Survey of Probability and Statistics

CLASS:	Mon, Wed 3:30 - 4:50 pm, Room: C103
INSTRUCTOR:	Hongshik Ahn
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Text: Hongshik Ahn, *Probability and Statistics for Science and Engineering with Examples in R*, 1st edition, Cognella, ISBN: 978-1-5165-1398-7

Prerequisite: AMS 161 or MAT 126 or 132 or 142

Topics to be Covered: Descriptive statistics; probability; discrete random variables and probability distributions; continuous random variables and probability distributions; joint distributions; sampling distributions; point estimation; confidence intervals; testing hypotheses

Homework: Assignments will be given weekly. No late homework will be accepted. The lowest two homework scores will be dropped before computing the average.

Homework Policy: You may discuss problems with other students, but you must write up your homework completely on your own. Your writings must be independent: Do not look at another writeup. To do otherwise is a case of Academic Dishonesty and is subject to University policy through CASA.

Quiz: The lecture note of each chapter will be posted on Blackboard a few days before the chapter is covered in class. A short quiz about the note will be given at the beginning of every lecture.

Tests

Exam I:	Monday, April 2, in class
Exam II:	Monday, May 7, in class
Final:	Monday, June 18, 12:30-3:00 pm, Room: C103

Grading Policy

Participation (5%), Homework (10%), Quizzes (15%), Midterms ($20\% \times 2 = 40\%$) and Final (30%)

Score	$[93, 100]$	$[90, 93)$	$[87, 90)$	$[83, 87)$	$[80, 83)$	$[77, 80)$	$[73, 77)$
Grade	A	A-	B+	B	B-	C+	C
Score	$[70, 73)$	$[67, 70)$	$[63, 67)$	$[60, 63)$	$[0, 60)$		
Grade	C-	D+	D	D-	F		

If a student has more than 6 unexcused absence, the student's final grade will be an F.
See the **Attendance** policy on p3.

Learning Outcomes

1. Learn and apply descriptive statistical tools in data analysis
    - distinguish between different types of data.
    - use of graphical tools to summarize a given data set.
    - use of numerical methods to summarize a data set.
    - identify the best method to highlight the interesting features in a data set.
2. Demonstrate and apply an understanding of the basic concepts in probability theory
    - describe the sample space and particular outcomes for some random experiments.
    - use the basic counting techniques to calculate the number of experimental outcomes.
    - calculate probabilities of simple events by working with sets that represents them.
    - apply the axioms of probability to calculate probabilities of compound events.
    - demonstrate an understanding of the differences between various concepts such as disjoint and independence.
    - compute conditional probabilities.
    - use the law of total probability and Bayes rule to calculate probability of complex events.
3. Demonstrate an understanding of the basic concepts in random variables and their distributions
    - use random variables to model the outcomes of simple experiments.
    - describe the properties of probability mass function and cumulative distribution functions.
    - calculate the means and variances of discrete random variables.
    - learn and apply commonly used discrete distributions such as binomial, geometric, Poisson, and hypergeometric distributions.
    - contrast discrete and continuous random variables.
    - describe the properties of continuous density functions and their cumulative distribution functions.
    - calculate the means and variances of continuous random variables.
    - learn and apply commonly used density functions such as exponential and normal densities.
    - learn and apply the general properties of the expectation and variance operators.
    - demonstrate an understanding of the connections and differences between different distribution functions, e.g., normal approximation to binomial, Poisson approximation to binomial, and the difference between binomial and hypergeometric distributions.
4. Use the sampling distribution of a statistic, in particular, the sample mean to:
    - tell the difference between a sample and a population
    - identify the similarities and differences between the normal distribution and the t-distribution.
    - understand and apply the basic concepts in estimation theory such as estimators, bias, variance, and efficiency.
    - construct point estimators (using strong law of large numbers) and interval estimators (in particular, confidence intervals) for estimating the mean of a population.
    - understand and apply confidence intervals.
    - apply the central limit theorem in solving probability questions involving averages from arbitrary distributions.

5. Use the basic concepts and ideas in inferential statistics, such as hypothesis testing, to:
    - identify the basic components in a classical hypothesis test, including parameters of interest, the null and alternative hypothesis, the rejection region, and test statistics.
    - formulate a given problem as a hypothesis testing problem.
    - calculate the p-value of a test statistic.
    - conduct the inference for the mean of a population when the underlying variance is either known or unknown.
    - explain the two types of errors and calculate their associated probabilities.

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/uaa/academicjudiciary/

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

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	Dates	Chapter	Topic	Homework
1	2/26, 2/28	Chapter 1	Describing Data	#1, due 3/7
2	3/5, 3/7	Chapter 2	Probability	#2, due 3/14
3	3/12	Chapter 2		
	3/14	Chapter 3	Discrete Distributions	#3, due 3/21
4	3/21	Chapter 3		#4, due 3/28
5	3/26	Chapter 3		
	3/28	Review		
6	4/2	Exam I		
	4/4	Chapter 4	Continuous distributions	#5, due 4/11
7	4/9, 4/11	Chapter 4		#6, due 4/18
8	4/16, 4/18	Chapter 4		#7, due 4/25
9	4/23, 4/25	Chapter 5	Multiple Random Variables	#8, due 5/2
10	4/30	Chapter 6	Sampling Distributions	
	5/2	Review		
11	5/7	Exam II		
	5/9	Chapter 7	Intro to Point Estimation & Testing	#9, due 5/16
12	5/14, 5/16	Chapter 8	Inferences Based on One Sample	
13	5/23	Chapter 8		#10, due 5/28
14	5/28	Chapter 8		
	5/30	Chapter 9	Inferences Based on Two Samples	#11, due 6/4
15	6/4	Chapter 9		#12, practice
16	6/11	Review		