

BENG 100. Introduction to Probability for Bioengineering

Syllabus

Instructor: Sheng Zhong, Ph.D., email is provided on CANVAS.

Lecture: October 1, 12:30pm, Zoom link is provided on CANVAS.

Online course videos: URL to course videos will be provided on CANVAS.

TA: Xingzhao Wen (Irene), email is provided on CANVAS.

Office hour: Fri 1:00-2:00pm, Zoom link is provide on CANVAS.

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 set theory, the foundation of probability, combinatorics, probabilistic models, preliminary data analysis, experiment design, and hypothesis testing. Written problems are provided for modeling and visualization.

Schedule

All lectures are pre-recorded. The recommended dates of studying the pre-recorded lectures are:

- Module 1: Randomness and probability axioms.
 - Lectures 1 – 3: 10/01, 10/06, 10/08
- Module 2: Conditional probability, law of total probability, Bayes rule.
 - Lectures 4 – 6: 10/13, 10/15, 10/20
- Module 3: Combinatorics
 - Lectures 7 – 8: 10/22, 10/27
- Module 4: Random variables, discrete distributions.
 - Lectures 9 – 11: 11/03, 11/05, 11/10.
- Module 5: Cumulative distribution function, functions of RV.
 - Lectures 12 – 13: 11/12, 11/17
- Module 6: Continuous RV, uniform and normal distributions, law of large numbers.
 - Lectures 14 – 16: 11/19, 12/01, 12/03
- Module 7: Hypothesis testing.
 - Lectures 17 – 18: 12/08, 12/10

The recommended means of solving the problems in the lecture videos

When we discuss a problem in the lecture video, you are welcome to pause the video and try to solve the problem by yourself, and then resume the video to follow the instructor's solution.

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. A course handout will be provided. 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 combinatorics
- b. Understand probability measure and conditional probability
- c. Describe the properties of discrete and continuous distribution functions
- d. Apply combinatorics and probability to solve real life problems
- e. Apply and probability to analyze genetics data including genotype-phenotype data
- f. Understand and apply the Central Limit Theorem
- g. Understand and use statistical tests in testing hypotheses on data