SUNY Korea **Probability Theory**
AMS AMS 311-90
Spring 2022 Rev. 11/22/2021

SYLLABUS

INSTRUCTOR: Dr. Ky Tran

CO-INSTRUCTOR: Dr. Hongshik Ahn (May 11, 2022 - May 23, 2022)

OFFICE: B525

LECTURE: MW 9:00AM – 10:20AM

OFFICE HOURS: MW 2:00PM - 3:30PM

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PHONE: 82-32-626-1911

TA AND TA OFFICE HOURS:
TBA

COURSE WEBSITE: Blackboard

PREREQUISITES: AMS 301 and 310

TEXTBOOK:
Required Text: "Introduction to Probability" by Mark Ward and Ellen Gundlach, Second Printing; 2016, MacMillon Higher Education, W.H. Freeman and Company, ISBN: 978-0716771098
Recommended for additional reading: "A First Course in Probability", by Sheldon Ross, 9th ed., Pearson, ISBN: 978-0321794772

TOPICS TO BE COVERED:
Probability Spaces; Conditional probability and independence; Random Variables; Special Distributions; Expectation; Joint Distributions; Conditional Distributions; Covariance and correlations; Moment Generating Functions; Transformation of variables; Order Statistics; Law of Large Numbers

HOMEWORK: Homework assignments are given weekly. No late assignment will be accepted. Please submit the questions in the order in which they are assigned and submit a detailed and complete solution for full credit on each question. Your work should be neat and clean if your instructor is expected to read it. This is your opportunity to showcase what you understand.

You may discuss homework problems with other classmates, or with TAs, or with your instructor. However, you must write the solutions by yourselves in order to be accepted.

Homework will be submitted directly to Blackboard. There will be no paper homework collected, eliminating any possibility of lost assignments. Write out your complete solutions on paper. Then use your scanner or mobile application such as tiny scanner app (Adobe Scan is a great app, you can download from Play Store or Apple Store. Another candidate is Camscanner) to take pictures of your assignment and save them as ONE single PDF. This PDF is what you will submit via Blackboard under your assignment. Submitting your work as multiple PDFs or in alternate formats is not acceptable and your assignment will not be graded.

The lowest two homework scores will be dropped before computing the average.

EXAM:

Exam 1 (tentative): Monday, April 4, 2022

Exam 2 (tentative): Wednesday, May 4, 2022

Final: TBA

No make-ups are allowed if you miss an exam without serious and documented reason.

GRADING POLICY

The final grade is based upon the following:

Homework: 20%; Midterm 1: 25%; Midterm 2: 25%; Final: 30%.

By the School Policy of Attendance, if a student has more than 20% unexcused absences, the student's final grade will be an F.

Grade Scale:

Percentage	[0, 60)	[60, 70)	[70, 73)	[73, 77)	[77, 80)
Grade	F	D	C-	C	C+

Percentage	[80, 83)	[83,87)	[87, 90)	[90, 93)	[93, 100]
Grade	B-	B	B+	A-	A

CELL PHONE AND OTHER ELECTRONIC DEVICES: Cell phones and other electronic devices use are not permitted in class for any reason, thus eliminating distractions. Please set your cell phones to silent mode, and turn off all your electronic devices during the class time. If you are expecting an emergency call, please sit near the door, and answer the phone outside.

Learning Outcomes

1. Demonstrate an understanding of core concepts of probability theory and their use in applications:

   - experiments, outcomes, sample spaces, events, and the role of set theory in probability;
   - the axioms of probability and the theorems and their consequences;
   - using counting principles to calculate probabilities of events in sample spaces of equally likely outcomes;

- independence and disjointness;
- conditional probability;
- the law of total probability and Bayes. law;
- the method of conditioning to solve problems;
- Markov chains and associated conditioning arguments.

2. Demonstrate an understanding of the theory of random variables and their applications:
   - the difference between discrete random variables, continuous random variables, and random variables with hybrid distributions;
   - cumulative distribution functions and their properties;
   - probability mass functions for discrete random variables and computations to evaluate probabilities;
   - properties of commonly used discrete distributions, such as binomial, geometric, Poisson, and hypergeometric distributions;
   - probability density functions, computing them from cumulative distribution functions, and vice versa;
   - properties of commonly used density functions, such as uniform, exponential, gamma, beta, and normal densities;
   - means, variances, and higher moments of random variables, and their properties;
   - connections and differences between different distribution functions, e.g., normal approximation to binomial, Poisson approximation to binomial, and the difference between binomial and hypergeometric;
   - Markov and Chebyshev inequalities and utilizing them to give bounds and estimates of probabilities;

3. Demonstrate an understanding of the theory of jointly distributed random variables and their applications:
   - computations with joint distributions, both for discrete and continuous random variables;
   - computations with joint density functions and conditional density functions;
   - conditional expectation and conditioning arguments in computations involving two or more random variables;
   - computations with the bivariate normal distribution, the t-distribution, and chi-squared distributions, order statistics;
   - applying indicator random variables to compute expectations;
   - using moment generating functions in solving problems with sums of independent random variables;
   - the weak and strong laws of large numbers;

- applying the central limit theorem in estimating probabilities.

School Policy on Attendance

1. If a student has over 20% unexcused absences, the student's final course grade will be an F.
2. Students should report the reason of absence to the professor in advance, or immediately after the absence.
3. When a student excuses his/her absence, the student must provide documentation of the reason for the absence to the professor.
4. The professor of the course reserves the right to excuse absences.
5. The professor may excuse the absence if the submitted documentation fulfills the following conditions: extreme emergences, severe medical reasons with doctor's note, very important events.

Academic Integrity

Each student must pursue his or her academic goals honestly and be personally accountable for all submitted work. Representing another person's work as your own is always wrong. Faculty are required to report any suspected instances of academic dishonesty to the Academic Judiciary. For more comprehensive information on academic integrity, including categories of academic dishonesty, please refer to the academic judiciary website at http://www.stonybrook.edu/commcms/academic_integrity/index.l

Cheating Policy

The grade of Q is assigned to a student found guilty of academic dishonesty. The Q remains on the transcript and is computed in your G.P.A. as a grade of F. Furthermore, a note describing the academic dishonesty is attached to your permanent records with the university.

Disability Support Services (DSS) Statement

If you have a physical, psychological, medical or learning disability that may impact your course work, please contact One-Stop Service Center, Academic Building A201, (82) 32-626-1117. They will determine with you what accommodations, if any, are necessary and appropriate. All information and documentation is confidential. In addition, this statement on emergency evacuation is often included, but not required. Students who require assistance during emergency evacuation are encouraged to discuss their needs with their professors and One-Stop Service Center.

Critical Incident Management

Stony Brook University expects students to respect the rights, privileges, and property of other people. Faculty are required to report to the Office of Judicial Affairs any disruptive behavior that interrupts their ability to teach, compromises the safety of the learning environment, or inhibits students' ability to learn.

Course Evaluations

Stony Brook University values student feedback in maintaining the high quality education it provides and is committed to the course evaluation process, which includes a mid-semester assessment as well as an end-of the-semester assessment, giving students a chance to provide information and feedback to an instructor which allows for development and improvement of courses. Please click the the following link to access the course evaluation system: http://stonybrook.campuslabs.com/courseeval/

Tentative Course Schedule

Week	Date	Chapter	Material Covered
1	2/21	1	Outcomes, Events, Sample Spaces
	2/23	2	Probability
2	2/28	3	Independent Events
	3/2	4, 5	Conditional Probability, Bayes' Theorem
3	3/7	7	Discrete Versus Continuous Random Variables
	3/14	8	Probability Mass Functions and CDFs
4	3/16	9	Independence and Conditioning
	3/21	10	Expected Values of Discrete Random Variables
		11	Expected Values of Sums of Random Variables
5	3/23	12	Variances of Discrete Random Variables
	3/28	14-20	Named Discrete Random Variables
6	3/30	Review	
	4/4	Exam 1	
7	4/6	24	Continuous Random Variables
	4/11	25	Joint Densities
		26	Independent Continuous Random Variables
8	4/13	27	Conditional Distributions
	4/18	28	Expected Values of Continuous Random Variables
9	4/20	29	Variances of Continuous Random Variables
	4/25	31-35	Named Continuous Random Variables
10	4/27	Review	
	5/2	Review	
11	5/4	Exam 2	
	5/11	36	Sums of Independent Normal Random Variables
12	5/16	37	Central Limit Theorem
	5/18	39	Variance of Sums; Covariance; Correlation
13	5/23	40	Conditional Expectation
	5/25	41	Markov and Chebyshev Inequalities
14	5/30	42, 43	Order Statistics, Moment Generating Functions
	6/7	Review	