ECE 341: Random Processes

http://venus.ece.ndsu.nodak.edu/~glower/ECE341/index.htm

Instructor:	Jacob Glower
Office Location:	ECE 201A
Office Phone:	none at present
Office Hours:	t.b.d.
Class Hours:	TR 3:30 - 4:45 PM
Class Location:	ECE 125
Text:	Probability and Stochastic Processes - yates & Goodman

Catalog Description: Principles of probability. Application of probability and statistics to electrical and computer engineering problems. 3 lectures. Prereq: MATH 266. F, S

Topics Covered: Combinatorics, trees, apriori, aposteriori, conditional probabilties, pdf, cdf, expectiotaions, single and multi random variables, discrete and continuous functions of random variables, analysis via statistics, MATLAB, and Monte Carlo approaches.

Course Objectives: By the end of the semester, students should be able to

• 1. Explain what a random process is and give examples,	A, E, G, K
• 2. Determine the mean, variance, and expected value of a random process given its cumulative distribution function or its probabilit density function via calculus as well as Monte-Carlo (MATLAB) simulations.	A, E, K
• 3. Determine what type of distribution applies to a random process including: binomial, Poisson, geometric, hyper-geometric, and normal distributions.	B, E, K
• 4. Determine if two random processes have similar means using a t-test.	A, B, E, K
• 5. Determine if a random process has a given distribution using a chi-squared test.	A, B, E, K

Relation of Course Objectives to ABET Criterion 3 Student Outcomes ABET Criterion 3 Student Outcomes	Course Objectives
(a) an ability to apply knowledge of mathematics, science, and engineering	1,2,4,5
(b) an ability to design and conduct experiments, as well as to analyze and interpret data	3,4,5
(c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability	
(d) an ability to function on multidisciplinary teams	
(e) an ability to identify, formulate, and solve engineering problems	1,2,3,4,5
(f) an understanding of professional and ethical responsibility	
(g) an ability to communicate effectively	1
(h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context	
(i) a recognition of the need for, and an ability to engage in, life-long learn	
(j) a knowledge of contemporary issues	
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice	1,2,3,4,5
(l) an ability to grow in the knowledge of and make professional contributions to at least one specific area of ECE	

Grading

- Midterms: 1 unit each
- Homework & Quizzes 1 unit
- Final 2 units
- Total: Average of all above

Final Percentage:

- 100% - 90% A
- 89% - 80% B
- 79% - 70% C
- 69% - 60% D
- < 59% E

Grading will be on a straight scale to encourage working together. My objective is to see that everyone learns the material. If the class studies together and everyone gets a 90% average, I'd gladly give all A's. (After all, your competitors are at schools like UCLA, Michigan, etc. - they're not your classmates.)

Policies: A student may take a makeup exam if he/she misses an exam due to an emergency, illness, or plant trip and notifies me in advance of the exam. Late homework will not be accepted once the solutions are posted online. All questions on the grading of a particular exam must be resolved within a week of returning the exam.

Homework: Homework is graded as

- 80%: You attempted the problem with an organized approach I can follow.
- 20%: You got the right answer.

Homework is practice using the tools being presented. Copying someone else's homework is sort of like watching someone else exercise. You need to do it yourself. Similarly, with grading I care most that you attempted the problem and thought about it.

Testing: All tests will be closed-book, closed-notes, open calculator. Midterms serve to identify who put in the time solving the homework problems. My goal in writing tests is add new twists you havn't seen yet so that

- If you did the homework and are comfortable with the concepts and tools, you'll have a shot at the midterms.
- If you copied someone else's homework, you'll be lost.

The best way to study for the midterm is to make up your own midterm. There's only so many ways to ask a question.

Special Needs - Any students with disabilities or other special needs, who need special accommodations in this course are invited to share these concerns or requests with the instructor as soon as possible.

Academic Honesty - All work in this course must be completed in a manner consistent with NDSU University Senate Policy, Section 335: Code of Academic Responsibility and Conduct. Violation of this policy will result in receipt of a failing grade.

ECE Honor Code: On my honor I will not give nor receive unauthorized assistance in completing assignments and work submitted for review or assessment. Furthermore, I understand the requirements in the College of Engineering and Architecture Honor System and accept the responsibility I have to complete all my work with complete integrity.

Syllabus

Aug 23	T	Introduction: What is a random process?
Aug 25	R	Combinatorics
Aug 30	T	Binomial distribution
Sep 1	R	Monte-Carlo techniques with MATLAB
Sep 6	T	Probability Density Function
Sep 8	R	Cumulative Distribution Function
Sep 13	T	Mean, expected value, averages, variance, and standard deviation
Sep 15	R	Conditional probability
Sep 20	T	review
Sep 22	R	Test #1
Sep 27	T	Multiple discrete random variables. Joint pdf, marginal pdf.
Sep 29	R	Functions of two random variables.
Oct 4	T	Uniform, exponential, Erlang distribution, CDF, PDF
Oct 6	R	Expectation, Variance, Standard Deviation
Oct 11	T	Law of Large Numbers, Median
Oct 13	R	Poisson Distribution, Approximation of Binomial Distribution
Oct 18	T	Normal Distribution, Central Limit Theorem
Oct 20	R	Multiple continuous random variables: joint CDF, PDF
Oct 25	T	Review
Oct 27	R	Test #2
Nov 1	T	Introduction to Confidence intervals & Hypothesis Testing
Nov 3	R	Confidence Intervals for Parameters of Normal Distribution
Nov 8	T	Hypotheses Testing, Bayes' Decision Rules
Nov 10	R	t-test
Nov 15	T	t-test examples
Nov 17	R	2-sample t-test, goodness of fit test
Nov 22	T	Chi-squred test
Nov 24	R	
Nov 29	T	Review
Dec 1	R	Test #3
Dec 6	T	Class Projects
Dec 8	R	Class Projects & Review
Dec 13	T	Final Exam – 10:30 – 12:30