



DSO 516: Probability and Data Modeling

Syllabus: Spring 2018, Jan. 8 – Feb. 28

Time: MW 11:00 am-12:20 pm and 12:30-1:50 pm

Location: JKP112

Professor: Amy R. Ward

Office: BRI 401H

Office Phone: 213-821-2616

Office Hours: MW 5:00-6:00pm and Friday afternoon by appt.

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Course Description:

Uncertainty is everywhere. Then, businesses must make decisions in the face of uncertainty every day. Hence it is important to understand methodology for dealing with uncertainty. We will do this by using probability theory. Throughout the course, we will use data and Excel computations to illustrate probability applications.

Please see the course lecture plan (posted separately) for more detailed information on the topics covered and course requirements. In relation to DSO 547 on spreadsheet modeling, this course goes more in-depth on probability theory and its connection with data modeling (and the material is coordinated to ensure minimum overlap without assuming knowledge from DSO 547).

This course is intended for all students interested in how to deal with uncertainty when building mathematical models (statistics models, simulation models, decision models, etc.). This course is a prerequisite for the more advanced course: DSO 536 Monte Carlo Simulation and Decision Models.

Learning Objectives:

- Students will understand basic probability and be able to use common discrete and continuous distributions for modeling.
- Students will learn to use Excel to simulate random variables (i.e., generate samples from a distribution).
- Students will learn techniques (exploratory data analysis, method of moments, maximum likelihood estimation) for deciding what probability distribution represents given data.
- Students will be able to apply inequalities (Markov, Chebyshev) and use limit theorems (law of large numbers, central limit theorem) to make probability calculations when the underlying distribution is not known.

Course Materials:

You will need access to Excel. A good reference textbook (not required, although readings to support many of the lectures are given from this textbook on the detailed course plan) is “Applied Probability: Models and Intuition” by Arnold I. Barnett, copyright 2015, ISBN 978-0-9899108-7-3.

We will analyze one cases from Darden Business Publishing, Appshop. You must buy this (\$6.75). For those of you also enrolled in DSO536, we will analyze another case from Darden Business Publishing, Flora(A). You may buy a combined course pack that includes both of these cases now (\$7.50). Please see Blackboard for the relevant URL.

Grading:

Your course grade will be based on the following individual and group assignments:

Class Participation:	10%
Homework (3 @20%):	60%
Exam:	30%.

For class participation, each student should be prepared to contribute individually to the class discussion. The quality of the contribution is more important than the quantity of contributions. Note that you must be present in class to be able to contribute.

There are three homework assignments, each to be done individually. Homework is due at the beginning of class, uploaded to Blackboard.

The exam will be on the last class session. The exam is open everything, including your laptop computers.

Prerequisites:

There are no prerequisites. This course is intended for students that would like basic probability and statistics knowledge.

Academic Conduct:

Plagiarism – presenting someone else’s ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in *SCampus* in Section 11, *Behavior Violating University Standards* <https://scampus.usc.edu/1100-behavior-violating-university-standards-and-appropriate-sanctions/>. Other forms of academic dishonesty are equally unacceptable. See additional information in *SCampus* and university policies on scientific misconduct, <http://policy.usc.edu/scientific-misconduct/>.

Discrimination, sexual assault, and harassment are not tolerated by the university. You are encouraged to report any incidents to the *Office of Equity and Diversity* <http://equity.usc.edu/> or to the *Department of Public Safety* <http://capsnet.usc.edu/department/departement-public-safety/online-forms/contact-us>. This is important for the safety of the whole USC community. Another member of the university community – such as a friend, classmate, advisor, or faculty member – can help initiate the report or can initiate the report on behalf of another person. *The Center for Women and Men* <http://www.usc.edu/student-affairs/cwm/> provides 24/7 confidential support, and the sexual assault resource center webpage <https://sarc.usc.edu/reporting-options/> describes reporting options and other resources.

Students will be referred to the Office of Student Judicial Affairs and Community Standards for further review, should there be any suspicion of academic dishonesty. The Review process can be found at: <http://www.usc.edu/student-affairs/SJACS/>. Failure to adhere to the academic conduct standards set forth by these guidelines and our programs will not be tolerated by the USC Marshall community and can lead to dismissal.

For Students with Disabilities:

Any student requesting academic accommodations based on a disability is required to register with Disability Services and Programs (DSP) each semester. A letter of verification for approved accommodations can be obtained from DCP. Please be sure the letter is delivered to your instructor as early in the semester as possible. DSP is located in STU 301 and is open 8:30 am – 5:00 pm, Monday through Friday. The phone number for DSP is (213) 740-0776.

Support Systems

Students whose primary language is not English should check with the *American Language Institute* <http://dornsife.usc.edu/ali>, which sponsors courses and workshops specifically for international graduate students.

Emergency Preparedness/ Course Continuity:

In case of a declared emergency, if travel to campus is not feasible, USC executive leadership will announce an electronic way for instructors to teach students in their residence halls or homes using a combination of Blackboard, teleconferencing, and other technologies.

Please activate your course in Blackboard with access to the course syllabus. Whether or not you use Blackboard regularly, these preparations will be crucial in an emergency. USC's Blackboard learning management system and support information is available at blackboard.usc.edu.

Course Disclaimer:

The instructor reserves the right to make modifications to this syllabus as determined by the learning needs of this particular class of students.

DSO 516 Probability and Data Modeling, Professor Ward, Spring 2018					
Date	Module	Topic	Learning Outcomes	Reading from Barnett	Due by 11:59 pm, the Day Before
8-Jan-18	Fundamental Concepts	Introduction	Compute summary statistics and empiric frequency calculations from data; Interpret hisogram plots.	Chapter 2.1-2.4	
10-Jan-18		Discrete Random Variables	Define the sample space and events; Understand what is a random variable and its cumulative distribution function; Calculate probabilities and summary statistics for discrete random variables.		
15-Jan-18			No Class: Martin Luther King Day		
17-Jan		The Appshop Case	Evaluate a decision tree in which uncertain outcomes follow a discrete probability distribution; Discuss the effect of risk preferences on decision-making; See Jensen's inequality.	Chapter 1	HW1
22-Jan-18		Basic Probability Building Blocks	Learn rules for calculating the probability of one event from others; Define conditional probability; Use Bayes's Theorem.		
24-Jan-18	More on Random Variables	Continuous Random Variables	Calculate probabilities and summary statistics for continuous random variables; Perform the original (unmodified) Appshop case calculation.	Chapter 3.1-3.3	HW2
29-Jan-18		Simulating Random Variables	Learn the inversion method; Use Excel to apply this method and generate samples from a normal and exponential distribution, and others	Chapter 3.8	
31-Jan-18		Common Distributions	Learn common distributions and the contexts in which they occur; See known summary statistics formulae for those distributions.	Chapters 2.5-2.9 and 3.4-3.6	
5-Feb-18		Sums of Random Variables	Discover why the normal distribution is so important in probability and statistics calculations; Learn the Law of Large Numbers and Central Limit Theorem.	Chapters 3.6 and 4.8	
7-Feb-18		Joint Distributions and Correlation	Discuss joint distributions, covariance, and correlation.	Chapters 4.1-4.4 and 4.9	
12-Feb-18	From Data to Distribution	Exploratory Data Analysis	Learn techniques (run-sequence and lag-lag) for deciding whether or not data can be fit to one probability distribution; Use the Method of Moments to fit a distribution to data.		
14-Feb-18		Maximum Likelihood Estimation	Determine from data the most probable parameters for an assumed distributional form (i.e., do maximum likelihood estimation); Compare and contrast the Method of Moments and Maximum Likelihood.		
19-Feb-18		In Class Mini-Case: Stock Price Modeling	Your turn to start with data and decide on the appropriate modeling distribution.		
21-Feb-18			No Class: Presidents' Day		
26-Feb-18	Review and Capstone: From data to distribution to probability calculations in decision-making.				HW3
28-Feb-18	EXAM (Open Notes and Computer)				