General Education Course Information Sheet
Please submit this sheet for each proposed course

Department & Course Number STAT 98T
Course Title Burden of Proof

1 Check the recommended GE foundation area(s) and subgroups(s) for this course

Foundations of the Arts and Humanities
- Literary and Cultural Analysis _____
- Philosophic and Linguistic Analysis _____
- Visual and Performance Arts Analysis and Practice _____

Foundations of Society and Culture
- Historical Analysis _____
- Social Analysis _____

Foundations of Scientific Inquiry
- Physical Science X
  With Laboratory or Demonstration Component must be 5 units (or more) _____
- Life Science _____
  With Laboratory or Demonstration Component must be 5 units (or more) _____

2. Briefly describe the rationale for assignment to foundation area(s) and subgroup(s) chosen.

This course focuses on the methods by which scientists reason with uncertainty and data in order to learn about the physical world. Students ill use these methods to critically engage controversial topics in the social and physical sciences.

3. List faculty member(s) and teaching fellow who will serve as instructor (give academic rank):
Robert Gould, Vice-Chair for Undergraduate Studies; Andrew Bray

4. Indicate what quarter you plan to teach this course:

2012-2013 Winter_____ Spring_____X____

5. GE Course units _____5_____

6. Please present concise arguments for the GE principles applicable to this course.

❑ General Knowledge | This course focuses on theories and methods of assessing a claim in a scientific framework. Methods include formal and informal logic, hypothesis testing, and study design.

❑ Integrative Learning	
❑ Ethical Implications	In discussing current areas of scientific controvery, students will evaluate the impact that these debates have on public discourse and public policy. For example: what are the risks and ethical implications of doing nothing to halt climate change?
❑ Cultural Diversity	
❑ Critical Thinking	This course encourages students to deliberately unpack a scientific claim and assess the validity of its methods and the strength of evidence.
❑ Rhetorical Effectiveness	In writing the term paper, students will assess both sides of a controversial scientific claim and make a well-reasoned and evidence-based argument in favor of one of the positions.
❑ Problem-solving	Having outlined methods by which a scientific claim is assessed, this course studies the sort of evidence that is necessary to formulate convincing evidence.
❑ Library & Information Literacy	Through an in-class workshop, students will learn how to gather and organize information in order to write a convincing and well-sourced term paper. Sources will range from popular secondary-source documents to technical peer-reviewed scientific articles. Students will compile sources and submit the as a literature review in preparation for their term paper.

(A) STUDENT CONTACT PER WEEK

1. Seminar:	3	(hours)
(A) TOTAL student contact per week	**3**	**(HOURS)**

(B) OUT-OF-CLASS HOURS PER WEEK (if not applicable write N/A)

1. General Review & Preparation:	**1**	(hours)
2. Reading	**6**	(hours)
3. Group Projects:	**0**	(hours)
4. Preparation for Quizzes & Exams:	**0**	(hours)
5. Information Literacy Exercises:	**1**	(hours)
6. Written Assignments:	**1**	(hours)
7. Research Activity:	**3**	(hours)
(B) TOTAL Out-of-class time per week	**12**	**(HOURS)**

GRAND TOTAL (A) + (B) must equal 15 hours/week ___15_____

Statistics 98T

Burden of Proof: Data and Scientific Reasoning

Location: TBA
Time: TBA

Instructor: Andrew Bray
Email: abray@stat.ucla.edu
Website: www.stat.ucla.edu/∼abray
Office: MS 8105H
Office Hours: TBA

Welcome to the Age of Data, where information is all around us, helping us live happier, healthier lives. Or does it? Do we know yet if cell phones cause cancer? Have we come to a decision on whether we should be eating lots of meat or none at all to stay healthy? Despite all of this information, we still have a difficult time turning it into the knowledge from which we can make sound decisions.

This course will explore the ways in which we use scientific reasoning to navigate the path from data to decisions. We will draw upon ideas in probability, logic, psychology, and economics to establish the methods that constitute the gold standard for reasoning through science. We will also discuss the ways in which our reasoning can lead us astray by learning about the biases and fallacies to which we are subject. These concepts will be fleshed out by studying three areas of current or past controversy: smoking and health, evolution and intelligent design, and climate change.

Course Objectives

By the end of this course, students will have developed a habit of assessing uncertain claims by the standards of sound scientific reasoning while being vigilant to the pitfalls of bias and fallacy. The core components of the course are in-class discussion and a quarter-long research paper. The discussions are motivated by assigned readings, giving students the opportunity to improve their critical reading of both popular and technical writing. The research paper will provide valuable experience in gathering references, drafting, editing, and writing in a manner that is clear and well-reasoned.

This course is meant to encourage a healthy skepticism, but you are also cautioned from becoming over-critical. If you have found a particular aspect of reasoning to be faulty, you should then focus on what *can* be said about the claim at hand. The aim is to be both skeptical *and* constructive.

Assignments

Reading Responses (15% of your final grade)

Creating an atmosphere of active discussion requires that all students engage the readings. To help in this regard, for every class you will write a one page paper in which you respond to guiding questions that I will post on the CCLE website. The objective is not to summarize the readings but to view them critically in order to stimulate class discussion. You are not required to answer every question that is posted, but in general consider things such as, "is there anything that I don't understand?", "is there anything I don't agree with?", "what other questions does this bring up?".

The readings vary greatly in their format, ranging from popular media such as newspapers and blogs to more technical scientific articles. The number of assigned pages will be scaled down for technical

articles and up for breezy ones, such that the amount of time that you spend per class period should remain consistent.

Required Texts

1. Course Reader
2. "What is a p-value anyway?" Andrew Vickers, 2010.

Term Paper: The State of the Debate (50%)

You will be writing a 15 page paper where you choose a controversial claim and evaluate the arguments both in favor and opposed to it. Examples of topics include, "It is dangerous to use a cell-phone while driving", "A detox diet is good for your health", "The death penalty deters violent crime", and "Drug use should be legalized (focusing on public health, economics, and crime)." You should select a claim with sufficient uncertainly to allow a substantive case for both sides. Those making the arguments must also rely, at least in part, to scientific methods. The paper will be divided into three sections.

Parts I and II: The first section outlines the arguments in favor of the claim while the second section evaluates the arguments opposed to it. Keep in mind, in the first two sections *you* are not making an argument about the claim, but rather evaluating arguments that have already been put forth. Consider both the arguments being made in popular media as well as in the scientific literature. Questions that you should be addressing include:

- What sort of evidence is relied upon?
- What statistical methods are used?
- How is the argument subject to bias and fallacy?

Part III: The third section considers both sides and makes a conclusion about the state of knowledge regarding the claim. Do not rehash the points brought up in the first two parts, but compare the quality and quantity of the evidence. Also, if there is any remaining uncertainty, suggest detailed ways in which they could be addressed.

Paper Proposal (5%)

You will turn in a topic proposal at the end of the second week of class and arrange by email a time to meet with me during third week. You are welcome to turn in multiple topics; we can discuss the merits of each when we meet.

Literature Review (20%)

At the end of the fifth week you will submit a literature review for your term paper topic. The review will be in the format of a written report, not a list or outline, that catalogs each of the resources that you intend to reference in your term paper. The resources should be listed chronologically and for each one you should include:

- main topic of the article
- main hypothesis or question
- statistical methods used

- major findings
- context: why are we reading this article?

The paper should be about 5 pages long. Keep in mind that time spent on your literature is time well-spent; it is an essential step in writing a quality term paper.

Term Paper Presentation (10%)

You will present your topic and preliminary findings to the class. Questions to address include: Why is this topic of interest? What is the strongest evidence put forth by both sides of the issue? What are the predominant obstacles to clear reasoning in this debate? What is your preliminary conclusion about the state of the debate? The presentation is brief: it is limited to 10 minutes, including time for questions. You are welcome to use either handouts or slides in your presentation. If you are using slides, a pdf of the presentation must be emailed to me no later than 5 pm before the date you present.

Due Dates

- Week 2: topic proposal
- Week 5: literature review
- Week 6: presentations
- Week 9: first draft
- Finals week: final draft

Policies

Scholarly Discourse: Throughout the course, topics will come up that are controversial. In order to be able to sort through the reasoning of both sides of the issue, it's vital that there is an atmosphere where students feel free to share their thoughts without fear of embarrassment or ridicule. If you disagree with something that is said, be sure to direct your thoughts to the idea, not the person. That is, refrain from personal or *ad hominem* attacks. In addition to being a violation of the policy of scholarly discourse at the university, it is also a form of fallacious reasoning that we will be covering.

Academic Integrity: In your writing you will be drawing upon a variety of sources, so be sure to cite them appropriately. For a refresher in how to reference other people's work, visit `http://www.library.ucla.edu/bruinsuccess/`.

Communication: The primary method of communication will be through the course website on CCLE. If you have a question related to the readings or assignments, post it as a question on the discussion forum. Students are free to respond to posted questions with their own ideas. I will also answer through the discussion forum so that issue will be cleared up for other students with the same question. If you have a private question or one that deals only with your term paper, feel free to email me directly.

Late work: Late work will not be accepted without prior approval or a doctor's note. If you foresee a problem in completing an assignment on time, come see me as soon as possible.

Preliminary Schedule

Day 1	**Data and uncertainty**. Age guessing activity, review of syllabus and course expectations, demo of eyewitness fallacy.	
Day 2	**How do we address an uncertain claim?** Taste test activity. What sort of conclusions can be made from incomplete information? Overview of the gold standards of experimental design.	Vickers (1-53), Brooks
Day 3	**Smoking I.** Claim: "Smoking is bad for your health". How have we studied and legislated smoking since the beginning of the 20th century?	Brandt, Vickers (77-95)
Day 4	**Smoking II.** How do we establish causation without randomized controlled trials? *Term paper proposal due by email by 5 pm.*	Brandt, Smith and Pell, Marston
Day 5	**Missteps in Probability.** What exactly is probability? Can there be multiple definitions? Overview of the common misconceptions.	Hacking (selections), Gilovich, vos Savant, Kahneman & Tversky
Day 6	**More Biases and Fallacies.** How does our mind deceive us into faulty reasoning? Discussion of logical and cognitive errors.	Kahneman (selections), Baillargeon (selections), Nisbett, Gigerenzer
Day 7	**Errors in the Practice of Statistics.** Fallacies and biases aside, what are the common ways statistics is done flat-out wrong?	Vickers (96-151), Freedman & Petitti
Day 8	**Peer Review and Publication Bias.** How robust is the system of peer review? A look at the Sokol Affair and persistent problems with academic publishing	Lehrer*, Zimmer, Barr & Diez, Galef
Day 9	**Complementary and Alternative Medicine I.** Claim: "Complementary and Alternative Medicine can help heal illness and restore health". Discussion of the scientific literature regarding Acupuncture and Chiropracty.	Selected readings
Day 10	**Complementary and Alternative Medicine II.** Discussion of the scientific literature regarding Yoga, Tai Chi, and Meditation.	Selected readings
Day 11	**Complementary and Alternative Medicine III.** Sequencing activity. *Literature review due by email by 5pm..*	Selected readings
Day 12	**The Placebo Effect.** Is there a placebo effect? What are the implications for research?	Specter, selected readings

Day 13	**Student Presentations.**	
Day 14	**Student Presentations cont.**	
Day 15	**Statistics in the Media.** How are data and science portrayed in the media? How can data graphics be misleading?	Tufte (107-122)
Day 16	**Writer's Workshop.** Presentation from a representative from the UCLA Writing Center, working in groups to critique term papers.	Bring two copies of your first draft.
Day 17	**Climate Change I.** Claim: "Anthropogenic climate change will have negative consequences and should be addressed aggressively". An overview of the climate science and approaches to modeling climate change. *First draft of term paper due by email by 5 pm*	Guttorp, IPCC report
Day 18	**Climate Change II.**	Lomborg, Pigliucci
Day 19	**Climate Change II.**	Lomborg Pigliucci
Day 20	**Special Topic: Residual Analysis in Spatial Models.** Consider one of the biggest unknowns of life in LA: when will the big one hit? A look into a method of assessing how well different models are doing at predicting earthquakes.	
Finals Week	Submit final draft of term paper by 5 pm Friday	

Reading List

[1] Normand Baillargeon. *A short course in intellectual self-defense*. Seven Stories Press, 2008.

[2] Christopher Barr and David Diez. Comprehensive smoking bans and acute myocardial infarction among medicare enrollees in 387 u.s. counties: 1999 to 2008. 2012. submitted.

[3] Allan Brandt. *The Cigarette Century: The Rise, Fall, and Deadly Persistence of the Product that Defined America*. Basic Books, 2007.

[4] David Brooks. Is our adults learning? *The New York Times*, April 26, 2012.

[5] David Freedman and Diana Petitti. Salt and blood pressure: conventional wisdom reconsidered. 25, 2001. Evaluation Review.

[6] Julie Galef and Massimo Pigliucci. Peer review. *Rationally Speaking*, March 25, 2012. podcast audio.

[7] Gerd Gigerenzer. How to make cognitive illusions disappear: beyond "heuristics and biases". *European Review of Social Pscyhology*, 2:1:83–115, 1991.

[8] T Gilovich, R Vallone, and A Tversky. The hot hand in basketball: On the misperception of random sequences. *Cognitive Psychology*, 17:295–314, 1985.

[9] Peter Guttorp. Introductory overview lecture on statistics and climate. August 1, 2012. Lecture, Joint Statistical Meetings, San Diego.

[10] Ian Hacking. *An introduction to probability and inductive logic*.

[11] Daniel Kahneman. *Thinking, Fast and Slow*.

[12] Daniel Kahneman and Amos Tversky. On the psychology of prediction. *Psychological Review*, 80:237–251, 1973.

[13] Jonah Lehrer. The truth wears off: Is there something wrong with the scientific method? *The New Yorker*, December 13, 2010.

[14] Bjorn Lomborg. *Cool It: The Skeptical Environmentalist's Guide to Global Warming*.

[15] Jean Marston. Smoking gun. *New Scientists*, 2646, 2008.

[16] R.E Nisbett, D.H. Krantz, C. Jepson, and Z. Kunda. The use of statistical heuristics in everyday inductive reasoning. *Psychological Review*, 90:339–363, 1983.

[17] Massimo Pigliucci. *Nonsense on Stilts: How to tell Science from Bunk*.

[18] Gordon Smith and Jill Pell. Parachute use to prevent death and major trauma related to gravitational challenge: systematic review of randomized controlled trials. *BMJ*, 327:1459–1461, 2003.

[19] Michael Specter. The power of nothing: Could studying the placebo effect change the way we think about medicine? *The New Yorker*, December 12, 2011.

[20] Edward Tufte. *The Quantitative Display of Information.*

[21] Andrew Vickers. *What is a p-value anyway?: 34 stories to help you actually understand statistics.* Addison-Wesley, 2010.

[22] Marilyn vos Savant. Ask marilyn. *Parade Magazine*, Sep 9, Dec 2, Feb 17, 1991.

[23] Carl Zimmer. A sharp rise in retractions prompts calls for reform. *The New York Times*, April 16, 2012.

UCLA Course Inventory Management System

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New Course Proposal

	Statistics 98T Burden of Proof: Data and Scientific Reasoning
Course Number	Statistics 98T
Title	Burden of Proof: Data and Scientific Reasoning
Short Title	BURDEN OF PROOF
Units	Fixed: 5
Grading Basis	Letter grade only
Instructional Format	Seminar - 3 hours per week
TIE Code	SEMT - Seminar (Topical) [T]
GE Requirement	Yes
Major or Minor Requirement	No
Requisites	Satisfaction of entry-level Writing requirement. Freshmen and sophomores preferred.
Course Description	Seminar, three hours. Enforced requisite: satisfaction of Entry-Level Writing requirement. Freshmen/sophomores preferred. Exploration of ways in which scientific reasoning is used to go from data to decisions. Examination of ideas in probability, logic, reasoning, and economics to establish methods that constitute gold standard for reasoning through science. Letter grading.
Justification	Part of the series of seminars offered through the Collegium of University Teaching Fellows.
Syllabus	File *Statistics 98T syllabus.pdf* was previously uploaded. You may view the file by clicking on the file name.
Supplemental Information	Dr. Robert Gould is the faculty mentor for this seminar.
Grading Structure	reading responses - 15% term paper - 50% paper proposal - 5% literature review - 20% term paper presentation - 10%
Effective Date	Spring 2013
Discontinue Date	Summer 1 2013
Instructor	Name: Andrew Bray; Title: Teaching Fellow
Quarters Taught	☐ Fall ☐ Winter ☐ Spring ☐ Summer
Department	Statistics
Contact	Name: CATHERINE GENTILE; E-mail: cgentile@oid.ucla.edu
Routing Help	

ROUTING STATUS

Role:	Registrar's Office
Status:	Processing Completed

Role:	Registrar's Publications Office - Hennig, Leann Jean (lhennig@registrar.ucla.edu) - 56704
Status:	Added to SRS on 10/4/2012 1:26:10 PM
Changes:	No Changes Made
Comments:	Fixed title; Doug fixed short title!

Role:	Registrar's Scheduling Office - Thomson, Douglas N (dthomson@registrar.ucla.edu) - 51441
Status:	Added to SRS on 10/4/2012 1:22:57 PM
Changes:	Short Title
Comments:	No Comments

Role:	Registrar's Office - Hennig, Leann Jean (lhennig@registrar.ucla.edu) - 56704
Status:	Returned for Additional Info on 10/4/2012 1:20:14 PM
Changes:	Title
Comments:	New title requested by Cathie Gentile. Doug, please correct the short title before passing form back to me!

Role:	Registrar's Publications Office - Hennig, Leann Jean (lhennig@registrar.ucla.edu) - 56704
Status:	Added to SRS on 7/30/2012 10:34:30 AM
Changes:	Description
Comments:	Edited course description into official version.

Role:	Registrar's Scheduling Office - Thomson, Douglas N (dthomson@registrar.ucla.edu) - 51441
Status:	Added to SRS on 7/17/2012 3:51:40 PM
Changes:	Short Title
Comments:	No Comments

Role:	L&S FEC Coordinator - Castillo, Myrna Dee Figurac (mcastillo@college.ucla.edu) - 45040
Status:	Returned for Additional Info on 7/17/2012 3:37:32 PM
Changes:	No Changes Made
Comments:	Routing to Doug Thomson in the Registrar's Office

Role:	FEC Chair or Designee - Kaufman, Eleanor K. (eleanork@ucla.edu) - 68155
Status:	Approved on 7/16/2012 4:54:02 AM
Changes:	No Changes Made
Comments:	Give full citations for bibliography on syllabus

Role:	L&S FEC Coordinator - Castillo, Myrna Dee Figurac (mcastillo@college.ucla.edu) - 45040
Status:	Returned for Additional Info on 6/7/2012 12:19:17 PM

Changes:	No Changes Made
Comments:	Routing to Eleanor Kaufman for FEC approval

Role:	CUTF Coordinator - Gentile, Catherine (cgentile@oid.ucla.edu) - 68998
Status:	Approved on 6/5/2012 5:09:21 PM
Changes:	No Changes Made
Comments:	on behalf of Professor Kathleen Komar, chair, CUTF Program

Role:	Initiator/Submitter - Gentile, Catherine (cgentile@oid.ucla.edu) - 68998
Status:	Submitted on 6/5/2012 5:08:37 PM
Comments:	Initiated a New Course Proposal

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Comments or questions? Contact the Registrar's Office at
cims@registrar.ucla.edu or (310) 206-7045