

Probability and Statistics



Session 4 Spring 2023

Lectures: **MoTuWeTh: 08:30--09:45 @ IB 1047**
Recitations: **TuTh 19:00—20:00 @ IB 1047**
Academic credit: 4 DKU credits

Instructor's information

Dr. Lin Jiu:	Lecturer of Mathematics, Duke Kunshan University Assistant Professor of the Practice, Duke University
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Office Hours:	Tuesdays and Thursdays 10:00—11:30 CC2057 or by appointment

Teaching Assistants (for recitation, WeBWork)

Siyuan Wu	Siyuan.Wu@dukekunshan.edu.cn	
Office Hours	Wednesdays 14:00—15:00	IB 2027
Lunji Zhu	Linji.Zhu@dukekunshan.edu.cn	
Office Hours	Mondays 18:00—19:00	IB 2027

What is this course about?

This course serves as an introduction to probability theory and statistics, with emphasis on problem solving. These topics have long been essential to the development of scientific theories and the interpretation of experimental results. With the advent of modern tools for collecting massive amounts of data, statistical modeling and analysis have become essential for scientific progress with applications across the natural and social sciences. Probability theory is an integral part of the modern physics worldview, lying at the core of quantum mechanics and playing an essential role in explaining the properties of large collections of particles. It also forms the basis for theories of statistical inference from data of all sorts. This course provides a mathematical foundation essential for natural scientists and social scientists alike.

The first part of the course covers sequences and series, expanding on what was covered in calculus. The second part of the course covers basic concepts of probability and statistics.

What background knowledge do I need before taking this course?

Prerequisite: MATH 101/105.

What will I learn in this course?

There are two main objectives for this course. Naturally one goal is that students learn

1. the fundamental concepts of sequences, series, probability and some of its applications to statistics,
2. and to develop a range of skills which will allow them to apply the concepts effectively.

A second and equally important goal is for students to learn to think in a precise and rigorous manner and to develop the ability to approach questions analytically.

Some of the skills include:

- An understanding of the concept of convergence of sequences and series of real numbers;
- An understanding of the definition of independent, identically distributed variables;
- Compute probabilities associated with a discrete probability distribution;
- Compute probabilities associated with a continuous probability distribution;
- Compute the probability of occurrence of a set of independent events;
- Become familiar with binomial, Poisson, and normal distributions;
- An understanding of Bayes' theorem;
- An understanding of the meaning of confidence intervals, statistical and systematic errors, and applications;
- An understanding of Chi-squared-tests, T-tests, and relevant applications;
- An understanding of the concept of linear regression and how to apply it to analyzing data;
- Problem solving.

What will I do in this course?

The course will be comprised of lectures, assigned readings, homework, quiz, and exams.

How can I prepare for the class sessions to be successful?

To succeed, students should be prepared to devote several hours to this course daily. They are strongly encouraged to use the online tutoring resources of ARC, to work with classmates, and to contact instructors in a timely manner for additional help as needed.

What required texts, materials, and equipment will I need?

1. "Calculus, Volume II", by OpenSTAX. Find it [HERE](#)
2. "Probability and Statistics The Science of Uncertainty Second Edition" by Michael J. Evans and Jeffrey S. Rosenthal Find it [HERE](#)
3. "Introductory Statistics", by OpenSTAX. Find it [HERE](#)

How will my grade be determined?

1. Homework:	24% (=4%×6)
• HW1 due	Apr. 01 23:59
• HW2 due	Apr. 08 23:59
• HW3 due	Apr. 15 23:59
• HW4 due	Apr. 22 23:59
• HW5 due	Apr. 39 23:59
• HW6 due	May 06 23:59
• HW7 due	May 13 23:59
2. Quizzes:	10%(=2%×5)
3. Formula Sheet:	2%
4. Midterm:	24%(=12%×2) Apr. 7 & Apr. 27
5. Final exam:	40%

Please refer to the following scale for your grading. *This is also subject to change, based on the overall performances of the whole class.*

A+= 98.00% - 100%; **A** = 93.00 - 97.99%%; **A-** = 90.00% - 92.99%;
B+=87.00% - 89.99%; **B** = 83.00% - 86.99%; **B-** = 80.00% - 82.99%;
C+=77.00% - 79.99%; **C** = 73.00% - 76.99%; **C-** = 70.00% - 72.99%;

D+=67.00% - 69.99%; **D** = 63.00% - 66.99%; **D-** = 60.00% - 62.99%;
F =59.99% and below.

Homework. Weekly homework will be assigned each Thursday and will be due on the following Saturday midnight, *except for the last week. We will use the **WebWork system** for homework assignments.* **No late homework will be accepted.** Each homework problem set is worth 4% and the LOWEST one will be dropped.

Quiz. Weekly quiz will be assigned during the last lecture day of each week, except for the first week. Each quiz will be counted 2% and the LOWEST one will be dropped.

Midterm and Final Exams. Two midterms will be given in the **third and sixth week**, during recitation time slots, i.e., Apr. 7 & Apr. 27 Thursday 19:00—20:00. *Please note that due to the Qingming holiday schedule, Apr. 7 follows a Thursday schedule.*

In case of documented illness or family emergency or documented University sponsored trips, you may miss the midterm, but the supporting documentation must be submitted to the instructor in advance. With the document, your missing midterm score can be counted as the same as your final. Do remember: let me know **BEFORE** the exam. **An unexcused absence from any exam will be counted as a zero.** If permitted, you will not be given a make-up midterm exam; instead, the percentage you missed will be added to your final exam.

Final Exam. May 15th, 2023, 15:30—18:30, AB 2107

If you have concerns about your tests, you have two options:

- re-calculating the grade, if you find the final grade does not match the sum of all the problems;
- re-grading, which only applies to the whole test instead of each problem. That is, you can ask me to regrade your test, but NOT a single problem.

Formula Sheets

For the three tests (two midterms and the final exam), you are allowed to bring A4 sized, double-sided formula sheet(s). One piece for each midterm and two pieces for the final exam. When turning in your answer sheets, formula sheet(s) should also be turned in, in order to get the credits, 0.5% for each piece.

- There is no specific requirement on the content for the formula sheets
- If you bring a larger size, or more pieces than required, this will be considered as violation of the Academic Integrity.
- If you fail/forget to turn in the sheet(s), you will not get the corresponding credits.

What are the course policies?

Collaboration with peers on homework is allowed, but solutions are to be written individually. You are not allowed to use other books/online resources. Late homework will not be accepted.

We do not give make-up exams for any reason if you miss a midterm exam. Thus, missing an exam is a very serious matter. An unexcused delay in taking any exam will be counted as a zero. Excuses may be accepted, at the discretion of the instructor, and any alternative arrangements must be made well in advance.

Academic Integrity:

As a student, you should abide by the academic honesty standard of the Duke Kunshan University. Its community Standard states: “Duke Kunshan University is a community comprised of individuals from diverse cultures and backgrounds. We are dedicated to scholarship, leadership, and service and to the principles of honesty, fairness, respect, and accountability. Members of this community commit to reflecting upon and upholding these principles in all academic and non-academic endeavors, and to protecting and promoting a

culture of integrity and trust.” For all graded work, students should pledge that they have neither given nor received any unacknowledged aid.

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Academic Policy & Procedures:

You are responsible for knowing and adhering to academic policy and procedures as published in University Bulletin and Student Handbook. Please note, an incident of behavioral infraction or academic dishonesty (cheating on a test, plagiarizing, etc.) will result in immediate action from me, in consultation with university administration (e.g., Dean of Undergraduate Studies, Student Conduct, Academic Advising). Please visit the Undergraduate Studies website for additional guidance related to academic policy and procedures. Academic integrity is everyone’s responsibility.

Academic Disruptive Behavior and Community Standard:

Please avoid all forms of disruptive behavior, including but not limited to: verbal or physical threats, repeated obscenities, unreasonable interference with class discussion, making/receiving personal phone calls, text messages or pages during class, excessive tardiness, leaving and entering class frequently without notice of illness or other extenuating circumstances, and persisting in disruptive personal conversations with other class members. Please turn off phones, pagers, etc. during class unless instructed otherwise. If you choose not to adhere to these standards, I will take action in consultation with university administration (e.g., Dean of Undergraduate Studies, Student Conduct, Academic Advising).

Academic Accommodations:

If you need to request accommodation for a disability, you need a signed accommodation plan from Campus Health Services, and you need to provide a copy of that plan to me. Visit the Office of Student Affairs website for additional information and instruction related to accommodations.

What campus resources can help me during this course?

Academic Advising and Student Support

Please consult with me about appropriate course preparation and readiness strategies, as needed. Consult your academic advisors on course performance (i.e., poor grades) and academic decisions (e.g., course changes, incompletes, withdrawals) to ensure you stay on track with degree and graduation requirements. In addition to advisors, staff in the Academic Resource Center can provide recommendations on academic success strategies (e.g., tutoring, coaching, student learning preferences). Please visit the [Office of Undergraduate Advising website](#) for additional information related to academic advising and student support services.

Writing and Language Studio

For additional help with academic writing—and more generally with language learning—you are welcome to make an appointment with the Writing and Language Studio (WLS). You can register for an account, make an appointment, and learn more about WLS services, policies, and events on the [WLS website](#). You can also find writing and language learning resources on the [Writing & Language Studio Sakai site](#).

IT Support

If you are experiencing technical difficulties, please contact IT:

- China-based faculty/staff/students 400-816-7100, (+86) 0512- 3665-7100
- US-based faculty/staff/students (+1) 919-660-1810
- International-based faculty/staff/students can use either telephone option (recommend using tools like Skype calling)
- Live Chat: <https://oit.duke.edu/help>
- Email: service-desk@dukekunshan.edu.cn

What is the expected course schedule?

Tentative, Subject to Change

Week 1 (Mar. 20— Mar. 24)	<ul style="list-style-type: none">● Sequences (definition, convergent sequences, find the limit of a convergent sequence, properties of convergent sequences),● series (partial sums, convergent series, geometric series, harmonic series, test for divergence).
Week 2 (Mar. 27— Apr. 2)	<ul style="list-style-type: none">● Testing series,● power series,● Taylor series,● general series of functions
Week 3 (Apr. 3—Apr. 7)	<ul style="list-style-type: none">● Probability models and axioms,● conditional probability,● Bayes' theorem,● independence, counting,● discrete random variables,● probability mass function <p style="text-align: center;">Midterm I: Covers Sequences and Series (Week 1 and 2)</p>

Week 4 (Apr. 10— Apr. 14)	<ul style="list-style-type: none"> ● continuous random variables ● pdf and cdf., ● joint density, ● marginals, ● conditional probability, ● independence, ● Bivariate normal distribution,
Week 5 (Apr. 17— Apr. 21)	<ul style="list-style-type: none"> ● expectation and variance ● covariance, ● correlation, ● weak law of large numbers ● Central limit theorem with applications
Week 6 (Apr. 24— Apr. 28)	<ul style="list-style-type: none"> ● More applications of the central limit theorem ● point estimation, ● maximum likelihood estimator, ● large and small sample confidence interval, <p style="text-align: center;">Midterm II: Probability (Week 3--5)</p>
Week 7 (May 8—May 12)	<ul style="list-style-type: none"> ● hypothesis testing ● linear regression

Final Exam
May 15th, 2023, 15:30—18:30, IB 2071