

**DSO 516: Probability & Data Modeling, Spring 2021**

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<b>Class Time:</b> Tuesday/Thursday, 12:30 – 1:50pm PST	<b>Email:</b> <a href="mailto:bangerth@marshall.usc.edu">bangerth@marshall.usc.edu</a>
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<b>Office Hours:</b> Tuesdays, 11:00am – 12:15pm PST and by appointment	

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**Course goals:**

Students completing this course will have a detailed understanding of how to work with, and understand, uncertainty. Many business decisions are made with imperfect information, so understanding the methodology and process for handling the unknown is critical. Probability theory will help us understand this, and Excel computations will be critical in applying these ideas to real situations.

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

**Learning Objectives:** Students will be able to

- Explain basic probability concepts and use common discrete and continuous distributions for modeling.
- Use Excel to simulate random variables (generate samples from a distribution).
- Apply techniques for deciding what probability distribution represents given data.
- Apply tools and theorems to make probability calculations when an underlying distribution is not known.

**Prerequisites:**

There are no prerequisites. This course is intended for students that would like basic probability and statistics knowledge. Please feel comfortable coming to me with any concerns you might have.

**Course Materials:**

You will need access to Excel and the Data Analysis Toolpak (discussed on our first day of class). A good reference textbook (not required) is “Applied Probability: Models and Intuition” by Arnold I. Barnett, copyright 2015, ISBN 978-0-9899108-7-3.

We will be analyzing one case from Darden Business Publishing, Appshop. This is a required purchase for \$6.95 from <http://store.darden.virginia.edu/appshop-inc>.

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**Classroom Policies:**

Class attendance and participation is important to develop a coherent view of the material covered in the course. Unless accommodated as described in (b) below, attendance and active participation is expected at synchronous Zoom class sessions. Please note: all sessions will be recorded and posted in Blackboard.

- a) Students are expected to have cameras on during the synchronous Zoom sessions, and preferably use headsets or earphones to ensure the best audio quality. Please advise me if you have circumstances under which you will not be able to meet these expectations.
- b) If you are in a time zone that prevents you from being able to attend the Zoom sessions synchronously, please contact me so you will not be penalized.

During synchronous Zoom sessions, the following netiquette is expected. Please do:

- a) Log into class early or promptly
- b) Arrange to attend class where there is a reliable internet connection and without distractions
- c) Dress respectfully and practice your professional telepresence for video business meetings.
- d) If you use a virtual background, please keep it respectfully professional.
- e) Display both your first and last name during video conferencing and synchronous class meetings.
- f) Respectfully minimize distractions by muting and or turning off video if necessary.
- g) Engage in appropriate tone and language with instructors and classmates.

Please try not to:

- a) Engage in a simultaneous activity not related to the class.
- b) Interact with persons who are not part of the class during the class session.
- c) Leave frequently or not be on camera for extended periods of time.
- d) Have other persons or pets in view of the camera.

**Grading & Requirements:**

Three Homework Assts (20% each)	60%
Final Exam	35%
Participation	5%

The 3 assignments are to be done and submitted individually to Blackboard, although you may work in groups. The exam will be on the last class session and is open everything, including your laptop computers.

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.

## Tentative Course Schedule & Topics

Session	Date	Topic	Reading	Due
1	1/19	Introduction <ul style="list-style-type: none"> <li>Summary Statistics, empirical frequency calculations from data, and interpretation of histograms.</li> </ul>		
2	1/21	Discrete Random Variables <ul style="list-style-type: none"> <li>Definitions of sample spaces and events, random variables (RV) and cumulative distribution functions (cdf), probability calculations &amp; summary statistics for discrete RVs.</li> </ul>	Chs 2.1 – 2.4	
3	1/26	Basic Probability Concepts <ul style="list-style-type: none"> <li>Rules for calculating probabilities of one event from others, conditional probability, Bayes' Theorem.</li> </ul>		
	1/27	<a href="http://store.darden.virginia.edu/appshop-inc">http://store.darden.virginia.edu/appshop-inc</a> .		HW 1: Appshop
4	1/28	The Appshop Case <ul style="list-style-type: none"> <li>Evaluation of decision trees with uncertain discrete outcomes, effects of risk preferences on decision-making.</li> </ul>	Ch 1	
5	2/02	Continuous Random Variables <ul style="list-style-type: none"> <li>Calculation of probabilities &amp; summary statistics for continuous RVs, reformulation of Appshop Case.</li> </ul>	Chs 3.1 – 3.3	
6	2/04	Simulating Random Variables <ul style="list-style-type: none"> <li>Inversion method with Excel, generation of samples from normal and exponential distributions.</li> </ul>	Ch 3.8	
7	2/09	Common Distributions I <ul style="list-style-type: none"> <li>Frequent contexts for various distributions, commonly-used statistical formulas.</li> </ul>	Chs 2.5 – 2.9, 3.4 – 3.6	
8	2/11	Common Distributions II & Review <ul style="list-style-type: none"> <li>Frequent contexts for various distributions, commonly-used statistical formulas.</li> </ul>	Chs 3.6 & 4.8	
	2/14			HW 2
	2/16	NO CLASS: WELLNESS DAY		
9	2/18	Sums of Random Variables <ul style="list-style-type: none"> <li>Importance of normal distribution, the Law of Large Numbers, Central Limit Theorem.</li> </ul>	Chs 4.1 – 4.4 & 4.9	
10	2/23	Joint Distributions & Correlation <ul style="list-style-type: none"> <li>Joint distributions, covariance, and correlations.</li> </ul>	S&F, Chs 22 – 25	
11	2/25	Exploratory Data Analysis <ul style="list-style-type: none"> <li>Run-sequence, lag-lag, and Method of Moments techniques for distribution fitting.</li> </ul>		
12	3/02	Maximum Likelihood Estimation <ul style="list-style-type: none"> <li>Probably parameter estimation from data, comparison to Method of Moments.</li> </ul>		
13	3/04	In-Class Case: Stock Price Modeling <ul style="list-style-type: none"> <li>Guided practice with modeling &amp; distributions.</li> </ul>		
	3/07			HW 3
14	3/09	Class Review		
	3/11	FINAL EXAM – In Class		

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## Statement of Academic Conduct and Support Systems

*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 Part B, Section 11, “Behavior Violating University Standards” [policy.usc.edu/scampus-part-b](https://policy.usc.edu/scampus-part-b). Other forms of academic dishonesty are equally unacceptable. See additional information in SCampus and university policies on scientific misconduct, [policy.usc.edu/scientific-misconduct](https://policy.usc.edu/scientific-misconduct).

*Support Systems:* Counseling and Mental Health - (213) 740-9355 – 24/7 on call, [studenthealth.usc.edu/counseling](https://studenthealth.usc.edu/counseling).

Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention.

National Suicide Prevention Lifeline - 1 (800) 273-8255 – 24/7 on call, [suicidepreventionlifeline.org](https://suicidepreventionlifeline.org). Free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week.

Relationship and Sexual Violence Prevention Services (RSVP) - (213) 740-9355(WELL), press “0” after hours – 24/7 on call, [studenthealth.usc.edu/sexual-assault](https://studenthealth.usc.edu/sexual-assault). Free and confidential therapy services, workshops, and training for situations related to gender-based harm.

Office of Equity and Diversity (OED) - (213) 740-5086 | Title IX – (213) 821-8298, [equity.usc.edu](https://equity.usc.edu), [titleix.usc.edu](https://titleix.usc.edu).

Information about how to get help or help someone affected by harassment or discrimination, rights of protected classes, reporting options, and additional resources for students, faculty, staff, visitors, and applicants.

Reporting Incidents of Bias or Harassment - (213) 740-5086 or (213) 821-8298, [usc-advocate.symplicity.com/care\\_report](https://usc-advocate.symplicity.com/care_report). Avenue to report incidents of bias, hate crimes, and microaggressions to the Office of Equity and Diversity | Title IX for appropriate investigation, supportive measures, and response.

The Office of Disability Services and Programs - (213) 740-0776, [dsp.usc.edu](https://dsp.usc.edu). Support and accommodations for students with disabilities. Services include assistance in providing readers/notetakers/interpreters, special accommodations for test taking needs, assistance with architectural barriers, assistive technology, and support for individual needs.