys and/or survey results about plagiarism acts and causes:
  - <http://www.questionpro.com/akira/showSurveyLibrary.do?surveyID=332806>
  - <http://wrt-howard.syr.edu/Bibs/PlagIncidence.htm>
  - <http://www.varsity.co.uk/news/1058/2/>
  - <http://www.jiscpas.ac.uk/documents/surveys/TutorSurvey.pdf>
7. Resources related to push polls
  - <http://www.cbsnews.com/stories/2000/02/14/politics/main160398.shtml>
  - [http://www.huffingtonpost.com/2008/09/11/nasty-anti-obama-push-poll\\_n\\_125607.html](http://www.huffingtonpost.com/2008/09/11/nasty-anti-obama-push-poll_n_125607.html)
  - <http://www.ncpp.org/?q=node/41>
  - <http://article.nationalreview.com/?q=Y2ZkMWNkZDkzOTk1YTM0NTNkNmJlZThmYjJmM2ZmOGE=>
  - <http://voices.washingtonpost.com/thefix/parsing-the-polls/parsing-the-polls-unmasking-th.html>
8. A host of sex and relationship polls. Could use either to construct your own hardcopy poll or to debate voluntary response or to take online: <http://www.womansavers.com/relationship-polls.asp>
9. A very interesting study (a little old) on working in college, with lots of references cited.  
<http://www.brockport.edu/career01/upromise.htm>

## 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.

### Academic Flexibility

The faculty instructor has complete freedom with respect to the topics that are used to address the learning outcomes. A resource list is attached but only as a suggestion. What is required is that the instruction flow from a limited set of specific go/no-go testing topics that the students read about and discuss (e.g. field sobriety testing, caffeine and blood pressure experiments). Topics will be assigned for TA instructors, except in very unusual circumstances.

### 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



## Resource List

1. Countering Indifference Using Counter-Intuitive Examples, by Larry Lesser.  
<http://ts.rsscse.org.uk/gtb/lesser.pdf>
2. Field Sobriety Tests: How Basic Science Proves They Have Little Power to Tell Impaired From Sober, by Dr. Greg Kane. <http://fieldsobrietytest.info/KanePDF/KaneFSTTwo.pdf>
3. National Association of Criminal Defense Lawyers.  
<http://www.nacdl.org/public.nsf/PrinterFriendly/A0305p48?openDocument>
4. Statistical Evaluation of Standardized Field Sobriety Tests, by Michael P. Hlastala, et al.  
<http://www.mphlastala.com/JFSSFST.pdf>
5. Home Pregnancy Tests May Be Less Sensitive Than Claims Suggest.  
<http://cme.medscape.com/viewarticle/469226>
6. Diagnostic Efficiency of Home Pregnancy Test Kits. <http://archfami.ama-assn.org/cgi/content/full/7/5/465>
7. Relevant links regarding the Prosecutor's Fallacy:
  - [http://www.conceptstew.co.uk/PAGES/prosecutors\\_fallacy.html](http://www.conceptstew.co.uk/PAGES/prosecutors_fallacy.html)
  - <http://www.jeremymiles.co.uk/learningstats/2005/11/prosecutors-fallacy.html>
  - <http://www.colchsf.ac.uk/math/dna/discuss.htm>
  - <http://buchanan.blogs.nytimes.com/2007/05/16/the-prosecutors-fallacy/>
  - [http://en.wikipedia.org/wiki/Prosecutor%27s\\_fallacy](http://en.wikipedia.org/wiki/Prosecutor%27s_fallacy)
  - <http://www.rss.org.uk/PDF/RSS%20Statement%20regarding%20statistical%20issues%20in%20the%20Sally%20Clark%20case,%20October%2023rd%202001.pdf> (JRSS response to famous Sally Clark case)
8. Relevant links regarding experimentation:
  - Decaffeinated coffee and blood pressure <http://hyper.ahajournals.org/cgi/reprint/14/5/563>;  
<http://www.pubmedcentral.nih.gov/picrender.fcgi?artid=2625695&blobtype=pdf>
  - HPT's <http://linkinghub.elsevier.com/retrieve/pii/S0002937803011359>;  
<http://pediatrics.aappublications.org/cgi/reprint/113/3/581>

## Appendix 2 – Description of the E-Portfolio

Approximately once a week you will be asked to find and read articles illustrating what we are talking about in class; or to listen to videos or audios that I assign as homework. This will be our way of staying grounded, our assurance that we stay focused on the practical importance of what we are studying. It is a very important part of our mission this semester. Do not fall behind on these.

All of these assignments will be archived (by you) as separate parts of an E-Portfolio on Blackboard. Early in the semester I will explain how this is to be done. Some typical assignments for this sort of activity are shown below.

- Find an example of an observational study in a newspaper that is not over two days old. Reference the title of the article, the paper it was in, and describe in two or three sentences what was being studied and what was concluded. Say clearly why the study was an observational study and not an experiment.
- Please find an example of a "push poll". Briefly explain why it is a push poll and why the results of push polls are often quite unreliable.
- Please find an example of an experiment (not one we talked about in class) that is reasonably current in the news. Make sure it is an experiment. Please list the response variable(s), the explanatory variable(s) and note whether the experimental results were statistically significant. Explain what statistical significance in this context means to you.
- Please read the BBC article by famous "sleep scientist" Jim Horne (below). If we assume that the standard deviation of hours of sleep per night is 1.5, about what percentage of people get more sleep than you do? [http://news.bbc.co.uk/2/hi/uk\\_news/magazine/6546209.stm](http://news.bbc.co.uk/2/hi/uk_news/magazine/6546209.stm)
- Read the MSNBC article <http://www.msnbc.msn.com/id/9007694/>. This article was posted on August 19, 2005, by Alex Johnson, and it reported the results of two polls (Governor's Poll and Alger's Poll) taken on two different, randomly chosen, groups of high school students at roughly the same time. Johnson reports that by overwhelming majorities, students said they would work harder at their studies if more was expected from them - 65 percent in one of the polls and 88 percent in the other. What's interesting here is that these two polls produced notably different numbers. In his article, Mr. Johnson suggests that this difference may well be due to the different ways the polls collected their data. Certainly that might be the case. But one could also argue that this difference in the poll results might be due to sampling variability. Make that case in a memo to the Arne Duncan, current Secretary of the Department of Education, who (hypothetically) is willing to fund a training program for teachers entitled "Increasing Expectations," provided that more than 75% of the students nationwide would commit to working harder if more was expected. You'll need to explain to him what sampling variability is and why he should care, in the context of the Johnson article. Your memo should be 500 words or less.
- Please access the audio by Professor Steve Ziliak (see below) and listen to the first 20 minutes of the hour-long talk he gives. Comment on some of Ziliak's points that are relevant to what we have been studying. Should have a half of a page (typed) as your answer. It has to be clear you listened to the whole 20 minutes and that you generally understood what he was talking about. To access the audio: Go to

<http://www.national-economists.org/podcasts/> , go down to NEC #79: Statistical Significance is Essentially Meaningless (at the 5 % Level) and click on "Listen".