

# ECEn 370, Probability Theory

Winter Semester 2010

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Office Hours: Dr. Mazzeo: Monday, 3-4 PM, 448 CB  
Thursday, 10-12 AM, 448 CB  
Friday, 3-4 PM, 448 CB  
Other hours by appointment and *encouraged* as needed.

Yabing Luo: Wednesday, TBD  
Thursday, TBD  
Friday, TBD

Class Hours: Monday, Wednesday, Friday, 2-2:50 PM in 381 CB

Recitation: Wednesday, Thursday, 1-2 PM in location TBD

Website: [http://www.et.byu.edu/~bmazzeo/ECEn\\_370\\_W10/](http://www.et.byu.edu/~bmazzeo/ECEn_370_W10/)

## I. Course Information

### Required Materials



Introduction to Probability, 2nd Edition (2nd edition)  
By Dimitri P. Bertsekas  
ISBN: 188652923X  
EAN: 9781886529236  
Athena Scientific (2008-07-15)

### Optional Materials

Schaum's Outline of Probability, Random Variables, and Random Processes (1 edition)  
By Hwei Hsu  
ISBN: 0070306443  
EAN: 9780070306448  
McGraw-Hill (1996-10-01)

### Course Description

The successful engineer must deal with systems with uncertain properties, whether this task includes component selection and design, reliability, digital signal processing, weather, or stock market predictions. This course will give you basic tools to both understand and quantitatively tackle these real-world situations as well as prepare you for more advanced courses in this subject. The mathematics involved in this course are not particularly complex, but the understanding behind it will require time and thought to build the intuition necessary to be successful in this course.

### Prerequisites

Math 313

## Course Competencies

Each degree program has Program Educational Objectives that will prepare graduates to succeed in their respective fields. To achieve the objectives, program learning outcomes are defined to meet the stated objectives. Consistent with this framework, each course has competencies that contribute to the program learning outcomes. The course competencies for EC En 370 are:

- A basic understanding of probabilistic reasoning and the foundations of probability theory.
- An understanding of random variables, probability mass functions, probability density functions, and cumulative distribution functions.
- An understanding of multivariate distributions, independence, conditioning, and functions of random variables, including the ability to compute expectations, moments, and correlation functions.
- An understanding of convergence concepts, including the central limit theorem and the law of large numbers.
- The ability to apply probability theory to the analysis of engineering systems.

## Exams

The midterm will be held in the testing center during the times specified in the syllabus. The final will be held at the University-scheduled time and place.

## Quizzes

On Fridays a 10 minute closed-book quiz will be given at the beginning of class on material covered in recent lectures, reading, and homework. No make-up quizzes will be offered. The lowest three scores (as computed below) from the semester will be dropped in the computation of final grades. If you have more than three university excused absences on quiz days, your grade will be computed using the remaining quizzes.

## Homework

Homework problem sets will be posted on the course website found at [http://www.et.byu.edu/~bmazzeo/ECEn\\_370\\_W10/](http://www.et.byu.edu/~bmazzeo/ECEn_370_W10/). Most of the solutions to the problems can be found within the text and on the publisher's website. However, all problems should first be attempted without aids to build understanding. It is expected and encouraged that students will work together in solving homework. However, all students must submit their own individual work. Homework is due in the fourth floor homework box by midnight on Thursday. It will be collected at a random time between midnight and 10 AM the next morning. Late homework will not be accepted. However, the lowest two homework scores of the semester will be dropped in computation of final grades. Some homework assignments will include MATLAB programming assignments that must be completed for full homework credit.

## Grading Policies

This course will use an estimation approach to assigning grades. You will learn about the effectiveness of this approach as we consider Gaussian probability distributions. This is based on the professor's opinion that probability should be applied. For each assignment, you will be given a Z-score. That is determined by  $(\text{your score} - \text{class average}) / (\text{class standard deviation})$ . Each of the Z-scores for each category will be weighted by the following percentage breakdown. Because of the dropped lowest grades, in effect everyone is "above average." Additionally, the average for the class is generally assigned by setting the average for the class in the range around a "B" with divisions between overall Z-scores of about 0.2.

## Percentage Breakdown

Assignment	Percent
Homework	20
Quizzes	25
Midterm (Testing Center)	25
Final Exam (scheduled)	30
Total Percent	100

## **II. University Policies**

### **BYU Honor Code**

In keeping with the principles of the BYU Honor Code, students are expected to be honest in all of their academic work. Academic honesty means, most fundamentally, that any work you present as your own must in fact be your own work and not that of another. Violations of this principle may result in a failing grade in the course and additional disciplinary action by the university. Students are also expected to adhere to the Dress and Grooming Standards. Adherence demonstrates respect for yourself and others and ensures an effective learning and working environment. It is the university's expectation, and my own expectation in class, that each student will abide by all Honor Code standards. Please call the Honor Code Office at 422-2847 if you have questions about those standards.

### **Preventing Sexual Discrimination and Harassment**

Title IX of the Education Amendments of 1972 prohibits sex discrimination against any participant in an educational program or activity that receives federal funds. The act is intended to eliminate sex discrimination in education. Title IX covers discrimination in programs, admissions, activities, and student-to-student sexual harassment. BYU's policy against sexual harassment extends not only to employees of the university, but to students as well. If you encounter unlawful sexual harassment or gender-based discrimination, please talk to your professor; contact the Equal Employment Office at 422-5895 or 367-5689 (24-hours); or contact the Honor Code Office at 422-2847.

### **Students with Disabilities**

Brigham Young University is committed to providing a working and learning atmosphere that reasonably accommodates qualified persons with disabilities. If you have any disability which may impair your ability to complete this course successfully, please contact the Services for Students with Disabilities Office (422-2767). Reasonable academic accommodations are reviewed for all students who have qualified, documented disabilities. Services are coordinated with the student and instructor by the SSD Office. If you need assistance or if you feel you have been unlawfully discriminated against on the basis of disability, you may seek resolution through established grievance policy and procedures by contacting the Equal Employment Office at 422-5895, D-285 ASB.

### **Academic Honesty Policy**

The first injunction of the BYU Honor Code is the call to be honest. Students come to the university not only to improve their minds, gain knowledge, and develop skills that will assist them in their life's work, but also to build character. President David O. McKay taught that 'character is the highest aim of education' (The Aims of a BYU Education, p. 6). It is the purpose of the BYU Academic Honesty Policy to assist in fulfilling that aim. BYU students should seek to be totally honest in their dealings with others. They should complete their own work and be evaluated based upon that work. They should avoid academic dishonesty and misconduct in all its forms, including but not limited to plagiarism, fabrication or falsification, cheating, and other academic misconduct.

### **Plagiarism Policy**

Writing submitted for credit at BYU must consist of the student's own ideas presented in sentences and paragraphs of his or her own construction. The work of other writers or speakers may be included when appropriate (as in a research paper or book review), but such material must support the student's own work (not substitute for it) and must be clearly identified by appropriate introduction and punctuation and by footnoting or other standard referencing.

### III. Class Schedule

Date	Topics	Book Chapters	Assignments
1/4	Introduction and Sets Background	1.1	-
1/6	Discrete Probability Laws	1.2	-
1/7	-	-	HW 1 Due
1/8	Continuous Probability Laws	1.2	Quiz 1
1/11	Conditional Probability	1.3	-
1/13	Total Probability Theorem	1.4	-
1/14	-	-	HW 2 Due
1/15	Independence	1.5	Quiz 2
1/18 Martin Luther King Jr. Day	No Class	-	-
1/20	Counting	1.6	-
1/21	-	-	HW 3 Due
1/22	Discrete Random Variables	2.1	Quiz 3
1/25	Probability Mass Function	2.2	-
1/27	Functions of Random Variables P1	2.3	-
1/28	-	-	HW 4 Due
1/29	Expectation, Mean, Variance	2.4	Quiz 4
2/1	Joint PMFs of Multiple Random Variables	2.5	-
2/3	Conditioning	2.6	-
2/4	-	-	HW 5 Due
2/5	Independence	2.7	Quiz 5
2/8	Summary of Discrete Random Variables	2.8	-
2/9	-	-	-
2/10	Continuous Random Variables and PDFs	3.1	-
2/11	-	-	HW 6 Due
2/12	Cumulative Distribution Functions	3.2	Quiz 6
2/15 President's Day	No Class	-	-
2/16 Monday Instruction	Normal Random Variables	3.3	-
2/17	Joint PDFs of Multiple Random Variables	3.4	-
2/18	-	-	HW 7 Due
2/19	Conditioning	3.5	Quiz 7

2/22	Continuous Bayes' Rule	3.6	Midterm
2/23	-	-	Midterm
2/24	Summary of Continuous Random Variables	3.7	Midterm
2/25	-	-	HW 8 Due
2/26	Derived Distributions P1	4.1	Quiz 8
3/1	Derived Distributions P2	4.1	-
3/3	Covariance and Correlation	4.2	-
3/4	-	-	HW 9 Due
3/5	Conditional Expectation and Variance Revisited	4.3	Quiz 9
3/8	Transforms	4.4	-
3/10	Sums of Independent Random Variables	4.5	-
3/11	-	-	HW 10 Due
3/12	Random Number of Independent Random Variables	4.6	Quiz 10
3/15	Markov and Chebyshev Inequalities	5.1	-
3/16	-	-	-
3/17	Weak Law of Large Numbers	5.2	-
3/18	-	-	HW 11 Due
3/19	Convergence in Probability	5.3	Quiz 11
3/22	Central Limit Theorem	5.4	-
3/24	Strong Law of Large Numbers	5.5, 5.6	-
3/25	-	-	HW 12 Due
3/26	Bernoulli Process	6.1	Quiz 12 Due
3/29	Poisson Process	6.2	-
3/31	Discrete-Time Markov Chains	7.1	-
4/1	-	-	HW 13 Due
4/2	Classification of States	7.2	Quiz 13
4/5	Steady-State Behavior	7.3	-
4/7	Absorption Probabilities	7.4	-
4/8	-	-	HW 14 Due
4/9	Continuous-Time Markov Chain	7.5	Quiz 14
4/12	Final Review	-	-
4/14, 4/15 Exam Prep Days	No Class	-	-
4/16 Final	Final Exam , 7 AM – 10 AM		-