

BENG 100. Statistical Reasoning for Bioengineering Applications **Course Syllabus**

Instructor: Ludmil B. Alexandrov, Ph.D.
Email: L2alexandrov@health.ucsd.edu
Office: Zoom; <https://ucsd.zoom.us/j/836844754>
Office Hours: Thursday, 12:00pm – 1:00pm

TAs/emails: Siddharth Chauhan, smchauha@ucsd.edu
Alexa Lewis, alewis@eng.ucsd.edu
Nishant Mysore, nmysore@ucsd.edu
Kokila Perera, kperera@ucsd.edu
Arya Suprana, asuprana@ucsd.edu

Prerequisites

BENG 1; Math 20C or Math 31BH; Math 20D; Math 18; Phys 2A-B-C; or consent of the department.

Course Description

General introduction to probability and statistical analysis, applied to bioengineering design. Topics include preliminary data analysis, probabilistic models, experiment design, model fitting, goodness-of-fit analysis, and statistical inference/estimation. Written ~~and software~~ problems are provided for modeling and visualization.

Textbook and Other Materials

Required Reading

Introduction to Probability, Statistics, and Random Processes, Hossein Pishro-Nik, Kappa Research, LLC. August 24, 2014. ISBN-10: 0990637204. ISBN-13: 978-0990637202.

Please note that the textbook is also freely available online: <https://www.probabilitycourse.com/>

Additional Materials

In addition to the textbook listed above, there is a plethora of available information on the Internet. This information includes peer-reviewed manuscripts, Wikipedia articles, YouTube videos of lectures from UCSD and/or other universities, and much more. Students are strongly encouraged to review additional online materials prior to each lecture.

Course Outcomes

After successfully completing this class, a student will be able to:

- a. Understand basic concepts of set theory, probability theory, and statistics
- b. Understand probability measure and conditional probability
- c. Describe the properties of discrete and continuous distribution functions
- d. Assess the consistency, efficiency and unbiasedness of estimators
- e. Apply methods of maximum likelihood estimation
- f. Understand and apply the Central Limit Theorem
- g. Understand and use statistical tests in testing hypotheses on data

Class Schedule

Students are expected to attend all lectures via Zoom. However, attendance will not be used as part of the grade. Further, all lectures will be recorded and posted on Canvas within two days of the lecture. Students should also select the most convenient time and attend at least one discussion section each

week. A detailed schedule of lectures, homework assignments, and exams is provided at the end of this document.

Lectures

| | | |
|----------|-----------------|---|
| Tuesday | 5:00pm – 6:20pm | Zoom; https://ucsd.zoom.us/j/237787002 |
| Thursday | 5:00pm – 6:20pm | Zoom; https://ucsd.zoom.us/j/237787002 |

Discussion Sections

The lectures and notes are structured to follow the main textbook *Introduction to Probability, Statistics, and Random Processes* by Hossein Pishro-Nik. During each week, the lectures will cover approximately one chapter in the book (please refer to the Detailed Class Schedule in the end of this document for more details). Each lecture will be conducted via Zoom, recorded in real-time, and posted on Canvas. While the lectures will predominately focus on theory, the discussion sections will be focused on solving problems. Each book chapter as well as most subchapters contain a number of solved problems. Teaching assistants will walk you through and explain these solved problems during the discussion sections. Please make sure that you review the solved problems for the appropriate chapter section(s) prior to attending any of the discussion sections. The schedule for discussion sections is provided below.

| Day | Time | Teaching Assistant | Location |
|--------|-------------------|--------------------|----------|
| Monday | 10:00am – 10:50am | Nishant Mysore | Zoom |
| Monday | 3:00pm – 3:50pm | Kokila Perera | Zoom |
| Monday | 4:00pm – 4:50pm | Kokila Perera | Zoom |
| Monday | 5:00pm – 5:50pm | Arya Suprana | Zoom |
| Friday | 11:00am – 11:50am | Alexa Lewis | Zoom |
| Friday | 12:00pm – 12:50pm | Siddharth Chauhan | Zoom |
| Friday | 1:00pm – 1:50pm | Siddharth Chauhan | Zoom |

Exams

| Exam | Date and Time Posted | Date and Time Due |
|----------------|----------------------|-------------------|
| Midterm Exam 1 | 28 April, 5:00pm | 29 April, 5:00pm |
| Midterm Exam 2 | 21 May, 5:00pm | 22 May, 5:00pm |
| Final Exam | 11 June, 7:00pm | 12 June, 7:00pm |

Homework Assignments

| Assignment | Date and Time Posted | Date and Time Due | Date and Time Solutions Posted |
|-----------------------|----------------------|-------------------|--------------------------------|
| Homework Assignment 1 | 31 March, 5:00pm | 7 April, 7:20pm | 7 April, 7:20pm |
| Homework Assignment 2 | 7 April, 6:20pm | 14 April, 11:00pm | 15 April, 7:20pm |
| Homework Assignment 3 | 14 April, 5:00pm | 21 April, 11:00pm | 22 April, 7:20pm |
| Homework Assignment 4 | 30 April, 5:00pm | 7 May, 11:00pm | 8 May, 7:20pm |
| Homework Assignment 5 | 7 May, 5:00pm | 14 May, 11:00pm | 15 May, 7:20pm |
| Homework Assignment 6 | 26 May, 5:00pm | 2 June, 11:00pm | 3 June, 7:20pm |

All dates and times are in Pacific Daylight Time (San Diego local time).

Methods of Evaluation

The final class grade will be based on the maximum from the following two grading options:

Class Grade: Option 1

Homework assignments (24%; 6 homework assignments each 4%)

Midterm exams (36%; two midterm exams each 18%)

Final exam (40%)

Any missed homework assignment or midterm exam will increase the weight of the final exam. For example, if a student does not submit homework assignment 1 (4% of the class grade), the final exam will increase with 4% of the total grade (i.e., from 40% to 44% of the class grade).

Class Grade: Option 2

Final exam (100%)

All students are encouraged to submit all homework assignments and to take the midterm exams, i.e., option 1. In principle, option 2 should be regarded as a safety option that allows receiving a higher grade even if the student's performance throughout the quarter was suboptimal.

Final Grades

The letter grade, P/NP grade (undergraduate students only), or S/U grade (graduate students only) for the class will be based on the final class grade, i.e., the maximum of options 1 and 2. The table below provides the minimum scores required for different grades. The default grade is the letter grade and you can change it to P/NP grade or S/U grade up to week 10.

| Letter Grade | Score | P/NP | S/U |
|--------------|-------|---------|----------------|
| A+ | 95 | Pass | Satisfactory |
| A | 90 | | |
| A- | 85 | | |
| B+ | 80 | | |
| B | 75 | | |
| B- | 70 | | |
| C+ | 65 | | |
| C | 60 | No Pass | Unsatisfactory |
| C- | 40 | | |
| D | 40 | | |
| F | 0 | | |

Class Policies

- Homework assignments must be written clearly and neatly. Illegible homework will not be graded. Homework assignments may be discussed in groups but must be worked individually and not copied. The homework assignments are to be submitted via Gradescope as PDF files. No late homework will be accepted or graded.
- A solution to each homework assignment will be provided on Canvas an hour after the homework assignment is due. Similarly, a solution to each exam will be provided on Canvas an hour after the exam's due date and time.
- All homework assignments will be graded within a week of the due date. Similarly, both midterm exams will be graded within a week of completion of the exams. The final exam will be graded by 15-June. All grading will be done via Gradescope.

- Submissions of homework assignments and exam need to follow the submission guidelines (provided in a separate document). Importantly, if a Gradescope submission lacks page numbers for a given problem, the student will receive 0 points for that problem even if the problem is included in the submission.
- In fairness to all students, work will only be re-graded after consideration of a request made through Gradescope when there is an evidence of a grading error. We reserve the right to re-grade an entire piece of work, which may result in an overall grade that is lower or higher. The deadline for re-grade requests is within 48 hours from the date the assignment is returned. Please note that partial credit given for any unsolved problem will not be changed.
- If a student does not take a midterm exam or does not submit a homework assignment, the final exam will be weighed more heavily. A final exam taken other than at the regularly scheduled date/time will be an oral exam via Zoom that includes solving problems in real time. Further, per University policy, a final exam taken other than at the regularly scheduled date/time will be allowed only in exceptional circumstances.
- Academic dishonesty will not be tolerated. According to UCSD policy, consulting any unauthorized material that contains answers to any assignment is academic dishonesty. Any suspected incident will be dealt with in accordance with UCSD policy, including reporting the misconduct to the Dean of Student Affairs. More information on UCSD's Policy on Integrity of Scholarship can be found at: <https://academicintegrity.ucsd.edu/process/policy.html>
- All examination will be conducted as “take-home” exams based on the honor system. Exams will become available at the scheduled time. Students will have 24 hours to submit them. The 24 hours include any time needed for scanning and uploading the exam. As per the Office for Students with Disabilities (OSD), no additional time is allowed for “take-home” exams to students with disabilities.
- All exams are open textbook; however, students cannot use any other online resources or other printed materials. Students must work on exams individually. Any group work will be treated as academic dishonesty.
- Questions about any of the exam's problems can be submitted via email to the instructor or in real-time using Zoom private chat message during the allocated exam timeslot.

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