UCLA DEPARTMENT OF STATISTICS

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To: General Education Governance Committee
July 30, 2021

Dear Chair Hackett,

Attached is a proposal for the course, Stats 15 Introduction to Data Science, for general education credit under the Foundations of Scientific Inquiry Category. Included are the Course Information Sheet and a syllabus.

Stats 15 is a new course that will be offered for the first time in Fall 2021. The course was designed to support the new Data Theory major, a joint major between Statistics and Mathematics. The Data Theory major was launched two years ago, and its first cohort will graduate this Spring (2022). Although Stats 15 is a requisite for entering the major, students can substitute Stats 10, Introduction to Statistical Reasoning, a course which enjoys GE status.

Enrollment in Stats 15 for Fall '21 is quite low, most likely because Stats 10 provides GE credit and Stats 15 does not. This proposal is intended, in part, to rectify this situation. The enrollment figures provided for Spring are estimations, although we do expect enrollments to grow over time.

Stats 15 is based on the same "bones" as Stats 10 and, like that course, emphasizes an approach to thinking about situations and problems that can be addressed by considering data. It is not a course that simply provides a laundry list of statistical methods to be memorized and applied, and is intended to prepare UCLA students of all majors, with minimal requisites, with the basic conceptual understandings needed to navigate our data-driven world. Compared to Stats 10, Stats 15 places more emphasis on the "front end" of data analysis: how data are stored and accessed, how data are cleaned and manipulated to prepare for analysis. Compared to Stats 10, Stats 15 places a greater emphasis on predictive modeling than on inferential modeling. Stats 15 pays particular attention to societal issues that arise from the use of data and algorithms applied at large scale, such as predictive policing, racial profiling, and college rankings.

Best,

Robert Gould
Vice-chair, Undergraduate Studies

General Education Foundations of Scientific Inquiry (FSI) Course Information Sheet

Please submit this sheet for each proposed course along with 1) a syllabus describing the key components of the course that will be taught regardless of the instructor and 2) assignment guidelines.

Department, Course Number, and Title ***Stats 15, Introduction to Data Scienc4***

Indicate when the department anticipates offering this course in 2019-20 and give anticipated enrollment: (based on previous year)

Fall: Enrollment 50 Winter: Enrollment 0 Spring: Enrollment 120 Summer: Enrollment 120

As stated in the guidelines regarding courses in the Foundations of Scientific Inquiry (FSI), the aim of these course offerings is:

To ensure that students gain a fundamental understanding of how scientists formulate and answer questions about the operation of both the physical and biological world. These courses also deal with some of the most important issues, developments, and methodologies in contemporary science and technology, addressing such topics as the origin of the universe, environmental degradation, and the decoding of the human genome. Through lectures, experiential learning opportunities such as laboratories, writing, and intensive discussions students consider the important roles played by the laws of physics and chemistry in society, biology, earth and environmental sciences, and astrophysics and cosmology.

General Education FSI Student Goals: Courses fulfilling the GE FSI will provide a minimum of four units and should align with some (not necessarily all) of the following seven general goals:

1. Students will actively engage in the scientific process of inquiry, analysis, problem-solving, and quantitative reasoning.
2. Students will acquire an informed appreciation of scientists, scientific research, and technology.
3. Students will experience the interdisciplinary nature of science.
4. Students will develop information literacy.
5. Students will make evidence-based decisions in a wide array of science and non-science contexts.
6. Students will develop scientific literacy by addressing current, critical issues and topics in science that are personally meaningful in daily life and/or connected to the needs of society.
7. Students will recognize fundamental scientific principles and the connections between different domains of science.

General Education FSI Student Learning Outcomes: Each course should have student learning outcomes listed in the syllabus. These outcomes may be tied to a specific discipline but should be associated with the seven broad categories listed above (please see **Appendix I** for a sample list of possible learning outcomes supporting each goal).

General Guidelines for GE FSI Courses: GE Courses may be upper or lower division, but they should have no prerequisites. Any student should be able to take them and understand the material with the background expected from all UCLA students. While the course may include material related to the history of science and the social and cultural implications of scientific research, **at least half** of the course should be devoted to students actively engaging in the scientific process of inquiry, analysis, problem-solving, and quantitative reasoning (Goal #1).

Please indicate the area/s which you believe this course should satisfy.

Life Science: ☐ Physical Science: x Life Science Lab*: ☐ Physical Science Lab*: x

**Please see the additional student learning outcomes and expectations for courses approved as GE FSI Labs.*

The GE FSI Assessment Project Resource Team would be delighted to meet with you to assist in filling out this form. Please contact us at RRamachandran@teaching.ucla.edu if you wish to arrange a meeting.

We are interested in understanding the alignment of your course learning outcomes with the GE FSI learning goals. First, identify measurable learning outcomes from your course and enter them in the first column of Table 1. You may add more rows as needed. If you need to state new learning outcomes, see Appendix I for a sample list of possible learning outcomes supporting each goal. Should you wish to choose any of these outcomes, you may simply indicate its number, e.g., 6a. Next, indicate how your learning outcomes relate to the GE FSI learning goals 1 through 7 (see previous page), by placing X's in the appropriate boxes. Note that all GE FSI courses must address Goal #1.

Table 1: Alignment of Course Learning Outcomes with GE FSI Learning Goals

	Your Course Learning Outcomes	**Select GE FSI Goal #**						
		1	**2**	**3**	**4**	**5**	**6**	**7**
1	prepare for analysis data consisting of a variety structures and formats	x	x		x			
2	create and interpret visualizations of data to answer particular questions	x	x	x	x			
3	engage in exploratory data analysis in order to detect problems in data and develop models	x	x	x	x			
4	apply and evaluate predictive models	x	x	x		x	x	
5	understand how data collection methods affect the scope of inference	x	x					x
6	identify and explain ways in which ethical considerations direct data collection, management, and modeling	x						x
7	communicate outcomes of investigations for a variety of audiences in a variety of formats.						x	x

Considering each of the GE FSI goals that you marked with X's in the table above, please provide information about related course activities and assignments.

Table 2: Course Activities and Assignments that Support the Learning Goals

Course Learning Outcome No. from Table 1	**Course Activities** How will progress towards meeting this outcome be facilitated? In other words, what types of course activities will be provided to assist students in achieving the learning goal?	**Course Assignments** How will students in the course demonstrate their ability to meet this goal? Please describe and provide a sample assignment, such as a term paper, exam, essay prompt, etc.
1	homeworks, class discussion, computer labs, readings	evaluation of homework, weekly quizzes, midterms, labs
2	homeworks, class discussions, readings	homework, quizzes, exams, lab
3	class discussions, homework, labs, readings	homework, labs, exams, final
4	class discussions, homework, labs, readings	homework and exams, quizzes

5	class discussions, homework, labs, readings	homework and exams and quizzes
6 & 7	labs, discussions, readings	labs, project

Weekly homework: students are assigned weekly problems that involve both written responses as well as computer-driven analyses. These vary from short, closed-form questions to longer, more open-ended queries that require student to provide written summaries with graphical support.

Students take weekly low-stake on-line quizzes intended primarily to assess conceptual understanding.

Students complete 8 computer labs (but meet weekly), in which they apply statistical software in order to (a) gather, organize, "wrangle" data; to create visualizations, build and evaluate predictive models, and apply concepts. Labs include short-form answers as well as inquiry-based activities that require students to submit a short report.

Classes meet in lecture format. Lectures include frequent opportunities for students to discuss issues and concepts, and audience-response systems are used to assess student learning in real-time.

Course content is delivered through textbook readings, lectures, and occasional videos and applets.

At instructors' discretion, the final exam may consist, in whole or in part, of a multi-week project to be completed in small groups.

Please provide information on estimated weekly hours for the class.

A) STUDENT CONTACT PER WEEK (if not applicable write N/A)

Activity	Number of hours per week
Lecture	3
Discussion Section	1
Labs	1
Experiential (Community-engagement, internships, other	0
Field Trips	0
A) TOTAL student contact per week	5

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

Activity	Number of hours per week
General Review and Preparation	1
Reading	1
Group Projects	
Preparation for Quizzes & Exams	1
Information Literacy Exercises	
Written Assignments	12
Research Activity	
B) TOTAL Out-of-class time per week	

GRAND TOTAL (A) + (B) must equal at least 15 hours/week: 20 (hours)

Additional Student Learning Outcomes for experiential learning courses approved as "GE FSI Labs"

GE FSI Lab Definition and Expectations: A hands-on laboratory, computer simulation, demonstration, or field experience that involves active participation in experimental observation, data generation and collection using the techniques, methodologies, and approaches of modern-day scientists. Any lab should be conducted under sufficient supervision by the instructor or a Teaching Assistant (TA). Furthermore, the instructor and TAs should meet regularly outside of class time (minimum weekly or biweekly) to practice performing the lab procedures and/or to review the experimental results.

Please select one or more of the following learning outcomes for your course (select all that apply):
Please note that bold-faced items are "checked"

☐ 1. Students will design, implement, and evaluate an experimental strategy for answering scientific questions, testing a hypothesis, or solving a problem.

☐ 2. When possible, students will replicate experiments to allow testing for and interpretation of statistical significance.

☐ **3. Students will apply commonly used mathematical concepts and statistical methods (e.g., basic addition, subtraction, multiplication, division, averages, standard deviation, t-test for significance) in their analysis of different types of scientific data they collect.**

☐ **4. Students will be able to visually depict a quantitative dataset as a chart, graph, table, or mathematical equation.**

☐ **5. Students will be able to concisely summarize trends and patterns deduced from quantitative and qualitative data to make informed conclusions about their experimental results.**

☐ **6. When interpreting their results, students will distinguish between the most important and extraneous findings (i.e. identify those that are critical to addressing a question, solving a problem, or supporting/refuting a hypothesis).**

☐ **7. When interpreting their results, students will infer relationships between controls and experimental variables as well as assess causality and correlation among variables.**

☐ **8. Students will be able to troubleshoot experimental procedures or methods of analysis to develop a sound scientific rationale for deducing what went wrong and why.**

Please present concise explanation of how your course satisfies these criteria.

How will students in this course actively experiment and engage in the hands-on process of gathering, analyzing, and interpreting data? How will progress towards meeting the student learning outcomes for "labs" be measured/assessed? In other words, what types of assignments will be given to determine whether students are achieving the learning outcomes?

Data science is a computer-intensive discipline, and the labs are essential for giving students the opportunity to practice and develop programming skills. Students will meet with a TA weekly in groups less than 40 and engage in mini-projects that will give them opportunities to learn how to gather data from the internet, organize data in a variety of formats, prepare complex data sets for analysis, train and test predictive models, apply statistical models and interpret output. While technical in nature, the labs themselves will engage students in a complete investigative cycle, in which students pose investigative questions, consider the suitability of data for answering the questions, analyze and interpret the data, and iterate as necessary until the posed questions are sufficiently addressed. Data for the labs come from a variety of contexts, including sports, medicine, and personal data..

Appendix I. Student Learning Goals with Nested Learning Outcomes for All General Education (GE) Foundations in Scientific Inquiry Courses

Course Goals (1-7) and Student Learning Outcomes (a, b, c, etc.) for all "GE FSI" courses:

1. Students will actively engage in the scientific process of inquiry, analysis, problem-solving, and quantitative reasoning.
    a. Students will explain how scientists answer scientific questions, test a hypothesis, or solve a problem.
    b. Students will make reasonable predictions of experimental outcomes based on observation, measurements, and/or prior knowledge surmised from the scientific literature or other reliable, validated, accurate information sources.
    c. Students will break down, reason through, and solve complex quantitative problem sets.
    d. Students will be confident working with numerical data.
    e. Students will estimate and complete calculations to solve a quantitative problem.
    f. Students will recognize different objects and apply units of measurement at relevant scales (quantity, size, time) and orders of magnitude.
2. Students will acquire an informed appreciation of scientists, scientific research, and technology.
    a. Students will value their academic experiences in a science course that is outside their primary field of study.
    b. Students will recognize the benefits of science to society or their everyday life.
    c. Students will express interest in contributing to the sciences (e.g., engaging in research or scientific discourse with others).
    d. Non-science students will see scientists as role models, helping them to identify as scientists themselves.
3. Students will experience the interdisciplinary nature of science.
    a. Students will investigate topics from a variety of scientific fields.
    b. Students will explore the perspectives of multiple diverse scientists.
    c. Students will make logical connections between key concepts from multiple scientific disciplines.
4. Students will develop information literacy.
    a. Students will be mindful of information they encounter, recognizing contexts or situations when it is necessary to seek out other sources or data.
    b. Students will identify, locate, and critically evaluate information sources and datasets to ensure they are reliable, validated, accurate, and scholarly (i.e. associated with citations in peer-reviewed, public research studies).
    c. Students will explain the peer-review process in science and its role in critical evaluation and validation of published, scientific findings.
5. Students will make evidence-based decisions in a wide array of science and non-science contexts.
    a. Students will distinguish between opinion and fact (i.e. recognize data-supported conclusions).
    b. Students will use reliable, validated, accurate, and scholarly information sources and datasets before accepting or formulating a conclusion.
    c. Students will draw conclusions or make judgements about experimental results informed by critical thinking, that is, a comprehensive exploration of ideas and systematic engagement with the scientific process.
6. Students will develop scientific literacy by addressing current, critical issues and topics in science that are personally meaningful in daily life and/or connected to the needs of society (e.g., climate change, vaccination, GMOs, evolution).
    a. Students will clearly state the significance or relevance of a research question or problem (i.e. state why scientists are motivated to study the issue or topic).
    b. Students will discuss societal impacts by citing examples of the ways in which scientists and scientific research contribute to society.
    c. Students will describe the interactions between humans and their physical world and the positive and negative effects of this interaction.
    d. Students will explain why issues perceived as "controversial" in the public domain are not considered "controversial" in among scientists.
7. Students will recognize fundamental scientific principles and the connections between different domains of science.
    a. Students will describe the nature, organization, and evolution of living systems.
    b. Students will explain the origin and physical processes of the planet earth and the surrounding universe.
    c. Students will differentiate between a scientific theory, hypothesis, fact, or law.

Syllabus Stats 15 Introduction to Data Science

Catalog Description

Stats 15 (Introduction to Data Science) (5). Lecture, three hours; discussion, one hour; computer laboratory, one hour. Preparation: three years of high school mathematics. Introduction to data science, including data management, data modeling, data visualization, communication of findings, and reproducible work flow. P/NP or letter grading.

This course will provide an overview to data science, which we define as the science of obtaining insight and finding meaning in data. We will use the statistical software R via the Rstudio interface.

Learning Objectives:

Upon completing this course students will

- prepare for analysis data consisting of a variety structures and formats
- create and interpret visualizations of data to answer particular questions
- engage in exploratory data analysis in order to detect problems in data and develop models
- apply and evaluate predictive models
- demonstrate understanding of ways in which data collection methods affect the scope of inference and limit or enhance conclusions/decisions
- identify and explain ways in which ethical considerations should direct data collection, management and modeling
- communicate outcomes of investigations for a variety of audiences (e.g. colleagues, lay public) in a variety of formats (e.g. verbal, written, poster, video)

Textbook

Baumer, B., Kaplan, D., Horton, N. Modern Data Science with R. CRC Press.

Outline

Week	Topic
	Unit 1: The toolkit
1	Data Investigations and Data Visualization
2	Tidy data and data wrangling
3	Data Types and Recoding variables
4	Webscraping and data storage
	Unit 2: Modeling Data
6	Scientific studies, experimental design, confounding, simpson's paradox Tidy Data
7	Ethics, Introduction to models and modeling
8	Predictive Modeling
9	Model Validation

10	Communicating Findings

Grading
Grades will be based on

- Weekly Homework (20%)
- Weekly Computer Lab Exercises (20%)
- Midterm (20%)
- Final Exam (40%)

Academic Integrity. As a student and member of the University community, you are here to get an education and are, therefore, expected to demonstrate integrity in your academic endeavors. All students must uphold University of California Standards of Student Conduct as administered by the Office of the Dean of Students. Students are subject to disciplinary action for several types of misconduct, including but not limited to: cheating, multiple submissions, plagiarism, prohibited collaboration, facilitating academic dishonesty, or knowingly furnishing false information. You may have assignments or projects in which you work with a partner or with a group. For example, you are welcome, and even encouraged, to work with others to solve homework problems. Even though you are working together, the assignment you submit for a grade must be IN YOUR OWN WORDS, unless you receive specific instructions to the contrary. For more information about academic integrity, please go to www.deanofstudents.ucla.edu.

Title IX prohibits gender discrimination, including sexual harassment, domestic and dating violence, sexual assault, and stalking. If you have experienced sexual harassment or sexual violence, you can receive confidential support and advocacy at the CARE Advocacy Office for Sexual and Gender-Based Violence, 1st Floor Wooden Center West, CAREadvocate@careprogram.ucla.edu, (310) 206-2465. In addition, Counseling and Psychological Services (CAPS) provides confidential counseling to all students and can be reached 24/7 at (310) 825-0768. You can also report sexual violence or sexual harassment directly to the University's Title IX Coordinator, 2241 Murphy Hall, titleix@conet.ucla.edu, (310) 206-3417. Reports to law enforcement can be made to UCPD at (310) 825-1491.

Faculty and TAs are required under the UC Policy on Sexual Violence and Sexual Harassment to inform the Title IX Coordinator should they become aware that you or any other student has experienced sexual violence or sexual harassment.

Psychological Health, Well-Being and Resilience

UCLA is renowned for academic excellence, and yet we know that many students feel overwhelmed at times by demands to succeed academically, socially and personally. Our campus community is committed to helping all students thrive, learn to cope with stress, and build resilience. Remember, self-care is a skill that is critical to your long-term success. Here are some of the many resources available at UCLA to support you:

- **Counseling and Psychological Services (CAPS):** https://www.counseling.ucla.edu/ Provides counseling and other psychological/mental health services to students. Walk-in hours are

Monday-Thursday 8am-4:30pm and Friday 9am-4:30pm in John Wooden Center West. Crisis counseling is also available 24 hours/day at (310) 825-0768.

- **Ashe Student Health and Wellness Center**: http://www.studenthealth.ucla.edu Provides high quality and accessible ambulatory healthcare and education by caring professionals to support the academic success and personal development of all UCLA students.
- **Healthy Campus Initiative (HCI):** https://healthy.ucla.edu Provides links to a wide variety of resources for enhancing physical and psychological well-being, positive social interactions, healthy sleep, healthy eating, healthy physical activity and more.
- **Campus and Student Resilience**: https://www.resilience.ucla.edu/ Provides programs to promote resilience and trains students to help support their peers.
- **UCLA Recreation**: https://www.recreation.ucla.edu/ Offers a broad array of services and programs including fitness, yoga, dance, martial arts, meditation, sports, and much more.
- **Equity, Diversity and Inclusion**: https://equity.ucla.edu/ Committed to providing an equal learning, working and living environment at UCLA and supports a range of programs to promote these goals campus-wide.

• Bruin Shelter: www.bruinshelter.org. **Bruin Shelter's mission is to** provide a safe, supportive environment for fellow college students experiencing homelessness by fostering a collaborative effort between universities, community-based organizations, and service providers.

.• UCLA Student Resources for Food: www.brc.ulca.edu/Resources. A variety of food-related resources for students needing assistance.

UCLA Ombuds Services

Mission Statement: The Office of Ombuds Services is a place where members of the UCLA community–students, faculty, staff and administrators–can go for assistance in resolving conflicts, disputes or complaints on an informal basis. In order to afford visitors the greatest freedom in using its services, the Office is independent, neutral and confidential.

UCLA GRIT Coaching Program

GRIT stands for guidance, resilience, integrity and transformation. In this program, UCLA students receive individualized support from trained peer coaches to manage stress, fostering positive social connections, set goals, and navigate campus resources.
https://www.grit.ucla.edu/